INSECURE PARTICIPATION: EXPERIMENTS IN A ONE-DAY INTRODUCTION TO ECONOMICS, WITH REVISED EXPERIMENTS AND EXERCISES

Insecure Participation: Experiments in a One-day Introduction to Economics

Chris Geller
Deakin University

The working papers are a series of manuscripts in their draft form. Please do not quote without obtaining the author’s consent as these works are in their draft form. The views expressed in this paper are those of the author and not necessarily endorsed by the School.
Abstract

Classroom experiments and exercises served as a one-day introduction to economics for students who felt insecure about taking first year business classes. The first experiment addresses demand in isolation, while the second addresses supply. A third integrates supply, demand and equilibrium in a pit market with all students having equal expected profits. A monopoly pricing exercise addresses market failure. Exercises use many incremental questions to reveal principles of microeconomics. Evaluations show that at the end of the program, students were familiar with economic results and concepts, and were more comfortable with taking economics. Key words: classroom experiments, exercises, principles, bond, auction, pit market. JEL classification A21, A22, C90.
1 INTRODUCTION

Experiments and exercises formed the core of a one-day introduction to economics program for two cohorts of incoming first year students with little or no previous experience in business classes. Economics was one day of a five-day program with two days each of accounting and finance. For eight years, we held and advertised this introductory program to prepare and reassure incoming students who felt unprepared for first-year university business units. Students paid fees specifically to attend this program, and the program was financially successful for our school.

The purposes of this paper are to make these teaching instruments available, persuade lecturers of their usefulness, and to give guidance on possible ways to use them. To that end, appendices include all instructions, experiments and exercises. I have reedited the appendices fixing a few errors, making them simpler to use, and condensing their printed length. The original materials in the Deakin University School of Accounting Economics and Finance working paper 2005-04. Teachers may use the experiments and exercises for educational, non-commercial purposes with appropriate citation.

Forty-nine students attended the first introductory program on a regional campus and 79 other students attended the following day on an urban campus. None of the students attended both sessions as each cohort was participating in the weeklong program on their campuses. Both cohorts had received two days of accounting lectures and the second had also received one day of finance lectures. The remaining day or two of finance followed the day of economics. I felt that an active day in the middle of a week of lectures would leave the students more open to my material on economics, and have them more refreshed for their remaining financial material.

Our one-day introduction to economics used four classroom sessions separated by breaks. The first session consisted of a thirty-minute
introduction and overview of economics, an experiment consisting of auctioning a bond, and an exercise using auction results to illustrate demand. The second session consisted of a ten-minute question and answer session on the bond auction exercise, a nightmare auction detailed below illustrating supply, and the beginning of a pit market experiment illustrating the interaction of supply and demand. The third session completed the market experiment and began an exercise investigating the market experiment. The final session completed the market exercise and an exercise on monopoly power. Overall, the students were active and engaged relative to undergraduate lectures throughout the program, returned promptly from lunch and breaks, and showed only limited fatigue in the final session.

Eighty-eight percent of the students who responded to an end of day evaluation expressed greater comfort about taking economics units. Further, three of the five participants who expressed no increase in comfort, drew supply and demand diagrams properly, read equilibrium price and quantity from their diagrams, and correctly answered at least half of multiple-choice questions applying supply and demand.

Although I developed these experiments and exercises over several years of teaching without referring to published materials, my experiments grew from seminars, classes on research experiments, and experiences with the experimental economics laboratory at Georgia State University in the 1990s. There is a large literature on classroom economics experiments and Charles Holt’s website at the University of Virginia: http://www.people.virginia.edu/~cah2k/teaching.html has many experiments and descriptions of much of the literature on economic experiments including instructional ones for classroom use. Holt (1999) provides an excellent overview of the broad range of classroom economics experiments.

The experiments presented here contribute to the body of experiments in three ways. First, they isolate demand and supply individually in two experiments. Second, the unusually detailed exercises ‘baby-step’ students
through discovery of economic principles and provide correct responses several lines after students address an issue. This level of detail and prompt checks make these exercises suitable to students who were absent for the experiment or take economics through distance learning. Third, these experiments are equitable in the sense that all students have the same potential to earn points, money or other incentives, and that none are excluded from participation through limited numbers of roles in games or through the need for non-participating assistants. However, the main contribution of this paper is an effective, entertaining, and reassuring introduction to economics.

These experiments and exercises have several objectives. They introduce students incrementally to the principles of supply and demand including equilibrium, changes of curves, market outcomes and market failures. They give the students personal experience with supply, demand, and related processes. They create interaction between students and give students a common experience of economic phenomenon. They build student ability to perform basic economic skills such as drawing diagrams.

As a one-day introduction, our program also had the objective of increasing student comfort with taking first year economics and providing students without previous economics experience with a foundation of economic knowledge.

2 BEGINNING THE PROGRAM
Preparation for the exercises took most of a workday: updating a bond, photocopying, printing and reviewing instructions, and preparing overhead slides. The bond (figure 1) required a new maturation date and redemption instructions, with one printed bond for each session and a slide version to display to students. Each student needed a copy of each exercise “write-up”: bond, market exercise, and monopoly; as well as a buyer or seller sheet for the market exercise. I used printed instructions for myself and enlarged
overhead slides of the instructions for the students to read. I wrote and photocopied the evaluation during the lunch break the first day of the program, having failed to consider the need for it in advance.

I began the program by introducing myself including my qualification and experience. Then I explained economics as the science, art, and mathematics of doing the best we can with what we have. ‘We’ can vary between individual, family and societal scales; ‘best’ can take a variety of meanings. Our one-day program in economics served as an illustration of such constrained maximization in which I had to make choices about what material to address and how to address it in the limited time available. My approach was unconventional, active, participatory, and used experiments. Students need not understand the lessons and objectives of the experiments while we did them, rather the meanings would become clear during the written exercises or even later. I finished by requesting their tolerance of the unusual approach and asking for their participation.

All of the following numerical observations about the experiments come from the second cohort. I did not retain records on the first day, as I had not thought of writing this piece.

3 BOND AUCTION

The first exercise of the day constructed a demand curve from demand prices provided by the students. A bond is a suitable good for addressing demand for students since it is easy to explain and students quickly understand that receiving money in a few months is worth something to them. The bond auction illustrates demand but also introduces the idea of bonds as well as providing an opportunity to explain interest rates. An example bond is figure 1; appendix 1 is my instructions; appendix 2 is the bond exercise and figure 2 gives results. Twenty-seven students did not submit bids, apparently without affecting the exercise.
While projecting a transparency of the bond and showing a twenty-dollar bill to the students, I explained that a bond is merely a document of debt with a specific date for payment. I would pay someone -- whoever brought the bond to me -- $20 at the end of the semester; I would also take money from someone -- the winner of the auction -- that day. This auction provided an opportunity to explain interest as the reward for delaying using money for consumption, as well as interest as the difference between the price of a bond and the redemption value. I noted my name, position, and university on the bond, illustrating the role of accountability and credibility in bond value. I also noted that I could die before the maturation date, which introduced the concept of risk and why the bond cannot be worth more than $20. While it not strictly true that the bond cannot be worth more than $20, I feel it is important to make the claim that it must be worth less. If I were to make a ‘profit’ by receiving more than $20 someone may complain that I had abused my position thereby causing me inconvenience.

The auction for the bond is a second price auction. Winners do not pay the amount they bid, but rather they pay the second highest bid amount. This invites an explanation of incentive compatibility, the reason for the use of the second price. If winners paid their bid, they would have an incentive to report a lower bid than the highest amount they would be willing to pay. By making the payment the second highest bid, the planner of the experiment has removed the incentive to report falsely. The incentives of the procedure are compatible with the teaching objective of revealing demand. Notice that this approach introduces the concept of demand as willingness to pay.

The students wrote their names on slips of paper with the most they would be willing to pay in order to get $20 at the end of the semester. (Detailed instructions are in appendix 1.) The students passed the pages to the end of the row and the student on the end sorted them from high on the bottom to low on the top. I restacked them into one pile with low on the bottom and high on the top, and wrote the bid prices quickly on a projected
transparency. The students copied the bids to use in their exercise (appendix 2). Figure 2 gives the results of the bond auction as a diagram.

While students copied the bids, I distributed the Bond Exercise that guides the students through organizing the bids into a diagram. Groups of two to four students completed this exercise in about 35 minutes. Each student should have an individual write-up as it provides notes on demand. I told the students that the exercise was written for diverse students. Most of the questions are very elementary (numbers 1 and 2 for example), and should be answered on face value. Others address particularly interested students (Appendix 2: Bond auction write-up question 50 for example) and are identified by statements like ‘Interested students may want to’. Most students should ignore such questions.

I walked around the room giving help to students as they worked on the exercise. After five minutes, I spent two minutes addressing the group as a whole to guide the students through the first 17 questions. These first questions merely orient the students to the bids and label the diagram. After 15 minutes, I briefly extended the students to question 24. Most students were beyond question 24, but a brief summary advanced those who lagged and may have reassured those who had proceeded further. After 25 minutes, I reviewed through question 41. This left seven minutes and most students completed the exercise.

One could well explain to the students during the regular unit following this introduction, or while debriefing this experiment as part of an introductory unit, that our “demand” curve is simplified for easy presentation. We allow each student to bid on only one bond, instead of allowing multiple bids at varying prices and quantities for each student. True demand curves allow each buyer to have values for many units, and permit different values for each unit each buyer desires. The following supply auction has a comparable simplification.
The objectives of the bond experiment and write-up exercise focus on a simple introduction to demand. Students must think explicitly about a dollar value of the benefit of a purchase. In the written exercise students plot points and draw curves, find demand prices and quantities demanded, shift demand curves as well as listing factors that shift demand. The relevance of this exercise goes beyond demand in that it exposes students to vocabulary relating to finance and macroeconomics.

