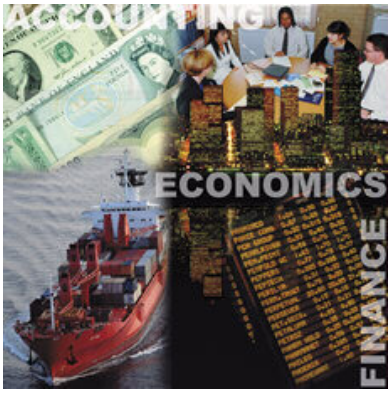

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Insecure Participation:
Experiments in a One Day Introduction to Economics

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Insecure Participation:
Experiments in a One Day Introduction to Economics

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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. Supply, demand and equilibrium are integrated in a pit market in which all students have 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.

Introduction

I presented a one-day introduction to economics programs to two cohorts of incoming first year students with no previous experience of economics. The students paid for this introductory program because they felt unprepared for first-year university business units. I selected a format with minimal lecturing, focusing rather on participatory experiments and exercises. The program was successful. 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. All instructions, experiments, and exercises are included as appendices and may be used with copyright acknowledgement and 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 a week long program on their campuses. Both cohorts had received two days of accounting lectures and the second had also received one day of finance lectures. Our one day introduction to economics program consisted of four class room 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 the completing 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.

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 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 include correct responses several lines after students address an issue. This level of detail and prompt checks makes these exercises suitable to students who were absent for the experiment or are taking the class through distance learning. Third, these experiments are equitable in the sense that all students have the same potential to earn points or money 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 elementary 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.

Preparation for the exercises took most of a workday: updating a bond,p hotocopying, printing and reviewing instructions, and preparing overhead slides. The bond (appendix 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.[1] I used printed instructions for myself and enlarged overhead slides of the instructions for the students to read.

I begarthe program by introducing myself including my qualification and experience. Th en 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 constrained maximization in which I had to make choices about what material to address as well as 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 asked for their participation.

The first exercise of the day was a sealed-bid auction of a bond. 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 appendix 1. Appendix 2 is my instructions; appendix 3 is the bond exercise and appendix 4 gives results.

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. One could introduce technical vocabulary for bonds as well as contrasting them from shares. Further, one might discuss risk, accountability and security. 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, introducing the concept of risk and why the bond cannot be worth more than $20. The latter point, while not strictly true, is important; 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.

[1] 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.

Bond Auction

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 objectives. 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 2.) 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 3). Appendix 4 gives the results of the bond auction as a diagram.

While students copied the bids, I distributed the Bond Exercise which guides the students through organizing the bid data 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 may be aimed at particularly interested students (the pit Market Experiment Write Up includes some 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. 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.

The objectives of the bond experiment 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 objectives go beyond demand in that students are exposed to vocabulary relating to finance and macroeconomics.

Supply Auction

In the nightmare auction, students submit the lowest payment they would accept to live through the old 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 an increase in marginal cost,
- show an increasing marginal cost schedule as a decrease of supply ,

- introduce shifts of supply, and
- introduce the idea of simplified models and the conditions of perfect competition.

The procedures in this experiment are emotionally sensitive; humour 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 who 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 what was auctioned.

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 5. 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. Is one billion dollars a thousand million (USA) or a million-million (UK)? What is the daily interest on a billion dollars anyway? Such patter gave them something to do while during the sorting. 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 tobe for a specific purchase – again a real price. 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 is finished, I plotted the prices on a diagram. Our results are in appendix 6. 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. Base 10provided a comfortable reminder for students: 1, 10, 100…

One begins plotting supply schedule with the lowest numbers because buyers sort them that way. They buy from the cheapest first then to progressively more expensive items. Students were sceptical. I explain that economists assume that all the goods 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 increasing marginal cost and supply is marginal cost.

I challenged the students. "I said supply was marginal cost. What costs are there in being the only person naked in class?" If no one suggested a cost, further prompts may help. "You were not willing to do it for free. Why not? What harm do you suffer by being the only person naked in class?" The students in the introduction to economics program 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 increasing marginal (mostly implicit) costs.

The final stage of the nightmare auction introduces shifts of supply, increase of the marginal cost schedule as a supply decrease, and concept of *caeterus paribus*. I repeated the nightmare auction saying that everything would be exactly the same as before, except for one condition. I explained that the practice of making one change at a time, *caeterus 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.

The nightmare auction introduced costs: implicit and explicit costs, increasing marginal costs 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.

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 the 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 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 a trade price was agreed upon. 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 prefer full participation by all students even at the cost of potentially weaker results. Of course, the double-oral auction format provides much more public information and faster convergence to equilibrium.

The market simulation experiment divides the participants evenly into buyers and sellers. Each participant receives a sheet of paper divided into seven playing rounds documenting two units of an

abstract commodity 'stuff' for each round (appendix 7). 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. The values and costs are set on each sheet so that each participant has an equal expected profit (appendix 8). 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 is designed for classes in multiples of 20. However, buyer and seller sheets are arranged so that other numbers can participate with only minor distortion of results (appendix 8). 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 as I had not thought of writing this piece. 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. The directions for the experiment state that rounds last five minutes. I allowed the practice round to run for seven minutes allowing the participants to practice. Participants were clearly hesitant with many playing from their seats. I walked through the classroom checking sheets, reminding people to only play the practice round, to buy low and sell dear, and other aspects of the instructions.