4 SUPPLY AUCTION

Bonds are not suitable for demonstrating supply as supply prices do not vary -- unless I issued everyone with a bond, which is prohibitively expensive. Instead, I chose ‘the nightmare auction’ in which students submit the lowest payment they would accept to live through the anxiety nightmare of being the only person nude in class. The objectives of this exercise are to:

- introduce supply highlighting the role of costs,
- introduce and illustrate implicit and explicit costs,
- show upward sloping supply as marginal cost increasing with quantity,
- show a general increase of marginal costs as a decrease of supply,
- present a shift of supply,
- introduce the idea of simplified models, and
- introduce the conditions of perfect competition.

The procedures in this experiment are emotionally sensitive; gradual introduction helps. I made sure that several points were clear to the students, and explained some issues before revealing the nature of the auction. I advised the students to select someone they know well, someone they can ‘speak for’ on privacy issues and that obviously the easiest person would be themselves, but they are free to select someone else if they wish. They need not ever reveal whom they chose. I told the students that unlike the bond...
experiment, in this one they would not reveal their names, no money would change hands, and the winner would not do the auctioned activity.

I gently introduced the topic. “When I was young we had this anxiety nightmare. We’d look up and realize that we were the only person in class with no cloths on.” Example instructions are in appendix 3. Students wrote on pieces of paper the minimum amount of money they would accept to live through that nightmare, to be the only person naked in class for an entire class period.

I then collected the papers as with the bond, but stacked with high on the bottom and low on the top. I kept an eye out for interesting cases in order to use the time constructively and engage the students while sorting the bids. Lessons about supply awaited more organized time after the sorting when I could present supply systematically. Is one billion dollars a thousand million (USA) or a million-million (UK)? What is the daily interest on a billion dollars anyway? In each session, someone computed the interest. Some students actually specified goods, unambiguous real prices. Others specified dollars and cents or a specific unrounded dollar, which is likely to be for a specific purchase. Such real prices provided an opportunity to discuss nominal and real. Some participants expressed surprise to find out that money is not real and that economics is not about money.

With the stack finished, I plotted the prices on a diagram. Our results are in figure 3, which also shows that most students did not submit bids. There is no written exercise for the nightmare auction as the specific skills and lessons would largely repeat the bond auction. Instead, I demonstrated the work. Beginning students may not know how to draw a diagram, so I showed them how to establish the length of the quantity axis and the height of the vertical axis. I had to use a logarithmic scale on the price axis. Nearly all Victorian students, from which we draw the vast majority of our students, learn logarithms during high school, although retention varies. I
briefly reminded them about base 10 logarithms as the number of digits: 1 for 1, 2 for 10, 3 for 100....

One begins plotting supply schedules with the lowest numbers because buyers sort them that way. They buy from the cheapest sources first, before ones that are more expensive. Students were sceptical. I explained that sometimes economists assume that all examples of a particular type of good are exactly interchangeable – equally useful naked bodies – and allowed further scepticism to remain for the final punch line. Anyway, buyers select the lowest cost unit and then select progressively more costly units. This is an example of marginal cost increasing as quantity increases and supply is marginal cost, as it is in markets with many buyers and sellers.

I challenged the students. “I said supply was marginal cost. What costs are there in being the only person naked in class?” The students offered a series of implicit costs including loss of social standing, embarrassment, loss of friends, etc. One person mentioned the possibility of legal costs. The latter example is as close to explicit costs as I normally received in this experiment, a risk of an out of pocket expense. I asked the students if loss of social standing and embarrassment were ‘real’. They agreed both were. At this point, we can see supply on a diagram illustrating marginal (mostly implicit) costs increasing with quantity.

The final stage of the nightmare auction introduces shifts of supply, increase of the marginal cost schedule as a supply decrease, and concept of *caeteris paribus*. I repeated the nightmare auction saying that everything would be the same as before, except for one condition. I explained that the practice of making one change at a time, *caeteris paribus*, is important in economics as it allows for interpreting the effects of specific causes. The one change in the nightmare auction is that ‘this time, pretend that your oldest living relative who can see is in the room with the class and you.’ I asked people to raise their hands if they (or their alter-ego) would be willing to be naked for a lower payment than before, and got no volunteers. When I
asked about who would require higher payment, about half the students raised their hands.

Returning to the supply diagram, some of the points moved higher with ‘grandma’ present, some stayed the same height (showing no change in cost of producing the product) and none moved downward. So, the curve in aggregate moved upwards. I reminded them that when asked for a show of hands, the participants indicated that they were less willing to provide the product, not more willing. Therefore, an increase in marginal costs (pointing upward on the diagram) is a decrease in supply (pointing leftward on the diagram).

The final aspect of the nightmare auction was to ask the students if the example was realistic. They said no. Then I told them that in the upcoming semester there would be classes with one naked person and any naked person who could hold still was as good as any other – figure drawing in arts. I hope this will make them more receptive to economic assumptions.

The nightmare auction introduced costs: implicit and explicit costs, increasing marginal cost schedule and upward sloping supply, shift of supply, and an increase of marginal cost as a decrease of supply. It illustrates vividly that implicit costs are real. It foreshadowed perfect competition and the use of assumptions, while challenging participants’ ideas about what is realistic. Academics have questioned the appropriateness of using the idea of public nudity as an auctioned activity. I have used this experiment for ten years in a variety of universities with students from all over the world. No students have complained about it either on student evaluations or through any other process. Using nudity for this labour supply auction has the marked advantage of being immediately imaginable in a way that most other labour supply examples are not: an hour of cooking hamburgers, painting a house, data entry, etc.
5 PIT MARKET EXPERIMENT

The third event of the introduction to economics program was a market simulation ‘pit’ experiment that integrated supply and demand. It introduces equilibrium, demonstrates demand and supply along with shifts of both, illustrates a level of precision in equilibrium, shows supply and demand as a predictive model, and further introduces the concept of perfect competition.

This pit experiment shares features, good and bad, with Chamberlin (1948). Chamberlin found that the quantity traded in his experiments often exceeded the equilibrium quantity due to his market breaking into smaller markets around the classroom, resulting in inefficient trades. Holt (1996) addresses this phenomenon in detail. Smith (1962) resolved the problem by having buyers separated from sellers and each group call successively more favourable bids to the other group until they agreed upon a trade price. I found Chamberlin’s method of having all buyers and sellers circulate in the room to be effective in large classes. Holt notes that double auctions can be difficult and slow in large classes. “With large classes it is better to use the students near the aisles and let the others watch” (1996, pg 196). “Classroom experiments are more difficult to use effectively in large classes since it is the personal involvement that stimulates student interest” (1999, pg 607). I have not experienced this difficulty, but my experiments have involved only at most 180 students. I prefer full participation by all students even at the cost of potentially weaker results. Of course, the double-oral auction format provides much more information to buyers and sellers, presents that information in a more public manner, and gives a faster convergence to equilibrium.

The market simulation experiment divides the participants evenly into buyers and sellers. Each participant receives a sheet (Appendix 4, pages 2 and 3) of paper divided into seven playing rounds documenting two units of an abstract commodity ‘stuff’ for each round. Detailed instructions are in appendix 4. Sellers have the costs for each unit of stuff and buyers have a
‘resale value’ for each of two units. Sellers make profits by selling units for more than their costs and buyers make profits by buying units for less than their resale values. Since this experiment focuses on costs and resale values, it provides an opportunity to introduce abstract commodities that feature strongly in introduction to economics units.

The values and costs yield an equal expected profit (appendix 5) for all buyers and sellers. That is, if each unit trades at equilibrium price, each participant would earn equal profit. As an incentive to participate industriously, I treated each point of profit as a ‘lottery ticket’ chance to win twenty dollars. Students did participate enthusiastically, and I conclude that $20 was sufficient motivation. If one used this experiment in a regular class, one may be tempted to use profit as class marks as incentive, since all students have equal chances to earn profits, but be aware of strong arguments against this practice (Stodder 1998 and Cheung 2003).

The market experiment sheets fit classes in multiples of 20. However, the order of the buyer and seller sheets allows other numbers to participate with only minor distortion of results. On the first day of our introductory program, there were 49 participants and 79 on the second day. I did not retain records on the first day. On the second day, there were 39 sellers and 40 buyers.

I read the instructions of the game to the participants, showing them example buyer and seller sheets, as well as demonstrating how to record trade prices and other information as well as how to compute profit.

The market experiment begins with a practice round in which the profit does not count as a chance to win money. I have found it productive to walk through the classroom checking sheets, reminding people to play only the practice round, to “buy low and sell dear” and other aspects of the instructions.

The demand and supply curves for the practice round were Pd=50-0.2Qd and Ps=20+0.2Qs with Q expressed as a percentage of the
participants. Equilibrium price and quantity were 35 points/unit and 75% of the class size of units (59 trades). The class reported 48 trades. Specifically, I asked all buyers who had traded no units to raise their hands, and none did—establishing at least 40 sales. Then I asked all buyers who had bought two units to raise their hands; eight did—establishing 48 sales or 61%. Presumably most of the participants had no idea at that time of the specifics of supply and demand, or even that the concept of equilibrium existed, much less what equilibrium was in this case. I asked buyers who traded in the last two minutes of the game to raise their hands then asked them to tell me the trading price. They reported prices of 26.5, 35, 39, and 32.

The supply and demand curves remained the same for the first and second round as in the practice round. Now that the participants were familiar with the game and playing with a chance to win money, they played more enthusiastically than in the practice round. Buyers reported 53 trades, or 67%. They reported prices of 38, 33, 33, 35, 36, 34.5, 36, 31 and 34, averaging 34.5. Round 2 had 54 trades with the average price of the final trades being 35.3.

In rounds 3 and 4, 25% of buyers self-selected out of each round through tâtonnement auction. I asked for a show of hands for buyers who would be willing to ‘sit out of’ round 3 and not trade any units. They would receive 10 points in compensation. Few raised their hands. I then suggested higher or lower prices until we settled on a compensation of 16 points for 10 buyers to sit out of round three.

It is impossible, a priori, to give the equilibrium prices for rounds three and four since we cannot know which buyers will accept the buy-out. However, a 25% reduction in demand drawn shifted or rotated from the price axis, yields a predicted equilibrium of about 63 or 64% (50 trades) and a price of about 32 or 32.5.

The result in round 3 was 40 reported trades (50%) with an average of final prices being 31.5. In round 4, 10 buyers sat out for 15 points. Buyers
reported 43 trades with the prices in the last minute between 30 and 35 yielding an average of 32.5.

Note that I asked buyers to report trade prices in rounds 3 and 4 when the equilibrium price had fallen. In the past, I have noticed a small bias in participant reporting of results. Buyers occasionally decline to report high prices, and sellers occasionally exclude low prices. Apparently, they hear other prices being reported and adjust their numbers or lower their hands before I can call on them. That bias could cause difficulties in the classroom if it conflicted with economic prediction. But, with care the bias can help in the classroom, although the distortion would be problematic in research. By asking buyers to report prices in rounds with suppressed prices, if a bias occurs, it does not harm teaching objectives.

In rounds 5 and 6, all buyers participated and 10 sellers sat out for payments of 8 and 11 points. Sellers reported 45 trades in each of rounds 5 and 6 with the average of the final prices being 36 and 37½.

Quantities traded were consistently lower than the predicted equilibrium quantity, while prices were close to the predicted equilibrium. This suggests that some costs affected both buyers and sellers. Such undocumented costs would shift both supply and demand inward. With brief leading questions, the students proposed possible costs, such as the inconvenience of moving around the room and seeking trades. In this way, students discovered transaction costs as a source of market distortions.

Detailed results from the six trading rounds provide students with empirical results to compare to theoretical predictions in a 53-question exercise (appendix 6). Students can complete the exercise independently or in small groups. Several important or informative answers follow shortly after relevant questions, providing students with prompt feedback and preventing them from going too astray. The exercise relies upon the students having access to the instructions introducing the market experiment, the number of participants in the exercise (class size), as well as the number of
trades and final prices for each of the trading periods. With that information, even students who did not participate in the experiment, including off-campus students, may complete the exercise.

Since I seldom know the number of participants before running this experiment, the exercise allows for any number of participants. Unfortunately, this requires an awkward rescaling of the quantity axis of the diagrams in the exercise, and the rescaling must be completed at the beginning of the exercise, questions 1.3 to 1.6. As I did with numbering the axes on the bond exercise above, I guided the students moderately quickly through rescaling the quantity axis on the market experiment exercise.

In the remainder of the first section (questions 1.xx) participants identify equilibrium through comparing marginal costs with marginal benefits, then compare the theoretical equilibrium with empirical results from the experiment. Unlike most introductions to economics, this exercise presents participants with an example of the dispersion of results around equilibrium. The second section (questions 2.xx) relates buyers to demand and shows a change in demand with its effects upon the equilibrium. The final section (section 3.11) presents the same lessons for supply.

6 MONOPOLY EXERCISE
The last exercise of the day presented students with monopoly price setting and foreshadows market failure (appendix 7). As well as introducing monopolies and the concept of price maker, the exercise also introduces profit maximization; total, fixed and, variable costs; total revenue; as well as marginal cost and demand as a system of equations.

I began developing this exercise years ago as an experiment. It did not work well. Over a few semesters, I reduced and dropped the experiment and simplified the exercise. I believe the current form is efficient and effective, but only engaging and fun for most students if they do it as a group exercise.
This exercise presents students with a downward sloping demand curve and a horizontal marginal cost curve. It then guides them through calculations of revenue, cost, and profit. It provides details of a zero profit example, and invites the students through a profitable but not profit maximizing example. The students then try to find the maximum profit through trial and error. Participants completed this exercise in small groups or individually, as they chose, and nearly all completed it in about 20 minutes.

I debriefed the students afterwards, and asked students to tell the highest profit. Most found $400, the correct answer. I then showed them how to find the profit maximizing price and quantity using the marginal revenue curve. I did not explain how to derive MR, but rather how to draw it from a linear demand curve. Many participants expressed appreciation of the speed of the technique.

7 CLOSING THE PROGRAM

I finished the introductory program with a five minute summary of what we learned. First, I told them that I would like them to complete an evaluation of my program before they left. I warned them that the evaluation would test them on the material so that I could find out what they learned. It would not evaluate them because their names would not be on the forms. I requested that they do their own work so that I may get good information and be able to improve the program. Then I summarized what we had done, reviewing demand and benefits from the bond exercise, supply as costs from the nightmare auction, demand and supply interacting in the market experiment, equilibrium, shifts of supply and demand, market results and monopoly pricing. While distributing the evaluation I thanked them for participating, I requested that students who had taken economics previously place their evaluations in one box, and the rest of the students place them in a box by the exit.
8 EVALUATION

An evaluation (figure 4) assessed the economic component of the introductory program, including the affect on the goals of increasing student comfort and providing basic economic knowledge. It was as an instrument to improve my teaching, not a research instrument. I wrote the evaluation quickly to provide information me as a participant and witness to the program. I did not include controls that would be important in convincing others of subtle conclusions. Therefore, conclusions using the instrument are broad and imprecise. However, the evaluation was sufficient to support some interesting conclusions.

Sixty-seven students who had not previously taken economics returned the evaluation. Of these, fifty-nine said they were more comfortable about taking economics (question 1) including 13 who volunteered that the increase was limited. Five reported no increase in comfort and three did not respond. No more than half a dozen students who had taken economics returned the evaluation, therefore I have not addressed them in any analysis.

The evaluation had eight questions, but it evaluated ten aspects of economic performance. Question two revealed two criteria: 2a) Did the student label price and quantity on the diagram? 2b) Were supply and demand drawn properly, sloping up and down respectively and labelled? Question three required that the student find both equilibrium price and quantity (rounding permitted). Questions four to seven were interpreted as stated on the evaluation. Question eight served as two questions with price and quantity treated distinctly. The tenth aspect was ‘Did the student draw a changed supply or demand curve in order to answer questions four to eight on the evaluation?’

The students performed at a passing level (at least 50%) on each of the first nine points. Few students drew a curve as a tool in finding the effects of a change. I did not tell them to draw curves generally to find effects of changes nor did I direct them to do so or in the evaluation. I ‘role-modelled’
drawing curves and I had them draw changes in curves in the market experiment exercise; however I did not present the technique as a general practice. Clearly, I should have explained the usefulness of drawing curves more explicitly as only three participants used the technique.

The other major problem area that the students showed was with relating marginal cost to economic results. Half of the students gave incorrect answers for each of the marginal cost questions (6 and 7).

Overall, the students received passing marks for the material we addressed. Students who replied that they were more comfortable about taking economics after the one-day program answered two-thirds of the evaluation questions correctly (table 1). Those reporting little or no increase in comfort responded correctly on 59 and 56 percent of the items.

9 SUMMARY AND CONCLUSION

I conclude that the experiment-based program for a one-day introduction to economics increased participants’ comfort about taking economics and provided participants with a foundation of knowledge of economics. As a participant, I feel that the program ran well, that the students remained engaged, and that the breadth and depth were appropriate given that the students would see the material again during a regular unit. The program would improve with a more explicit recommendation to use economic tools of analysis, specifically supply and demand diagrams and drawing changes in the curves.

Economic experiments show promise as engaging and effective teaching techniques that may benefit our increasingly diverse student base. Experience with experiments and detailed exercises may assist foreign students (who may feel insecure about both the English language and economics terminology) as well as less academically inclined students who are entering university in increasing numbers due to economic shifts. However, experiments and especially the detailed exercises as used in this
paper are not yet internationally mainstream teaching tools. A next step would be to evaluate these techniques in a controlled study in which the effectiveness of these experimental techniques is directly compared to the effectiveness of some other preparatory course.

I hope other instructors find these experiments and exercises useful and I would appreciate any comments on their applications and effectiveness.
Figure 1: Example bond

The holder of this bond is entitled to $20.00 from Teacher Name of the School of Economics, This University.

The bond may be redeemed on or after Date during office hours.

This bond may only be redeemed once, after which it is of no value. Only the signed original of this bond is valid.

Teacher name
Department of Economics
This University
Figure 2: Bond auction results

Note: Twenty-seven of seventy-two students did not submit bids.
Figure 3: Results of nightmare auction

Supply for Nightmares

Bids to be the only person nude in class were: 5, 20, 50, 100, 200, 1000x4, 1500, 1734.73, 5K, 6K, 10Kx3, 50K, 300K, 300K, 800K, 1M, 1.1M, 1.1M, 10M, 1KM, 1.25KM, 99KM, 1MM, 1KMM. Also, ‘3 bottles of tequila’. The $5.00 bid said “lunch money.”
Figure 4: Evaluation for one-day introduction to economics

1) Do you feel more comfortable about taking economics this year?

2) Draw reasonable supply and demand curves in the diagram below and label the axes.

![Diagram](image)

3) If there were many buyers and sellers facing your supply and demand curves, what would be the market equilibrium price and quantity traded?

\[ P = \quad Q = \]

4) What would happen to the equilibrium price if demand increased?
- Decrease
- Stay the Same
- Increase
- Not enough information
- Don’t Know

5) What would happen to the equilibrium quantity traded if demand increased?
- Decrease
- Stay the Same
- Increase
- Not enough information
- Don’t Know

6) What would happen to the equilibrium price if marginal cost increased?
- Decrease
- Stay the Same
- Increase
- Not enough information
- Don’t Know

7) What would happen to the equilibrium quantity if marginal cost increased?
- Decrease
- Stay the Same
- Increase
- Not enough information
- Don’t Know

8) Referring back to your original supply and demand curves and answer in question 3, what would happen to the equilibrium price and quantity if there were one seller instead of many (and still many buyers)?