The demand 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. 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%. Of course, 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. Appendix 9 presents 49 actual trades, which tell a similar story. Apparently, some participants were hesitant to raise their hands.

Participants provided their buyer and seller sheets to me in order to have a chance of winning the $20 reward. Most but not all participants provided a sheet. I was able to use these sheets as a measure of trades and prices. Having both buyer and seller sheets allowed me to confirm most trades, exclude several errors and find one participant's version of trades involving those participants who did not provide their sheets. I do not consider either the verbal classroom reports or the sheets to be a precise measure of the experimental results, but they agree in substance if not detail.

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. Appendix 9 reports a similar but not identical story. Apparently a last minute buyer declined to report a zero profit

trade at 42.5. Although the reported figures are imperfect, prices converged near equilibrium and the quantity approached equilibrium quantity.

Round 2 showed closer convergence to equilibrium. Interestingly seven trades occurred before the round began. Although the early trades conflicted with directions and were not part of the experimental design, perhaps there is potential to discuss futures market, various models of expectation, and imperfect information.

In round 3, I bought the trading rights from ten buyers. I arranged the purchase through tatonnment 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. Since the experiment calls for one-fourth of the buyers to sit out, I then suggested 20 points and around 20 hands went up. I suggested lower prices when too many raised their hands and higher prices when too few did. We settled on a compensation of 16 points for 10 buyers to sit out of round 3. The result was 40 reported trades (50%) with an average of final prices being 31.5.

It is impossible, *a priori*, to give the equilibrium prices for rounds 3 and four since we cannot know which buyers will accept the buy-out. However, a 15% reduction in demand drawn shifted or rotated from the price axis, yields a predicted equilibrium of about 63 or 64% and a price of about 32 or 32.5. The buyer and seller sheets tell substantially the same story (Appendix 9), with 38 trades and a last-trades average price of 32. The pre-round traders appear to have anticipated the new equilibrium price, if one is willing to interpret six observations.

In round 4 10 buyers sat out for 15 points. There were eight pre-round trades, all traded below the initial equilibrium of 35 and averaging 30.5. Buyers reported 43 trades with the prices in the last minute between 30 and 35 yielding an average of 32.5. Appendix 9 shows two fewer trades but is close to the reported results.

Note that I asked buyers to report 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 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. I use that bias in the classroom, although the distortion would be problematic in research. Comparison between reports and participants' sheets reveals that in round 3 reported final prices were slightly lower than those on the sheets. In rounds 3 and4 two more trades were reported than were supported by the sheets. Also, in round 4 a last-minute trade was reported at 33 ½ points that was not supported by the sheets, whereas a 30 point trade went unreported. Of course, I may have miscounted the raised hands or misheard called prices.

Quantities traded were consistently lower than the predicted equilibrium quantity. This suggests that some costs affected both buyers and sellers. Such undocumented costs would shift both supply and demand inward. It is easy to propose possible costs, such as the inconvenience of moving around the room and seeking trades.

In rounds 5 and 6, all buyers participated and 10 *sellers* sat out for payments of 8 and 11 points. Diagrammatically, equilibrium price rose to 37 ½ while equilibrium quantity fell to 64% of the class or 51 trades. As was consistent with the day's experience, a lower than expected number of trades occurred with final prices close to the expected equilibrium. Sellers reported 45 trades in each of rounds 5 and 6 with the average of the final prices being 36 and 37 ½. Appendix 9 reports comparable results of 46 trades each round and final two-minutes of prices averaging 37 and 38 ½.

Participants learn from the market experiment through completing a 53 question exercise (appendix 10). This exercise was developed so that students can complete it independently or in small groups. Important or informative answers are often presented in descriptions shortly after relevant questions, providing students with prompt feedback and preventing them from going too far 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, the exercise may be completed by students who did not participate in the experiment, including off-campus students.

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 relates buyers to demand and shows a change in demand with its effects upon the equilibrium. The final section presents the same lessons for supply.

Ambitious and risk loving instructors could easily modify the market experiment and exercise to relate changes in marginal benefit and marginal cost the demand and supply. In round four instead of removing buyers, one could give all buyers 10 points then have them subtract five points from the value of each unit in period four. Likewise compensate sellers 10 points in round 6, while increasing their costs by five for each unit. When I use these experiments and exercises in semester long classes, I run a second experiment incorporating changes in marginal benefit and marginal cost as well as other issues.

Monopoly Exercise

The last exercise of the day presented students with monopoly price-setting and foreshadows market failure (Monopoly exercise, appendix 11). 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 supply and demand as a system of equations.

This exercise presents students with a downward sloping demand curve and a horizontal marginal cost curve. It then guides them though calculations of revenue, cost, and profit. It provides details of a zero profit example, and invites the students to 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 on a projection, 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. Participants appreciated the speed of the technique.