Price would:
- Decrease
- Stay the Same
- Increase
- Not enough information
- Don’t Know

Quantity trade would:
- Decrease
- Stay the Same
- Increase
- Not enough information
- Don’t Know
Table 1: Evaluation results

<table>
<thead>
<tr>
<th>Students with no previous economics.</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>More Comfortable about taking econ?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>46</td>
<td>68.6</td>
</tr>
<tr>
<td>Marginally Yes</td>
<td>13</td>
<td>19.4</td>
</tr>
<tr>
<td>No</td>
<td>5</td>
<td>7.5</td>
</tr>
<tr>
<td>Not Answered</td>
<td>3</td>
<td>4.5</td>
</tr>
<tr>
<td>Total</td>
<td>67</td>
<td>100</td>
</tr>
</tbody>
</table>

Performance of those not more comfortable

<table>
<thead>
<tr>
<th>Comfort</th>
<th>Percent of test questions correct</th>
<th>Drew S&amp;D correctly</th>
<th>Found Equilibrium P&amp;Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marginal Yes</td>
<td>59</td>
<td>12/13</td>
<td>10/13</td>
</tr>
<tr>
<td>No</td>
<td>56</td>
<td>3/5</td>
<td>4/5</td>
</tr>
<tr>
<td>Not Answered</td>
<td>67</td>
<td>3/3</td>
<td>3/3</td>
</tr>
</tbody>
</table>
Appendix 1: Instructions for bond auction

Today we will auction a bond for $20, using a mechanism called a sealed bid auction. I will explain this process step by step. I will not yet explain the lessons you are supposed to learn from the experiment. Just participate and observe for now. The lessons will come. You will have a long but straightforward assignment based on this exercise.

[Project the bond on the overhead projector.]

[Read the bond.]

[Explain the bond.] This means that whoever has this bond at the end of the quarter can hand it to me and get twenty dollar in return for it.

How do you get the bond? You win an auction and pay for it. Only the winner of the auction will pay, and only the winner gets the bond.

This is how the auction will work.

Each of you should decide how much you are willing to pay today to get twenty dollars at the end of the quarter.

1. Write that amount and your name on a piece of paper.
2. We will collect and record the prices to use in an assignment.
3. The winner of the bond will pay for it and receive the bond.
4. You will complete an assignment analysing the bond sale.

Let’s begin.

1. Please take a piece of paper and write your name on it.
2. Check how much money you have.
3. Decide how much you are willing to pay now to get $20 at the end of the semester.
4. Write that price on your paper.
   
   It is not helpful to write a lower number in hope of getting a good deal. This auction is special; the winner will only have to pay the second highest price. But do not write more than you would be happy to pay because the next highest price might equal yours. Thus, you have an incentive to report accurately the price you are willing to pay.

5. Consider your price. If you won, would you be sorry; if so, lower your price. If you lost, would you be overly disappointed; if so, raise your price.
6. Do you have any questions?
7. Pass the paper to the nearest end of your row.
8. The person at the end of the row will sort the bids, highest on the bottom and lowest on the top. The person next to the end should watch to make sure none are dropped.

9. The person on the end then passes he sorted bids forward to a volunteer.

10. This volunteer (4 preferably) will combine the stacks sorted from lowest on the bottom to highest on the top.

11. Four volunteers will then list the numbers from highest to lowest on four sections of the board.

12. Everyone in the class then copies the numbers from the board (Teamwork is OK).

   We also need someone to write an extra copy of the numbers and provide them to the volunteers.

13. While people are copying the numbers, the instructor will call for the person who wrote the highest bid. That person will then come forward, pay for the bond and receive it from the instructor.

   [14. If the winner refuses to trade, that bid will be scratched off the board and the next will be called.]

Review quiz:

1. Raise your hand if you think that everyone will have to pay.

2. Raise your hand if you understand that only one person will pay for the bond.

3. Raise your hand if you think the winner will get the $20 today.

4. Raise your hand if you think the winner will have to wait until the end of the semester to get the $20.

5. Raise your hand if you think the winner will get their money back plus $20.

6. Are there any questions?
Appendix 2: Bond auction write-up

1) Look at the amounts of money that people said they would be willing to pay for the $20 class bond.

2) If you had to sell one bond to the class, which price would you sell it for? _______

3) In 2), did you pick the highest price? If yes, go to question 4.

3’) If you picked a lower number on purpose answer the following three questions.
   a) Why did you not pick the highest price?
   b) Do you prefer to have less money when you could have more?
   c) Do you think most people who sell stuff would prefer to get more money rather than less for the stuff?

We will assume in this class that sellers try to sell for high prices. This assumption is useful. For the rest of this exercise, please assume that you, and other sellers of bonds, would prefer to get more money rather than less.

4) How much could you sell a second bond for? __________

5) How much could you sell a third bond for? __________

6) If the people who bought the first and second bond knew the lower price you accepted from others, do you think you could charge them more than the other buyers?

7) Do you think you could charge them more than the other buyers after they have watched you sell bonds lots of times?

Considering the material above, let us make some simplifying assumptions. First, sellers sell their goods at the same price for everyone. Second, sellers prefer to sell stuff for as much money as they can get.

Now we will organize the information about the prices people are willing to pay. We will put the information into a diagram. This diagram is called a “Supply and Demand graph.” We will start with demand, as in: “How many bonds does the class demand?” The diagram will have price on the vertical (up and down) axis and quantity on the horizontal (right and left) axis.

8) Write “Price” to the left of the top of the grid below. (We abbreviate price as P.)

9) Write “Quantity” below the right hand edge of the grid. (We abbreviate quantity as Q.)
Now we can stop calling it a grid and start calling it a diagram. If you can scale the axes, do so and go to the sentence before question 18. If you want a review of putting numbers on axes, proceed with question 10.

10) What was the highest price anyone was willing to pay for the class bond? _______

Number 10 tells us how high the diagram has to be. The numbers on the vertical axis must reach at least the highest price anyone will pay.

11) Count the number of lines along the vertical (price) axis in the diagram above. ____

Notice that there are more than 20 lines. We can number them from 0 to 20.
12) Start in the lower left corner and write “0” beside the corner. Then put a “1” beside the first line above it, then a “2” and so forth until you reach 20 near the top.

Next we will number the horizontal (quantity) axis.

13) What is the most number of bonds that could be sold at any price? That is, how many price bids were turned in? ______________

Item 13) tells us how wide the diagram has to be. The numbers on the quantity axis must reach at least the highest number of bonds that could be traded.

14) Count the number of lines along the horizontal (quantity) axis.

15) Are there fewer lines than bids?

If so, each line must represent more than one bond.

16) Divide the number of bids by the number of lines and round up. Write that whole number here.

Each line must represent the number of bonds in 16). If each line represents that many bonds, then we could fit all that we need onto this diagram.

17) Write “0” below the lower left hand corner and put the number from 16) below the first line. Then write double the number in 16) and write it below the next line (the second line to the right of the vertical axis). Multiply the number in 16) by 3 and place it below the third line to the right of the axis. Continue this numbering until you have more than enough for the class.

Now you have a diagram with price (P) measured vertically (up and down), and the number of bonds measured horizontally (right and left).

The objective of the next section is to convert all the prices from the bids into a single (crooked) curve.

18) If there were only one bond for sale, what price could the seller get for it? (What was the highest price anyone listed?)

You have just given a price (P) to go with a quantity (Q) of one bond. It can be represented as a point on the diagram.

19) Plot this point by following the procedure below.

a) Find the price (the highest price for one bond) on the price axis and put your pencil tip on that price.

b) Move your pencil tip to the right by one bond. Remember that each line may be more than one bond. If so, move the pencil tip only part way to the first line.

c) Put a dot on the diagram (showing the highest price and a quantity of one bond).
Now we shall plot the second price and a quantity of two bonds. If you can do so easily, do so and skip to question 23. Two bonds are represented by a distance left to right on the diagram. Let’s see how wide it is.

20) Write the number of bonds represented by the first line to the right of the vertical axis. To find out, look at the line just to the right of the vertical axis and follow it to the bottom (horizontal) axis and find the number you wrote at the bottom of the line (just to the right of “0”).

The number in 20) should be the same as the number in 16). If not, redo the work starting at right after 12).

If the number in 20) is “1”, two bonds are represented by the distance from the axis across one line, and to the next. If the number in 20) is “2”, two bonds are represented by the distance between two adjacent (neighbouring) vertical lines. If the number in 20) is more than 2, two bonds are represented by a fraction of the distance between two vertical lines. To find this fraction put 2 over the number in 20). For example 2/3, 2/4, 2/5, etc.

21) What is the distance that represents 2 bonds?

22) What is the second highest price that a bond could be sold for? (It might be the same as the highest price and it might be lower. If it is higher, reconsider your thinking.)

23) Plot the offered price of the second bond.
   a. Find the price on the vertical (price) axis. Put your pencil tip there.
   b. Move your pencil tip to the right the distance you wrote in 21).
   c. Draw the point.

24) Repeat the plotting procedure for every vertical line. For example, if each line represents five bonds, plot the fifth highest price on the 5 bond line (first line right of the price axis), and plot the tenth highest price on the 10 bond line (2nd right of the price axis). Likewise, if each line represents two bonds, you have already plotted a point on the first line, and put the fourth highest price on the 4-bond line (2nd right of the price axis), etc.

25) Connect the dots (your plotted points).

26) Label your “curve” with a “D” for “demand”.

You now have a demand curve that tells how many bonds can be sold for any given price. Let’s find out how many bonds I could have sold for $6.00.

27) Put your pencil tip on the bottom of the price (vertical) axis. Move your pencil tip up (without actually drawing on the line) until it reaches the $6 mark.

28) Next, move your pencil tip to the right along the horizontal line at $6 until it reaches the demand curve (the mark connecting your points).
29) Move your pencil tip straight down until it reaches the horizontal (quantity of bonds) axis. Your pencil tip now points at the number of bonds I could sell for $6. It is easy to read this number if it is on a line, just read the number below it. If it is between lines, estimate the number based on the labels to the right and left of your pencil tip.

30) What is the number of bonds I could have sold for $6.00?

31) What is the number of bonds I could have sold for $10.00? (If D is flat at $10, use the point farthest to the right.)

32) What is the number of bonds I could have sold for $15.00?

33) Does it make sense to you that I would not be able to sell as many bonds for a higher price than I could for a lower price?

The quantity of bonds that can be sold for some price is called the “quantity demanded” at that price.

34) What is the quantity of bonds demanded at $2.00?

You have seen how we can use a demand curve to find the quantity that people would buy, given some price. Now we will use the demand curve to find the most that people would be willing to pay for some given quantity of a good. That is, we will start with a quantity and go to a price.

Let’s find out the price I could have sold 10 bonds for.

35) Put your pencil tip on the quantity of bonds (Q) axis at the point for 10 bonds.