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 door.

Evaluation

I wrote an evaluation of the economic component of the introductory program (appendix 12) as an instrument to improve my teaching, not as a research instrument. Therefore, conclusions using the instrument are broad and imprecise. However, the evaluation was sufficient to reach 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.

The evaluation has eight questions, but 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 was treated 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 well except on the tenth point (appendix 13). 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 majorproblem area was with relat ing marginal cost to economic results. Halfof 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. Those reporting little or no increase in comfort responded correctly on 59 and 56 percent of the items.

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. The program could be improved with a more explicit recommendation to use economic tools of analysis, specifically supply and demand diagrams and drawing changes in the curves. I hope other instructors find these experiments useful and would appreciate any comments on their application and effectiveness.

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Appendix 1: Example bond

The holder of this bond in entitled to the $20.00 from Chris Geller of the Department of Accounting, Economics and Finance, Deakin University.

The bond may be redeemed on or after 1 June, 2004 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.

_____

Chris Geller
Department of Accounting, Economics and Finance
Deakin University

Appendix 2: 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 straight-forward assignment based on this exercise.

[Project the bond on the overhead projector.]

[Read the bond.]

[Explain the bond.] This means that whomever 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.

1) Each of you should decide how much you are willing to pay today to get twenty dollars at the end of the quarter.
2) Write that amount and your name on a piece of paper.
3) We will collect and record the prices to use in an assignment.
4) The winner of the bond will pay for it and receive the bond.
5) 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) Are there 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 (Team-work is OK).
    We also need someone to provide these numbers 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 quarter 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 3: 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. The bids are on the last page. You may remove it for convenience. I only used one class session so you would not have to do as much work.

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?

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 any other seller of bonds, would prefer to get more money rather than less.

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

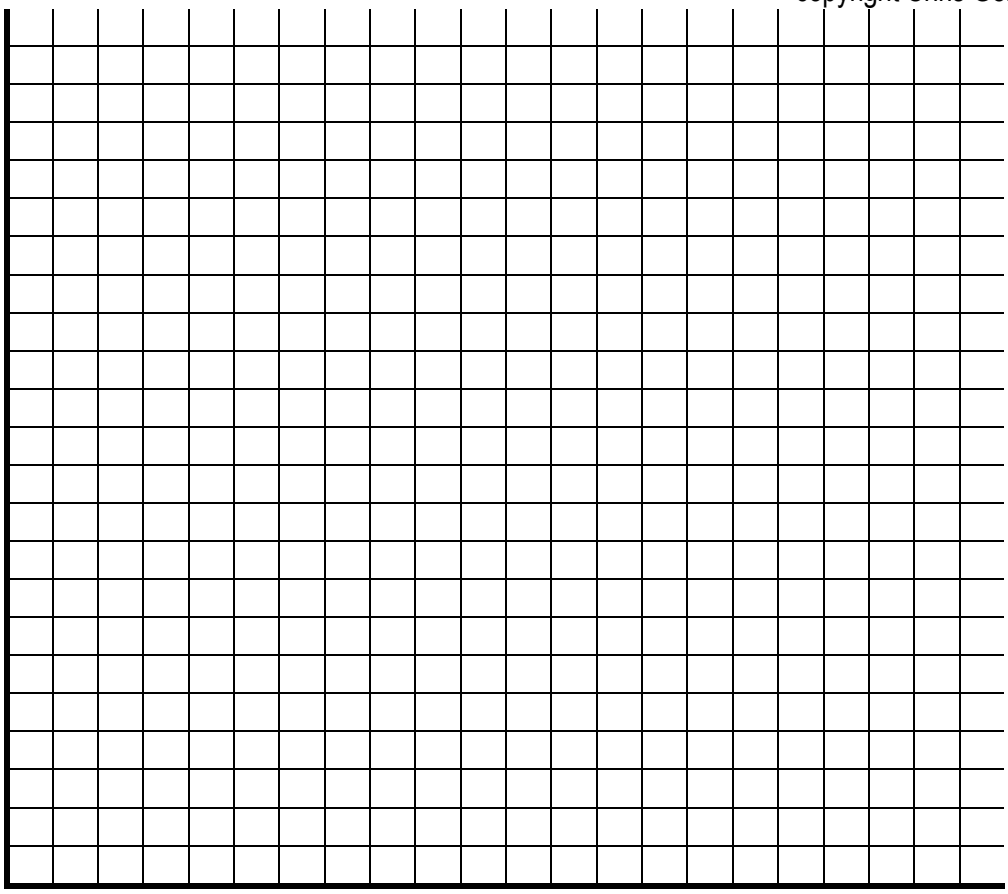
5) How much could you sell a third bond for? _____

6) If the people who bought the first and second bond knew how much you charged for 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 graph. This graph is called a "Supply and Demand graph." We will start with demand, as in: "How many bonds does the class demand?" The graph 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 above. (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 graph.

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

Number 10 tells us how high the graph 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 graph 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 graph 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 graph.

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 graph 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 graph.

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 graph (showing the highest price and a quantity of one bond).

Now we shall plot the second price and a quantity of two bonds. Two bonds are represented by a distance left to right on the graph. Let's see how wide it is.

20) Write 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 (neighboring) 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).

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? (If there were more than 40 prices offered, find the price I could have received for 40 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?

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 that shows $10 and half as many bonds as you found 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 "D_2", 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 "D_1".

Notice that the new demand curve (D_2) is below, and more importantly to the left, of the original demand curve (D_1). This is called a "**decrease in demand**".

Notice that for any price, the quantity demanded is less on D_2 than on D_1 (you drew it that way). Also, for any quantity, the demand price is lower for D_2 than for D_1. The second observation emerges from the logic of the system. You got more out of the graph than you put in. It worked; it worked for you.

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) D_1 and label it D_3. (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 rotate upwards from there.)

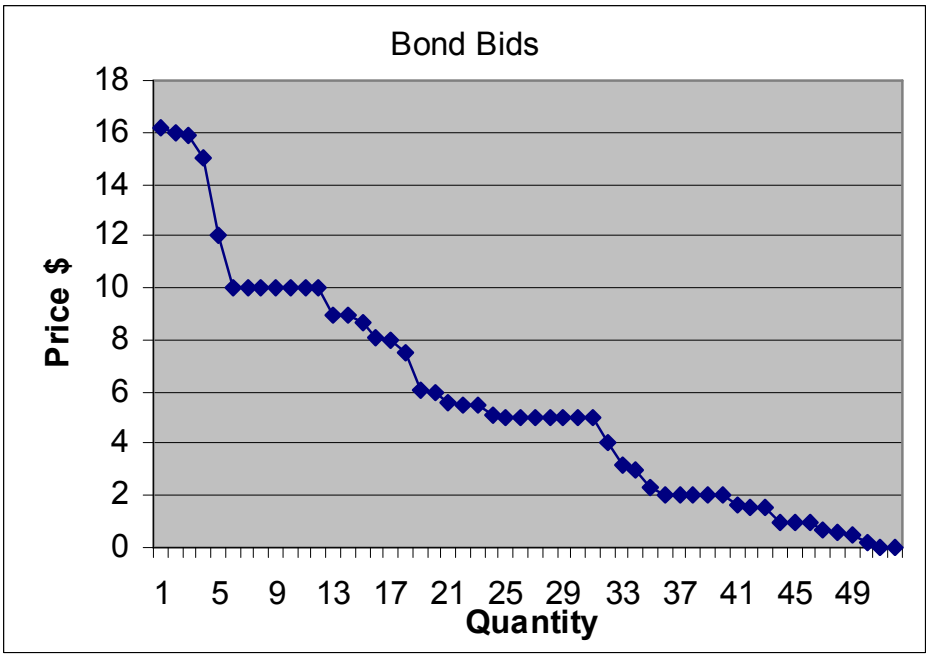
Changes in demand such as we just demonstrated are called "**shifts in demand**" because the curve shifts to a new location.

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 4: Bond Auction Results



Appendix 5: Nightmare auction instructions

Supply "NIGHTMARE" auction.

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.

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 do forth.

[Plot these points using a logarithmic scale (base 10 of course). The results will slope up nicely.]

Explain supply as marginal cost.
Implicit as in this experiment.
Explicit as is easy to think of.

Next, repeat the auction. The students should think of the same person. But this time conditions have changed! That person's oldest living relative will be in the room during the nudity!

[Now get bids again and plot them.]

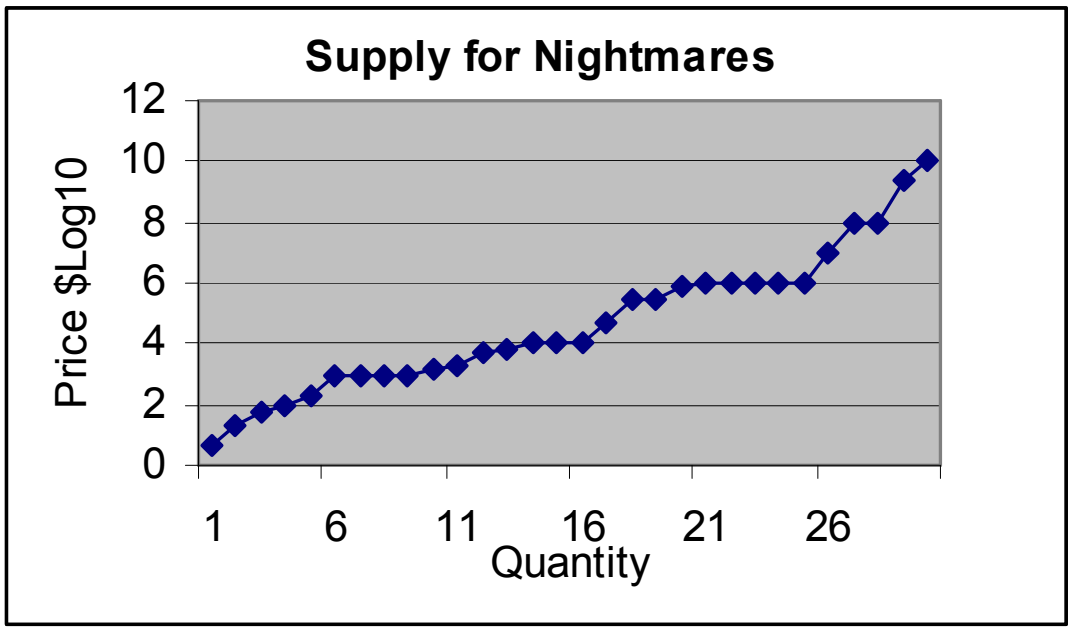
Note to the class that the curve has moved up and that is a decrease in supply, and an increase in cost per unit!