36) Move your pencil tip straight up until you reach the D (demand) curve.

37) Move your pencil tip straight and level to the left until it reaches the P (price) axis.

38) Read the number nearest (really at or below) your pencil tip. This is the price I could have sold ten bonds for. Write the price I could have received for ten bonds.

39) What is the price I could have received for 20 bonds?

The price that some number of bonds can be sold for is called the “demand price”.

40) What is the demand price for five bonds? Also, if there were more than 40 prices offered, find the price I could have received for 40 bonds.

41) Does it make sense to you that the demand price is higher when quantities are lower?
Now you can draw and read demand curves.

The next section of the exercise addresses changes in demand curves. Keep in mind that the demand curve gives the amount of money that people will pay for any quantity of some good, and also the quantity that people would buy at any given price. That is, the demand curve gives the relationship between the prices and quantities that people are willing to buy.

Let’s change the demand curve through some simple operations.

42) If there were only half as many people in class, would there have (probably) been more or fewer people willing to pay $10.00 for the bond? It is reasonable to estimate that about half as many would have been willing to pay $10.00 per bond.

43) Plot a point showing $10 and half as many bonds as for $10 above (in 31).

44) Plot a point that shows $6 and half as many bonds demanded as you found above.

45) Plot a point that shows $15 and half the quantity of bonds demanded as you found above.

46) Plot a point at $0 and half the total number of bond prices offered by the class (item 13).

47) Connect the four new points and label the new curve “D2”, for the second demand curve? For completeness extend the new curve upward to the left and connect it to the Price axis at what you consider to be a reasonable place.

48) For consistency and convenience, please re-label the original curve “D1”.

Notice that the new demand curve (D2) is below, and more importantly to the left, of the original demand curve (D1). This is called a “decrease in demand”.

Notice that for any price, the quantity demanded is less on D2 than on D1 (you drew it that way). Also, for any quantity, the demand price is lower for D2 than for D1. The second observation emerges from the logic of the system. You got more out of the diagram than you put in. It worked; it worked for you. Both D1 and D2 slope down because if few bonds are on the market, sellers sell them to the buyers who would pay the most. That is, at low quantities, the demand price is high because that is who the sellers choose to sell to. See question 41 and the beginning of this exercise.
49) Let’s say everyone in class received $100 before class. What would have probably happened to the amounts that class members were willing to pay for the bond?

50) Draw this increase in demand by following these instructions. Draw a new curve to the right (above) D₁ and label it D₃. (Detail oriented people may wish to consider that the curve is likely to stay about the same at the top end near the P axis and also at the Q axis, and bulge out in the middle. Other people should just draw D₃ to the right.)

Changes in demand such as we just demonstrated are called “shifts in demand” because the curve shifts to a new location.

51) Please list at least two processes that you think could cause demand to decrease.

52) Please list at least two processes that you think could cause demand to increase.

53) Why does demand for a good not change when the price of that good changes? Hint: look at your lists, items 30) to 34), items 47 and 50) and the comment between items 50) and 51).
Appendix 3: Nightmare auction instructions

Supply “NIGHTMARE” auction script. Read the following.

Today we will do a new auction. This time it will be imaginary. No money will change hands and no one will do what we bid for.

Further, the auction will be imaginary because you get to use someone else’s point of view if you want. Think of someone you know well, someone that you could “speak for” concerning privacy issues. This person could be you or anyone you know well. We will not actually use the name of the person. Unlike the bond auction, do not put a name with your bid. Choose your person now.

My age group often had a certain anxiety nightmare. We would look up and suddenly realize that we were the only person stark naked in class!

Write down the least amount of money that the person you are thinking of would accept to live through this nightmare. That is, from the point of view of the person you selected, what is the lowest acceptable payment to get you to go through a class nude – and you are the only one without cloths!

DO NOT WRITE NAMES ON THIS PAPER.

Please pass your bids to the nearest end of the row.

[Once the bids are passed, ask the people on the ends for help.]

People at the end please bring them to the front and place them in stacks according to the number of digits in the bid: 1-9 together, 10-99 together, and so forth.

[Plot the points using a logarithmic scale (base 10; it will slope up nicely.]

[Explain supply as marginal cost. Ask them:] ‘What costs are there to sitting in class nude?’ When they have suggested several point out that most do not involve paying anyone anything out of their pockets. Note implicit costs as in this experiment, and explicit costs are easy to think of.

Now we will repeat the auction. You should think of the same person. But, this time one condition has changed. Your oldest living relative who can see is in the room during the nudity!

[Get bids again and plot them. OR ask:] ‘How may of you (or your alter egos) would supply nudity for a lower price?’ Count hands. How many of you would require a higher price?’ Compare the number of hands.

Note to the class that the curve has moved up. Ask the class if the class as a whole was more willing or less willing as a whole to supply nudity with ‘grandma’ in the room. That is a decrease in supply. A decrease in supply is an increase in cost per unit!

Discuss other things that shift supply.
Appendix 4: Market experiment instructions

Preparation for Supply and Demand Pit Experiment

In this experiment, half the class plays the role of buyers and half act as sellers. You are buying or selling ‘stuff’ that comes in amounts called ‘units’. Stuff is an abstract commodity and it does not matter in any way that it does not really exist. What matters is that you will get a chance to win money for every point of profit that you earn in the game. We will present some general points first and then explain how to actually do the experiment.

If you are a buyer, I will pay you some number of points for one or two units of stuff. If you can buy them from a seller for less, you keep the profit. Each point of profit acts as a lottery ticket to win $20. If you are a seller, you can get stuff from me for some price, then try to sell it for more. The profit is your chances to win $20. If you do not trade, you do not lose anything. Sellers will only incur a cost if they sell a unit of stuff. This is like being a fashion broker. You try to sell someone’s design, but you only pay for it once you have made a deal.

Specifically, I will distribute sheets (see the following pages) to you that give your beginning values. They show six rounds in addition to a practice round. There are values for two units each round. In each round you must trade the top unit before the bottom one. Some of you will be able to trade two units, some one, and some may not be able to trade any in some rounds. There is no need to trade for the other person’s first unit for your first unit. In fact, all you should know about them is their ID number and the price you agree on. As long as you are trading your units in order, you can trade your first for their second, or your first for their first. You trade your units in order; their order does not matter.

The experiment has six trading periods taken one at a time. Trading periods will last five minutes. If you are a seller, you want to find a buyer who will pay you more than the amount on your sheet, so that you make a profit. If you are a buyer, try to find someone who will sell to you for less than the amount on your sheet. Of course, you can trade so that you make no profit or even a loss. But remember that losses reduce your chance to win the money. You never have to trade, and you should never trade at a loss.

Consider some examples from other experiments. The values shown on these examples have nothing to do with our experiment and will not help you figure out trading prices in our game. First, let’s consider buyers. The following buyer and seller sheets are formatted just like ours, but have different values. Buyer and seller numbers may be updated by hand as class sizes vary.
<table>
<thead>
<tr>
<th>Unit</th>
<th>Practice</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st U N I T</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value</td>
<td>310</td>
<td>210</td>
<td>320</td>
<td>1.15</td>
<td>12.20</td>
<td>720</td>
<td>3200</td>
</tr>
<tr>
<td>Purchase Price</td>
<td>- 273</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profit</td>
<td>= 37</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>3:12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seller</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd U N I T</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value</td>
<td>8</td>
<td>155</td>
<td>180</td>
<td>.95</td>
<td>4.60</td>
<td>1.30</td>
<td>1550</td>
</tr>
<tr>
<td>Purchase Price</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profit</td>
<td>=</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seller</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profit for Round (Sum of two units)</td>
<td>37</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cumulative Profit (Sum for all rounds)</td>
<td>37</td>
<td>(Equals above)</td>
<td>(Left+ above)</td>
<td>(Left+ above)</td>
<td>(Left+ above)</td>
<td>(Left+ above)</td>
<td>(Left+ above)</td>
</tr>
<tr>
<td>Unit</td>
<td>Practice</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>------</td>
<td>----------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>1st UNIT</td>
<td>Selling Price</td>
<td>273</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cost of 1st unit</td>
<td>-210</td>
<td>110</td>
<td>220</td>
<td>0.45</td>
<td>2.20</td>
<td>1.20</td>
</tr>
<tr>
<td></td>
<td>Profit</td>
<td>63</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time</td>
<td>3:12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Buyer</td>
<td>41</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd UNIT</td>
<td>Selling Price</td>
<td>315</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cost of 2nd unit</td>
<td>-320</td>
<td>150</td>
<td>270</td>
<td>1.35</td>
<td>4.60</td>
<td>1.40</td>
</tr>
<tr>
<td></td>
<td>Profit</td>
<td>-5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time</td>
<td>3:14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Seller</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profit for Round</td>
<td>57</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Sum of two units)</td>
<td>(Equals above)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cumulative Profit</td>
<td>57</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Sum for all rounds)</td>
<td>(Equals above)</td>
<td>(Left + above)</td>
<td>(Left + above)</td>
<td>(Left + above)</td>
<td>(Left + above)</td>
<td>(Left + above)</td>
<td></td>
</tr>
</tbody>
</table>
Study the buyer sheet below briefly. Across the top there are several rounds. On the left side there are two units with 1st unit above the 2nd unit. In each trading round you will attempt to trade the 1st unit for that round then the 2nd unit. Do not attempt to trade units from any other round.

In the practice round, Buyer 41 had a value of 310 and bought the unit at 3:12 PM from Seller 18 for 273 points, leaving a profit of 37 points. We will abbreviate points as ‘p’, e.g. a profit of 37p. Buyer 41 did not manage to buy a unit for less than 8p, so her profit for the practice round was 37p.

Seller 18 traded with Buyer 41 in the practice round. You can see the transaction recorded on seller sheet 18 also. Double recording helps verify accurate results. Notice that the 1st unit in the practice round has a cost of 210p. Seller 18 wanted to get more than this for the unit and succeeded. Just above the cost, he wrote the price of 273. The difference between the selling price and the cost is his profit of 63p. He traded the second unit next. It has a higher value than the 1st unit, but unfortunately he sold the item for 315p. He suffered a loss of 5p. Probably the seller just became confused since it was the first round he played. Certainly, no one in this experiment has to trade at a loss. Anyway, his total profit is 57p. Notice that he would have been better off if he had not traded the second unit, and he did not have to.

Supply and Demand Experiment One will progress as follows.

1. Instructor makes sure sheets are distributed properly. (Done)
2. Instructor explains the sheets. (Done)
3. Students each decide on a strategy.
4. Trading begins for a 5 minute round.
5. Buyers and sellers rush around the classroom looking for deals. Buyer sheets have blue edges and seller sheets have red edges for easy identification.
6. Individual buyers and sellers negotiate trades.
7. Each student records the trade price, time, and their trading partner’s number in the appropriate column and row for that round and unit.
8. When five minutes are over, trading ends.
9. Instructor asks for and records the prices from the last few trades of the round.
10. We repeat steps 3 to 9 for additional rounds.

Rounds three to six will be different from the first two. In rounds 3 and 4 I will offer payment to buyers to remain out of the game. This is done by tâtonnement auction. I will call out various numbers of points that I will pay buyers to drop out for one round. All buyers willing to drop out raise their cards. I will increase or decrease the points until one fourth of the buyers are willing to not play. The buyers that dropped out will then record that
number of points as their profit for the round and get my initials as verification. They return to the game in future rounds.

In rounds five and six, I will remove one fourth of the sellers the same way.

Before we start trading, you should think of what strategy you will use. You could:

1. Take the first profitable deal you find.
2. Ask at least two possible trading partners and then take any price that you get that is at least as good as the best of the two.
3. Trade fast and hope to make a big profit before anyone figures out how things will go.
4. Wait until the last minute to trade in hope that there will be a panicked market that will help you.
5. Make up a strategy of your own.

Please do the following review exercise.

Use the sheet for buyer 41 and pretend that you are that buyer. For round 1, you buy one unit for 120 points.

Record this exchange on the buyer 41 sheet.

Compute your earnings for your first unit and record the time as 3:19 and seller as number 12.

What is your profit?

Should you buy a second unit for 190 points?

Compute and record your profit for round 1?

What are your cumulative profits for round 1?

You should not have purchased the second unit in round 1. Your cumulative profit is 90 as the practice round does not count.

In round two you are able to buy two units, each for 150p. What is your cumulative profit after round 2?

Next pretend that you are Seller 18. What would be your profit for round 1 if you were able to sell a unit for 190p and then one for 140p?

The cumulative profit for buyer 41 at the end of round 2 was 290. Seller 18 should only trade the first unit and cumulative profit equals 80 for round 1.
Appendix 5: Values and costs for market experiment

Rows with sellers’ costs by round for 1\textsuperscript{st} (T) and 2\textsuperscript{nd} (B) units.