Discuss other things that shift supply.

Appendix 6: Results of Nightmare auction

Units	5
10s	5,2
100s	1,2
Ks	1.7,1,6,5,1,1,1.5,1
10Ks	1,5,1,1
100Ks	3,8,3
Ms	1,1,1,1,1
10Ms	1
100Ms	
KMs	1,99,1,25
Higher	10**15, 10**12

Also, '3 bottles of tequila'. The $5.00 bid said "lunch money" and the bid at 1.7 K was $1734.73.



Appendix 7: Market Experiment instructions

Preparation for Supply and Demand Experiment 1

In this experiment half the class plays the role of buyers and half act as sellers. You are buying as 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 exit. 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 our examples have nothing to do with our experiment and will not help you figure out trading prices. 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 changed by hand as class sizes vary.

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 also.

Seller 18 traded with Buyer 41 in the practice round. You can see the transaction recorded there 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, she wrote the price of 273. The difference between the selling price and the cost is her profit of 63p. She

traded the second unit next. It has a higher value than the 1st unit, but unfortunately she sold the item for 315p. She suffered a loss of 5p. Probably the seller just became confused since it was the first round she played. Certainly, no one in this experiment has to trade at a loss. Anyway, her total profit is 57p. Notice that she would have been better off if she had not traded the second unit, and she did not have to.

Experiment Decision Sheet for Buyer 41

Name: _____ Class: _____ Term: _____ Experiment # ___

		ROUNDS						
Unit		Practice	1	2	3	4	5	6
1st UNIT	Value	**310**	**210**	**320**	**1.15**	**12.20**	**720**	**3200**
	Purchase Price	- 273						
	Profit	= 37						
	Time	3:12						
	Seller	18						
2nd UNIT	Value	**8**	**155**	**180**	**.95**	**4.60**	**1.30**	**1550**
	Purchase Price	-						
	Profit	=						
	Time							
	Seller							
	Profit for Round (Sum of two units)	37						
	Cumulative Profit (Sum for all rounds)	37 (Equals above)	(Equals above)	(Left + above)	(Left + above)	(Left + above)	(Left + above)	(Left + above)

Experiment Decision Sheet for Seller 18

Name: _____ Class: _____ Term: _____ Experiment # ___

		ROUNDS							
Unit		Practice	1	2	3	4	5	6	
1st UNIT	Selling Price	273							
	Cost of 1st unit	- **210**	**110**	**220**	**0.45**	**2.20**	**1.20**	**900**	
	Profit	= 63							
	Time	3:12							
	Buyer	41							
2nd UNIT	Selling Price	315							
	Cost of 2nd unit	- **320**	**150**	**270**	**1.35**	**4.60**	**1.40**	**1850**	
	Profit	= -5							
	Time	3:14							
	Seller	7							
	Profit for Round (Sum of two units)	57							
	Cumulative Profit (Sum for all rounds)	57 (Equals above)	(Equals above)	(Left + above)	(Left + above)	(Left + above)	(Left + above)	(Left + above)	

Supply and Demand Experiment One will progress as follows.

1) Instructor makes sure sheets are distributed properly.
2) Instructor explains the sheets.
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 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 the instructor will offer payment to buyers to remain out of the game. This is done by tâtonnment auction. I will call out various numbers of points that I will pay buyers to drop out for a 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.

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

Appendix 8: Values and costs for market experiment

Rows with sellers' costs by round for 1st (T) and 2nd (B) units.

Sellers		RPT	RPB	R1T	R1B	R2T	R2B	R3T	R3B	R4T	R4B	R5T	R5B	R6T	R6B
S	1	27.5	31.0	20.5	40.0	25.5	35.0	30.0	30.5	22.5	38.0	27.5	33.0	25.5	36.0
S	2	26.5	34.0	21.5	39.0	26.5	35.5	28.0	32.5	22.0	39.0	26.5	34.0	28.0	32.0
S	3	25.5	35.0	26.0	38.0	27.5	33.0	25.5	34.5	20.5	40.0	25.5	35.0	30.0	30.5
S	4	29.0	33.0	23.5	37.0	28.5	33.5	24.0	36.5	23.0	36.0	29.5	32.0	22.0	38.5
S	5	28.5	32.0	24.5	36.0	29.5	31.0	22.0	38.5	27.0	37.0	28.5	32.5	24.0	34.5
S	6	25.0	38.0	22.0	35.0	22.0	40.0	28.5	31.5	24.0	31.5	24.5	38.0	24.5	38.0
S	7	21.5	39.0	24.0	34.0	21.5	39.0	27.0	33.5	26.5	34.0	22.5	39.0	27.0	33.5
S	8	21.0	40.0	28.5	30.5	23.0	38.0	26.0	35.5	24.5	35.0	22.0	40.0	29.0	32.5
S	9	24.0	36.0	28.0	32.5	23.5	37.0	22.5	37.5	29.5	31.0	24.0	36.0	21.5	39.5
S	10	23.5	37.0	29.5	31.0	24.5	36.0	21.0	39.5	28.5	32.0	21.5	37.0	23.5	37.5
S	11	27.0	33.5	21.0	39.5	26.0	34.5	27.5	32.0	21.5	38.5	27.0	33.5	26.5	36.5
S	12	26.0	34.5	23.0	38.5	27.0	32.0	29.0	34.0	21.0	39.5	26.0	34.5	29.5	31.5
S	13	30.0	30.5	22.5	37.5	28.0	32.5	24.5	36.0	25.5	35.5	30.0	30.5	22.5	40.0
S	14	29.5	31.5	26.5	36.5	29.0	31.5	23.0	38.0	25.0	36.5	29.0	31.5	23.0	35.0
S	15	28.0	32.5	25.5	35.5	30.0	30.5	20.5	40.0	27.5	37.5	28.0	31.0	25.0	35.5
S	16	22.0	38.5	25.0	34.5	21.0	39.5	29.5	31.0	23.5	33.5	23.5	38.5	27.5	33.0
S	17	20.5	39.5	27.0	33.5	20.5	38.5	26.5	33.0	26.0	34.5	23.0	39.5	28.5	31.0
S	18	24.5	35.5	27.5	32.0	22.5	37.5	25.0	35.0	30.0	30.5	25.0	35.5	20.5	39.0
S	19	22.5	36.5	29.0	31.5	25.0	36.5	23.5	37.0	29.0	33.0	21.0	36.5	21.0	37.0
S	20	23.0	37.5	30.0	33.0	24.0	34.0	21.5	39.0	28.0	32.5	20.5	37.5	26.0	34.0

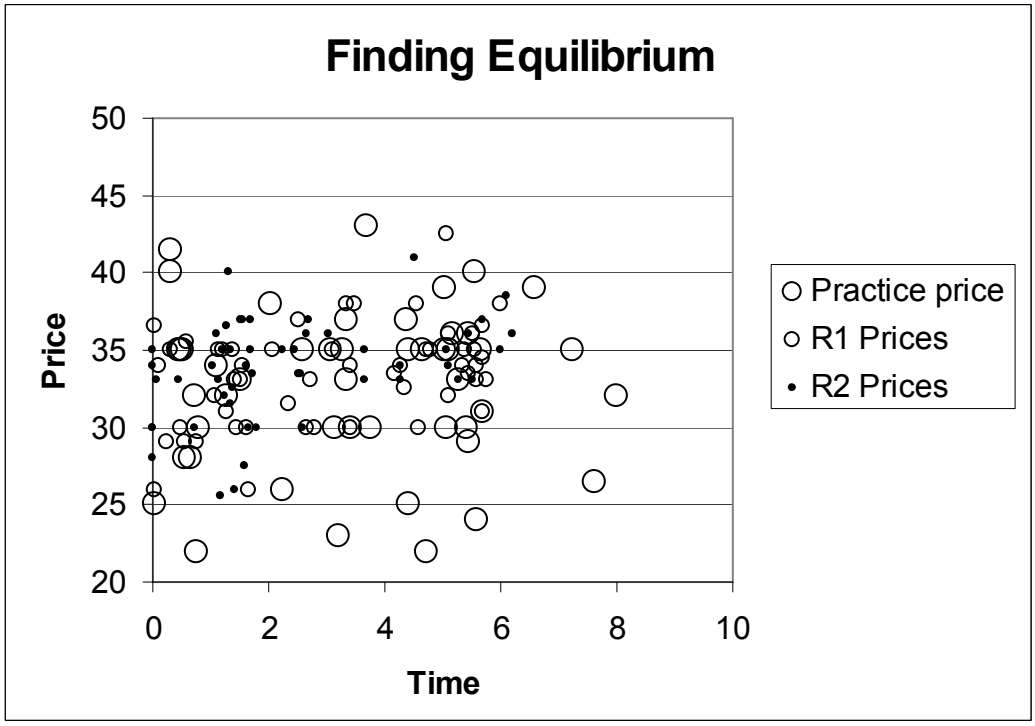
Rows with buyers' values by round for 1st (Top) and 2nd (Bottom) units.