<table>
<thead>
<tr>
<th>Sellers</th>
<th>RPT</th>
<th>RPB</th>
<th>R1T</th>
<th>R1B</th>
<th>R2T</th>
<th>R2B</th>
<th>R3T</th>
<th>R3B</th>
<th>R4T</th>
<th>R4B</th>
<th>R5T</th>
<th>R5B</th>
<th>R6T</th>
<th>R6B</th>
</tr>
</thead>
<tbody>
<tr>
<td>S 1</td>
<td>27.5</td>
<td>31.0</td>
<td>20.5</td>
<td>40.0</td>
<td>25.5</td>
<td>35.0</td>
<td>30.0</td>
<td>30.5</td>
<td>22.5</td>
<td>38.0</td>
<td>27.5</td>
<td>33.0</td>
<td>25.5</td>
<td>36.0</td>
</tr>
<tr>
<td>S 2</td>
<td>26.5</td>
<td>34.0</td>
<td>21.5</td>
<td>39.0</td>
<td>26.5</td>
<td>35.5</td>
<td>28.0</td>
<td>32.5</td>
<td>22.0</td>
<td>39.0</td>
<td>26.5</td>
<td>34.0</td>
<td>28.0</td>
<td>32.0</td>
</tr>
<tr>
<td>S 3</td>
<td>25.5</td>
<td>35.0</td>
<td>26.0</td>
<td>38.0</td>
<td>27.5</td>
<td>33.0</td>
<td>25.5</td>
<td>34.5</td>
<td>20.5</td>
<td>40.0</td>
<td>25.5</td>
<td>35.0</td>
<td>30.0</td>
<td>30.5</td>
</tr>
<tr>
<td>S 4</td>
<td>29.0</td>
<td>33.0</td>
<td>23.5</td>
<td>37.0</td>
<td>28.5</td>
<td>33.5</td>
<td>24.0</td>
<td>36.5</td>
<td>23.0</td>
<td>36.0</td>
<td>29.5</td>
<td>32.0</td>
<td>22.0</td>
<td>38.5</td>
</tr>
<tr>
<td>S 5</td>
<td>28.5</td>
<td>32.0</td>
<td>24.5</td>
<td>36.0</td>
<td>29.5</td>
<td>31.0</td>
<td>22.0</td>
<td>38.5</td>
<td>27.0</td>
<td>37.0</td>
<td>28.5</td>
<td>32.5</td>
<td>24.0</td>
<td>34.5</td>
</tr>
<tr>
<td>S 6</td>
<td>25.0</td>
<td>38.0</td>
<td>22.0</td>
<td>35.0</td>
<td>22.0</td>
<td>40.0</td>
<td>28.5</td>
<td>31.5</td>
<td>24.0</td>
<td>31.5</td>
<td>24.5</td>
<td>38.0</td>
<td>24.5</td>
<td>38.0</td>
</tr>
<tr>
<td>S 7</td>
<td>21.5</td>
<td>39.0</td>
<td>24.0</td>
<td>34.0</td>
<td>21.5</td>
<td>39.0</td>
<td>27.0</td>
<td>33.5</td>
<td>26.5</td>
<td>34.0</td>
<td>22.5</td>
<td>39.0</td>
<td>27.0</td>
<td>33.5</td>
</tr>
<tr>
<td>S 8</td>
<td>21.0</td>
<td>40.0</td>
<td>28.5</td>
<td>30.5</td>
<td>23.0</td>
<td>38.0</td>
<td>26.0</td>
<td>35.5</td>
<td>24.5</td>
<td>35.0</td>
<td>22.0</td>
<td>40.0</td>
<td>29.0</td>
<td>32.5</td>
</tr>
<tr>
<td>S 9</td>
<td>24.0</td>
<td>36.0</td>
<td>28.0</td>
<td>32.5</td>
<td>23.5</td>
<td>37.0</td>
<td>22.5</td>
<td>37.5</td>
<td>29.5</td>
<td>31.0</td>
<td>24.0</td>
<td>36.0</td>
<td>21.5</td>
<td>39.5</td>
</tr>
<tr>
<td>S 10</td>
<td>23.5</td>
<td>37.0</td>
<td>29.5</td>
<td>31.0</td>
<td>24.5</td>
<td>36.0</td>
<td>21.0</td>
<td>39.5</td>
<td>28.5</td>
<td>32.0</td>
<td>21.5</td>
<td>37.0</td>
<td>23.5</td>
<td>37.5</td>
</tr>
<tr>
<td>S 11</td>
<td>27.0</td>
<td>33.5</td>
<td>21.0</td>
<td>39.5</td>
<td>26.0</td>
<td>34.5</td>
<td>27.5</td>
<td>32.0</td>
<td>21.5</td>
<td>38.5</td>
<td>27.0</td>
<td>33.5</td>
<td>26.5</td>
<td>36.5</td>
</tr>
<tr>
<td>S 12</td>
<td>26.0</td>
<td>34.5</td>
<td>23.0</td>
<td>38.5</td>
<td>27.0</td>
<td>32.0</td>
<td>29.0</td>
<td>34.0</td>
<td>21.0</td>
<td>39.5</td>
<td>26.0</td>
<td>34.5</td>
<td>29.5</td>
<td>31.5</td>
</tr>
<tr>
<td>S 13</td>
<td>30.0</td>
<td>30.5</td>
<td>22.5</td>
<td>37.5</td>
<td>28.0</td>
<td>32.5</td>
<td>24.5</td>
<td>36.0</td>
<td>25.5</td>
<td>35.5</td>
<td>30.0</td>
<td>30.5</td>
<td>22.5</td>
<td>40.0</td>
</tr>
<tr>
<td>S 14</td>
<td>29.5</td>
<td>31.5</td>
<td>26.5</td>
<td>36.5</td>
<td>29.0</td>
<td>31.5</td>
<td>23.0</td>
<td>38.0</td>
<td>25.0</td>
<td>36.5</td>
<td>29.0</td>
<td>31.5</td>
<td>23.0</td>
<td>35.0</td>
</tr>
<tr>
<td>S 15</td>
<td>28.0</td>
<td>32.5</td>
<td>25.5</td>
<td>35.5</td>
<td>30.0</td>
<td>30.5</td>
<td>20.5</td>
<td>40.0</td>
<td>27.5</td>
<td>37.5</td>
<td>28.0</td>
<td>31.0</td>
<td>25.0</td>
<td>35.5</td>
</tr>
<tr>
<td>S 16</td>
<td>22.0</td>
<td>38.5</td>
<td>25.0</td>
<td>34.5</td>
<td>21.0</td>
<td>39.5</td>
<td>29.5</td>
<td>31.0</td>
<td>23.5</td>
<td>33.5</td>
<td>23.5</td>
<td>38.5</td>
<td>27.5</td>
<td>33.0</td>
</tr>
<tr>
<td>S 17</td>
<td>20.5</td>
<td>39.5</td>
<td>27.0</td>
<td>33.5</td>
<td>20.5</td>
<td>38.5</td>
<td>26.5</td>
<td>33.0</td>
<td>26.0</td>
<td>34.5</td>
<td>23.0</td>
<td>39.5</td>
<td>28.5</td>
<td>31.0</td>
</tr>
<tr>
<td>S 18</td>
<td>24.5</td>
<td>35.5</td>
<td>27.5</td>
<td>32.0</td>
<td>22.5</td>
<td>37.5</td>
<td>25.0</td>
<td>35.0</td>
<td>30.0</td>
<td>30.5</td>
<td>25.0</td>
<td>35.5</td>
<td>20.5</td>
<td>39.0</td>
</tr>
<tr>
<td>S 19</td>
<td>22.5</td>
<td>36.5</td>
<td>29.0</td>
<td>31.5</td>
<td>25.0</td>
<td>36.5</td>
<td>23.5</td>
<td>37.0</td>
<td>29.0</td>
<td>33.0</td>
<td>21.0</td>
<td>36.5</td>
<td>21.0</td>
<td>37.0</td>
</tr>
<tr>
<td>S 20</td>
<td>23.0</td>
<td>37.5</td>
<td>30.0</td>
<td>33.0</td>
<td>24.0</td>
<td>34.0</td>
<td>21.5</td>
<td>39.0</td>
<td>28.0</td>
<td>32.5</td>
<td>20.5</td>
<td>37.5</td>
<td>26.0</td>
<td>34.0</td>
</tr>
<tr>
<td>Buyers</td>
<td>RPT</td>
<td>RPB</td>
<td>R1T</td>
<td>R1B</td>
<td>R2T</td>
<td>R2B</td>
<td>R3T</td>
<td>R3B</td>
<td>R4T</td>
<td>R4B</td>
<td>R5T</td>
<td>R5B</td>
<td>R6T</td>
<td>R6B</td>
</tr>
<tr>
<td>--------</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>B 1</td>
<td>42.5</td>
<td>37.0</td>
<td>49.5</td>
<td>30.0</td>
<td>45.0</td>
<td>35.0</td>
<td>41.0</td>
<td>39.5</td>
<td>47.5</td>
<td>32.0</td>
<td>42.5</td>
<td>37.0</td>
<td>44.0</td>
<td>35.5</td>
</tr>
<tr>
<td>B 2</td>
<td>43.5</td>
<td>36.0</td>
<td>49.0</td>
<td>31.0</td>
<td>47.0</td>
<td>36.0</td>
<td>42.0</td>
<td>37.5</td>
<td>46.0</td>
<td>31.0</td>
<td>43.0</td>
<td>36.0</td>
<td>43.0</td>
<td>38.0</td>
</tr>
<tr>
<td>B 3</td>
<td>45.5</td>
<td>35.0</td>
<td>47.5</td>
<td>32.0</td>
<td>41.0</td>
<td>37.0</td>
<td>45.0</td>
<td>36.5</td>
<td>49.5</td>
<td>30.0</td>
<td>45.5</td>
<td>35.0</td>
<td>40.0</td>
<td>39.5</td>
</tr>
<tr>
<td>B 4</td>
<td>40.5</td>
<td>39.0</td>
<td>46.5</td>
<td>33.0</td>
<td>41.5</td>
<td>38.0</td>
<td>46.5</td>
<td>33.5</td>
<td>45.5</td>
<td>34.0</td>
<td>40.5</td>
<td>39.5</td>
<td>48.5</td>
<td>31.5</td>
</tr>
<tr>
<td>B 5</td>
<td>41.5</td>
<td>38.0</td>
<td>45.5</td>
<td>34.0</td>
<td>40.5</td>
<td>39.0</td>
<td>48.5</td>
<td>31.5</td>
<td>48.0</td>
<td>33.0</td>
<td>41.5</td>
<td>38.0</td>
<td>47.5</td>
<td>33.5</td>
</tr>
<tr>
<td>B 6</td>
<td>47.0</td>
<td>32.0</td>
<td>44.5</td>
<td>35.0</td>
<td>49.5</td>
<td>30.0</td>
<td>40.0</td>
<td>38.5</td>
<td>40.5</td>
<td>37.0</td>
<td>47.0</td>
<td>32.0</td>
<td>44.5</td>
<td>34.5</td>
</tr>
<tr>
<td>B 7</td>
<td>48.5</td>
<td>31.0</td>
<td>43.5</td>
<td>36.0</td>
<td>48.5</td>
<td>31.0</td>
<td>43.0</td>
<td>35.5</td>
<td>43.5</td>
<td>36.0</td>
<td>48.5</td>
<td>31.0</td>
<td>42.0</td>
<td>36.5</td>
</tr>
<tr>
<td>B 8</td>
<td>49.5</td>
<td>30.0</td>
<td>42.5</td>
<td>37.0</td>
<td>47.5</td>
<td>32.0</td>
<td>44.0</td>
<td>34.5</td>
<td>44.5</td>
<td>35.0</td>
<td>49.5</td>
<td>30.0</td>
<td>41.0</td>
<td>38.5</td>
</tr>
<tr>
<td>B 9</td>
<td>44.5</td>
<td>34.0</td>
<td>43.0</td>
<td>37.5</td>
<td>46.5</td>
<td>33.0</td>
<td>47.0</td>
<td>32.5</td>
<td>42.5</td>
<td>38.5</td>
<td>43.5</td>
<td>34.0</td>
<td>45.5</td>
<td>30.5</td>
</tr>
<tr>
<td>B 10</td>
<td>46.5</td>
<td>33.0</td>
<td>40.5</td>
<td>39.0</td>
<td>43.0</td>
<td>34.0</td>
<td>49.0</td>
<td>30.5</td>
<td>41.5</td>
<td>38.0</td>
<td>48.0</td>
<td>33.0</td>
<td>45.0</td>
<td>32.5</td>
</tr>
<tr>
<td>B 11</td>
<td>45.5</td>
<td>36.5</td>
<td>47.0</td>
<td>30.5</td>
<td>46.0</td>
<td>35.5</td>
<td>41.5</td>
<td>38.0</td>
<td>46.5</td>
<td>31.5</td>
<td>46.0</td>
<td>36.5</td>
<td>43.5</td>
<td>36.0</td>
</tr>
<tr>
<td>B 12</td>
<td>44.0</td>
<td>35.5</td>
<td>48.0</td>
<td>31.0</td>
<td>45.5</td>
<td>36.5</td>
<td>43.5</td>
<td>36.0</td>
<td>49.0</td>
<td>30.5</td>
<td>44.0</td>
<td>35.5</td>
<td>41.5</td>
<td>37.5</td>
</tr>
<tr>
<td>B 13</td>
<td>40.0</td>
<td>39.5</td>
<td>48.5</td>
<td>32.5</td>
<td>42.0</td>
<td>37.5</td>
<td>45.5</td>
<td>34.0</td>
<td>45.0</td>
<td>34.5</td>
<td>40.0</td>
<td>39.0</td>
<td>48.0</td>
<td>30.0</td>
</tr>
<tr>
<td>B 14</td>
<td>41.0</td>
<td>38.5</td>
<td>46.0</td>
<td>33.5</td>
<td>42.5</td>
<td>38.5</td>
<td>48.0</td>
<td>32.0</td>
<td>47.0</td>
<td>33.5</td>
<td>41.0</td>
<td>38.5</td>
<td>46.5</td>
<td>32.0</td>
</tr>
<tr>
<td>B 15</td>
<td>42.0</td>
<td>37.5</td>
<td>45.0</td>
<td>34.5</td>
<td>40.0</td>
<td>39.5</td>
<td>49.5</td>
<td>30.0</td>
<td>48.5</td>
<td>32.5</td>
<td>42.0</td>
<td>37.5</td>
<td>47.0</td>
<td>34.0</td>
</tr>
<tr>
<td>B 16</td>
<td>48.0</td>
<td>31.5</td>
<td>44.0</td>
<td>35.5</td>
<td>49.0</td>
<td>30.5</td>
<td>40.5</td>
<td>39.0</td>
<td>43.0</td>
<td>36.5</td>
<td>46.5</td>
<td>31.5</td>
<td>42.5</td>
<td>37.0</td>
</tr>
<tr>
<td>B 17</td>
<td>49.0</td>
<td>30.5</td>
<td>42.0</td>
<td>36.5</td>
<td>48.0</td>
<td>31.5</td>
<td>42.5</td>
<td>37.0</td>
<td>44.0</td>
<td>35.5</td>
<td>49.0</td>
<td>30.5</td>
<td>40.5</td>
<td>39.0</td>
</tr>
<tr>
<td>B 18</td>
<td>45.0</td>
<td>34.5</td>
<td>41.5</td>
<td>38.0</td>
<td>43.5</td>
<td>32.5</td>
<td>44.5</td>
<td>35.0</td>
<td>40.0</td>
<td>39.5</td>
<td>45.0</td>
<td>34.5</td>
<td>49.5</td>
<td>31.0</td>
</tr>
<tr>
<td>B 19</td>
<td>43.0</td>
<td>33.5</td>
<td>41.0</td>
<td>38.5</td>
<td>44.5</td>
<td>33.5</td>
<td>46.0</td>
<td>33.0</td>
<td>41.0</td>
<td>39.0</td>
<td>44.5</td>
<td>33.5</td>
<td>49.0</td>
<td>33.0</td>
</tr>
<tr>
<td>B 20</td>
<td>47.0</td>
<td>32.5</td>
<td>40.0</td>
<td>39.5</td>
<td>44.0</td>
<td>34.5</td>
<td>47.5</td>
<td>31.0</td>
<td>42.0</td>
<td>37.5</td>
<td>47.5</td>
<td>32.5</td>
<td>46.0</td>
<td>35.0</td>
</tr>
</tbody>
</table>

RPT: Practice round top cost or value
RnB: Cost or value for 2\textsuperscript{nd} (bottom) unit in round n, for practice, 1\textsuperscript{st} and to 6\textsuperscript{th} rounds.
The diagram below gives the supply and demand curves for rounds one and two. Hence they are labelled $S_{1,2}$ and $D_{1,2}$.

### Supply

1.1) Consider that the supply curve is by definition, the cost of each unit in succession. What would be the lowest price (in points) for which any seller would sell one unit of stuff?

Your answer should have been 20, 20.5, or 21 points. If not, reconsider the definition of supply above. Recall that in economics we consider implicit costs (like the hassle of making a deal, the value of your time, and even "normal profits") as part of cost. Also, reread the supply curve.
1.2) What is the lowest price that sellers could sell two units for and still cover their costs?

The answer to 1.1 and 1.2 should be nearly the same. If you got something else, reconsider the above instructions. (You can check your book.)