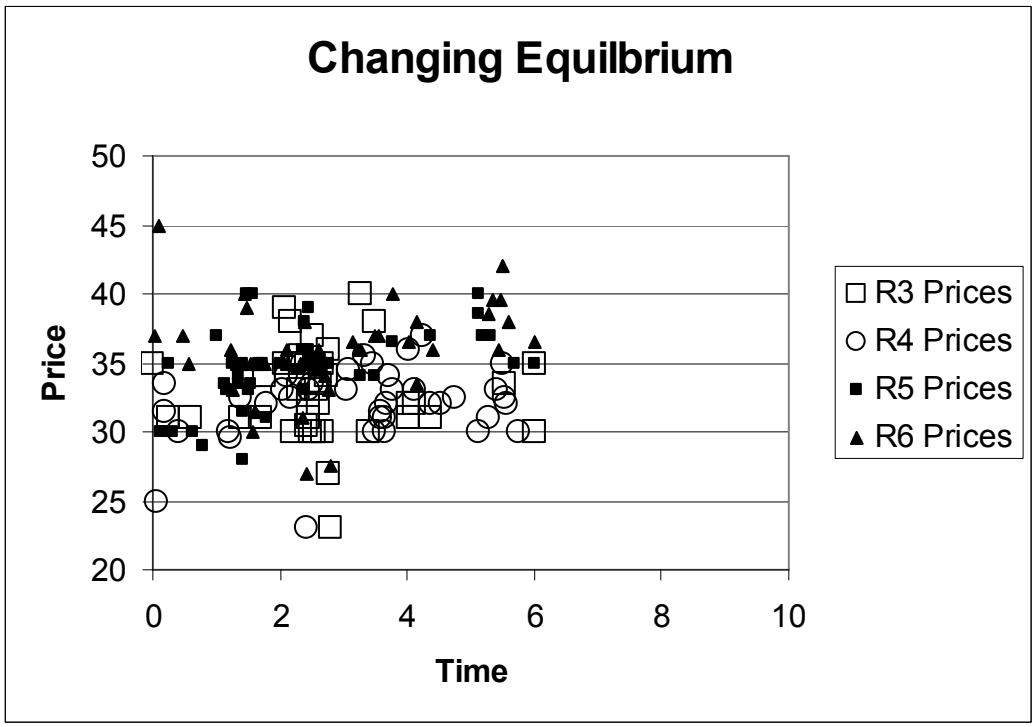
Buyers		RPT	RPB	R1T	R1B	R2T	R2B	R3T	R3B	R4T	R4B	R5T	R5B	R6T	R6B
B	1	42.5	37.0	49.5	30.0	45.0	35.0	41.0	39.5	47.5	32.0	42.5	37.0	44.0	35.5
B	2	43.5	36.0	49.0	31.0	47.0	36.0	42.0	37.5	46.0	31.0	43.0	36.0	43.0	38.0
B	3	45.5	35.0	47.5	32.0	41.0	37.0	45.0	36.5	49.5	30.0	45.5	35.0	40.0	39.5
B	4	40.5	39.0	46.5	33.0	41.5	38.0	46.5	33.5	45.5	34.0	40.5	39.5	48.5	31.5
B	5	41.5	38.0	45.5	34.0	40.5	39.0	48.5	31.5	48.0	33.0	41.5	38.0	47.5	33.5
B	6	47.0	32.0	44.5	35.0	49.5	30.0	40.0	38.5	40.5	37.0	47.0	32.0	44.5	34.5
B	7	48.5	31.0	43.5	36.0	48.5	31.0	43.0	35.5	43.5	36.0	48.5	31.0	42.0	36.5
B	8	49.5	30.0	42.5	37.0	47.5	32.0	44.0	34.5	44.5	35.0	49.5	30.0	41.0	38.5
B	9	44.5	34.0	43.0	37.5	46.5	33.0	47.0	32.5	42.5	38.5	43.5	34.0	45.5	30.5
B	10	46.5	33.0	40.5	39.0	43.0	34.0	49.0	30.5	41.5	38.0	48.0	33.0	45.0	32.5
B	11	45.5	36.5	47.0	30.5	46.0	35.5	41.5	38.0	46.5	31.5	46.0	36.5	43.5	36.0
B	12	44.0	35.5	48.0	31.5	45.5	36.5	43.5	36.0	49.0	30.5	44.0	35.5	41.5	37.5
B	13	40.0	39.5	48.5	32.5	42.0	37.5	45.5	34.0	45.0	34.5	40.0	39.0	48.0	30.0
B	14	41.0	38.5	46.0	33.5	42.5	38.5	48.0	32.0	47.0	33.5	41.0	38.5	46.5	32.0
B	15	42.0	37.5	45.0	34.5	40.0	39.5	49.5	30.0	48.5	32.5	42.0	37.5	47.0	34.0
B	16	48.0	31.5	44.0	35.5	49.0	30.5	40.5	39.0	43.0	36.5	46.5	31.5	42.5	37.0
B	17	49.0	30.5	42.0	36.5	48.0	31.5	42.5	37.0	44.0	35.5	49.0	30.5	40.5	39.0
B	18	45.0	34.5	41.5	38.0	43.5	32.5	44.5	35.0	40.0	39.5	45.0	34.5	49.5	31.0
B	19	43.0	33.5	41.0	38.5	44.5	33.5	46.0	33.0	41.0	39.0	44.5	33.5	49.0	33.0
B	20	47.0	32.5	40.0	39.5	44.0	34.5	47.5	31.0	42.0	37.5	47.5	32.5	46.0	35.0

RPT: Practice round top cost or value

R*n*B: Cost or value for 2nd (bottom) unit in round *n*, for practice, 1st, to 6th round.