We can express quantity in a number of ways: actual numbers, percentages, frequencies, etc. Since our class size varies, this exercise must rely on percentages. But, actual numbers are easiest to use so we will take the time to add them to diagram 1.

1.3) What was the total number of buyers and sellers in the game? (This is the class size for the game.)

1.4) What number of buyers or sellers goes with each percentage of the class size below? What is each percentage of the value in question 1.3? Wait to complete 'Supply Price'.

<table>
<thead>
<tr>
<th>Percent</th>
<th>20%</th>
<th>40%</th>
<th>60%</th>
<th>80%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply price</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.5) For each quantity above, what is the lowest price that suppliers would sell that number of units of stuff for (and cover their costs, make normal profits, not lose points)? These prices are called "supply prices".

Check your answers. The supply prices should have started at 24 points (24p) and increased evenly, ending with a price of 40p.

1.6) Enter the number values from 1.4 onto diagram 1. They go directly above the percentages below the horizontal axis.

**Now we consider Demand:**

Consider that demand gives the benefit that some buyer gets for each successive unit of stuff.

1.7) What is the most points that any buyer would pay for one unit of stuff? ________

Your answer should be 49, 49.5, or 50. If you got something else, reconsider.

1.8) For each quantity below, what is the highest price that buyers would pay for that number of units of stuff (and come out ahead, not lose class points)? This is the "demand price".

<table>
<thead>
<tr>
<th>Percent</th>
<th>20%</th>
<th>40%</th>
<th>60%</th>
<th>80%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demand price</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Check your answers. The demand prices should have started at 46p and decreased evenly, ending with a price of 30p.

**Putting supply and demand together:**

1.9) At what **quantity** does the supply curve \((S_{1,2})\) cross the demand curve \((D_{1,2})\)? This is the equilibrium quantity.

1.10) Consider the costs and benefits you reported above. Would you expect 90 percent of the units to be traded per round?

With costs being more than benefits, the 90\(^{th}\) percentile unit should not be traded.

1.11) Consider the diagram and that demand is benefits per unit while supply is cost per unit. (Maybe even look at questions 1.5, and 1.8.) What would you expect the quantity traded (the number of units bought and sold) to be each round?

1.12) What is the **price** \((P)\) at which the supply curve \((S_{1,2})\) crosses the demand curve \((D_{1,2})\)?

This is the equilibrium price.

1.13) What were the actual quantities traded in our experiment for rounds 1 and 2? \(R1\) ____________ \(R2\) ____________.

1.14) What were the final prices from round 1? ______________________

1.15) What were the final prices from round 2? _______________________

1.16) Comment briefly on your answers to the last five questions. Were the equilibrium prices and quantities from the diagram fairly close to what we got in the experiment? Was round 2 closer than round one? What do you think caused these results?
Please use the supply and demand diagram below for the questions in the next section (numbered 2.x). Notice that it is the same as the one you used for rounds one and two.

2.1) What was the main difference between rounds three and four compared to rounds one and two? What did we do differently at the beginning of the round?

Notice that the supply curve ends at 100 percent of stuff. This is because half the class was sellers with two units to trade for each seller. So, the number of units for sale equals the class size. Further, the demand curve ends at 100 percent of stuff because half the class was buyers with two units to buy each.
2.2) Would removing several buyers change supply, demand, both, or neither?  
(You may circle the right bold choices or change the others to non-bold or over-strike.)

2.3) How would the demand change when one fourth of the buyers was removed?

2.4) Draw this decrease in demand on the diagram above by shifting it inward towards the price axis as described below. We do not know exactly which buyers were removed, so we cannot plot the new curve exactly. However, you do know that only \( \frac{3}{4} \) as many units can now be traded. This is because only \( \frac{3}{4} \) of the buyers remain. Put a pencil tip on the right hand end of the demand curve. Move it inward toward the price axis by 25% of the units. It should now be at \( Q=75\% \) and \( P=30 \). Draw a new demand curve from this point, up to the left, and parallel to the original demand curve. (Particularly curious people may want to: a- figure out why a parallel shift in demand is not exactly right in this case, b- figure out the better way, and c- determine how little difference it makes in this case.)

2.5) Label the new demand curve \( D_{3,4} \).  
The supply curve did not move; supply did not change.

2.6) What is the equilibrium quantity for \( D_{3,4} \) and \( S_{1,2} \) ? __________________

2.7) What is the equilibrium price for rounds 3 and 4? ______________

2.8) Did the equilibrium price increase or decrease when demand decreased?

2.9) Did the equilibrium quantity increase or decrease when demand decreased?

2.10) Does this make sense to you that if there were fewer buyers then before that the price would drop? Briefly explain your answer.

2.11) Briefly explain how the sellers reacted when they could not find as many buyers.

2.12) Write the average of the last prices from round 2. ______________

2.13) Write down the average of the last prices from the first round when demand was lower (round 3). ____________________________

2.14) What was the average of the last prices the second time that the instructor bought out buyers (round 4)? ______________________________
2.15) Did the last prices (our measure of equilibrium price) decrease when demand decreased from D_{1,2} to D_{3,4}?

2.16) How many units were traded in each round before the instructor bought out buyers (rounds 1 & 2)? _______ _______

2.17) How many units were traded in each of the two rounds (3 & 4) when the instructor bought out buyers? ______ ______

2.18) Did decreasing the demand curve show the correct direction in which price and quantity changed?

2.19) Compare your answers to numbers 2.7), 2.13) and 2.14). How accurate were S_{1,2} and D_{3,4} in showing the new price?

2.20) Comparing your answers to numbers 2.6) and 2.17), how accurate were S_{1,2} and D_{3,4} in showing the new quantity?
For the remaining questions (3.x), please use the supply and demand diagram below. Notice that it is the same as the one you used for rounds one and two.

3.1) What was the main difference between rounds five and six compared to rounds one and two? What did we do different at the beginning of these rounds?

3.2) Would removing several sellers change supply, demand, both, or neither?

3.3) How would the supply change when one fourth of the sellers was removed?
3.4) Draw this decrease in supply on the diagram above by shifting it inward towards the price axis as described below. We do not know exactly which sellers were removed, so we cannot plot the new curve exactly. However, you do know that only ¾ as many units can now be traded. This is because only ¾ of the sellers remain. Put a pencil tip on the right hand end of the supply curve. Move it inward toward the price axis 25% of the units. It should now be at Q=75% and P=40. Draw a new supply curve from this point, up to the left, and parallel to the original supply curve. (Curious students may want to play with more realism in making the change in supply.)

3.5) Label the new supply curve S_{5,6}.

3.6) What is the quantity at which S_{5,6} and D_{1,2} cross? ______________

The demand curve did not move, so demand did not change.

3.7) What is the price at which S_{5,6} and D_{1,2} cross? ______________

3.8) Did the equilibrium price increase or decrease when supply decreased?

3.9) Did the equilibrium quantity increase or decrease when supply decreased?

3.10) Does this make sense to you that if there were fewer sellers then before that the price would increase? Briefly explain your answer.

3.11) Briefly explain how the buyers reacted when they could not find as many sellers.

3.12) Write down the average of the last prices from the rounds when supply was lower (rounds 5 & 6). ________ ________

3.13) Did the last prices (our measure of equilibrium price) increase when supply decreased? (Compare rounds 1 & 2 to rounds 5 & 6.)

3.14) How many units were traded per round when the instructor bought out sellers? ______________ ___________

3.15) Did decreasing the supply curve correctly show the direction in which price and quantity changed?

3.16) Comparing your answers to numbers 3.7) and 3.12), how accurate were D_{1,2} and S_{5,6} in showing the new price?

3.17) Comparing your answers to numbers 3.6) and 3.14), how accurate were D_{1,2} and S_{5,6} in showing the new quantity?
Appendix 7: Monopoly written exercise

Class: Date: Name:

What happens when there is only one seller, and no others to force the seller to use a competitive price? That is, what happens when there is a monopoly seller who gets to set the price of a good? Use the diagram below to do this exercise and find out.

As we saw in the Supply and Demand Experiment, competition would force the price and quantity traded to \( Q=40, \ P=10 \). Would this price and quantity get a monopolist the most profit?

Profit is simply total revenue less total cost. Economists find it useful to calculate total costs as fixed costs plus variable costs. Fixed costs are whatever costs the company must pay even if they produce nothing, for example the lease for the factory. In our example, the monopoly has no fixed costs. This is a reasonable assumption under some conditions and it makes the exercise easier without harming the main lesson. Variable costs are what it costs to produce each item: parts, labour, etc. On our diagram we see variable costs as the sum of the marginal costs. To find the variable costs, calculate the area under the supply or marginal cost curve (S:MC) up to the quantity in question. With a flat MC curve this is easy. It is just the area of a rectangle, just \( Q \times MC = VC \).

Total revenue is Quantity times the Demand Price, \( TR = Q \times P_D \).

Find the profit at \( Q=40 \).

Profit = Total Revenue (TR) less Total Cost (TC) = TR-TC.

\[
\text{Total Revenue} = TR = Q \times P_D = 40 \times 10 = 400.
\]

\[
\text{Total Cost} = TC = FC + VC = FC + \text{sum(MC)} = FC + (Q \times MC) = 0 + (40 \times 10) = 400.
\]

\[
\text{Profit} = TR - TC = 400 - 400 = 0
\]

No profit! Surely we can do better than that.
What if the monopoly raised the price to 40? How many could they sell? What would be the Total Revenue, Total Cost and Profit?

<table>
<thead>
<tr>
<th>TR</th>
<th>TC</th>
<th>Profit</th>
</tr>
</thead>
</table>

Now that you see that a profit of three hundred is possible, try to find the highest possible monopoly profit. What is the price and quantity that cause the highest profit (the ‘profit maximizing monopoly price and quantity’)? Use the backs and below the diagram as scratch paper.

Maximum monopoly profit =

Notice that the quantity supplied no longer lies on the marginal cost curve as it did in the nightmare auction and the Supply and Demand Experiment. For monopolies, supply does not equal marginal cost. Please mark out the S on the diagram, and leave the MC.
References