Appendix 9: Market experiment results



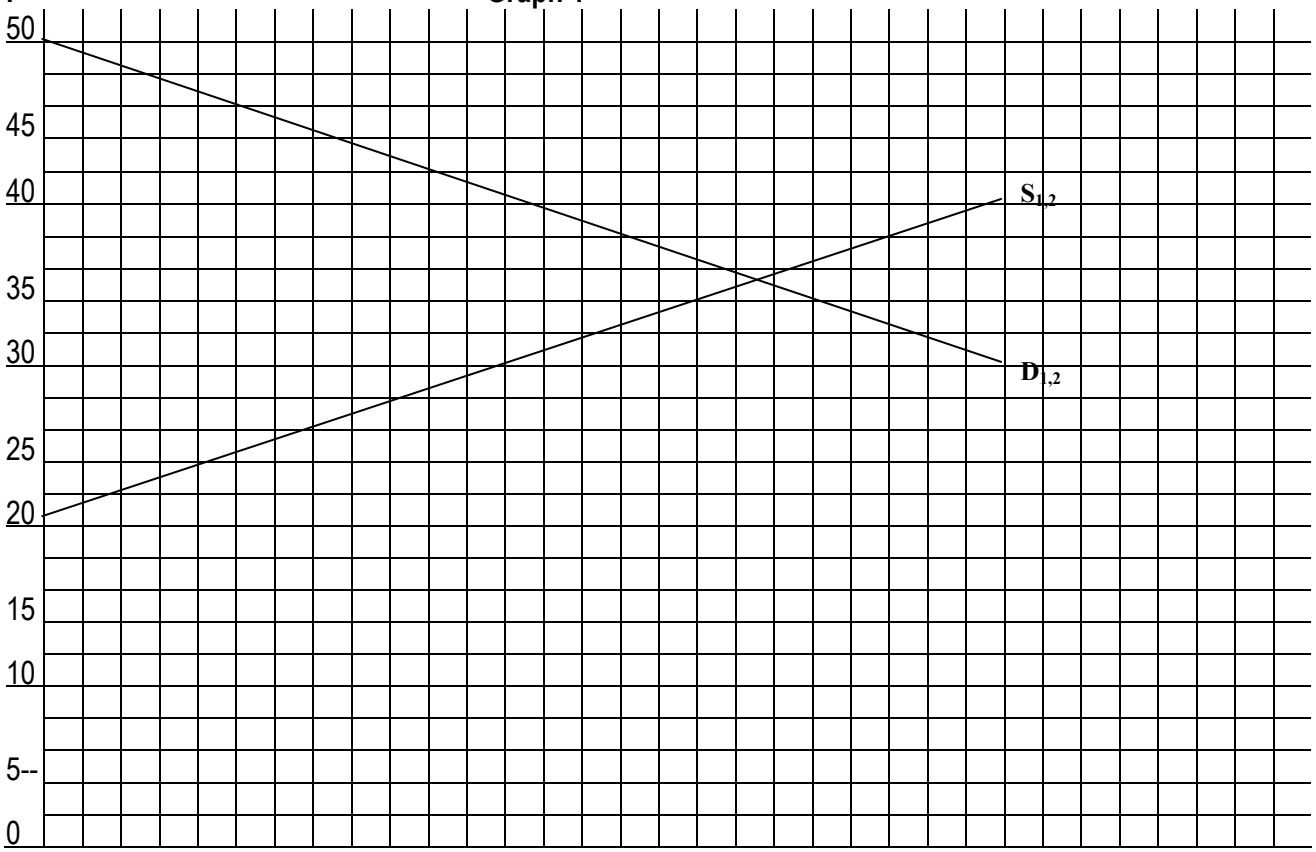


Note: Experimental data recorded time in discrete minutes. Times were altered with a delta variation to permit clearer diagrams.

Appendix 10: Market experiment written exercise

The graph below gives the supply and demand curves for rounds one and two. Hence they are labelled $S_{1,2}$ and $D_{1,2}$.

P **Graph 1**



Numerical Scale
0 20 40 60 80 100
Percent scale

Q

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&1/2 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 should be the nearly same. If you got something else, reconsider the above instructions. (You may even want to check your book.)

Quantity may be expressed 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 graph 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'.

Percent	20%	40%	60%	80%	100%
Number	____	____	____	____	____
Supply price	____	____	____	____	____

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 graph 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".

Percent	20%	40%	60%	80%	100%
Number	____	____	____	____	____
Demand price	____	____	____	____	____

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 90th percentile unit should not be traded.

1.11) Consider the graph 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 _____.

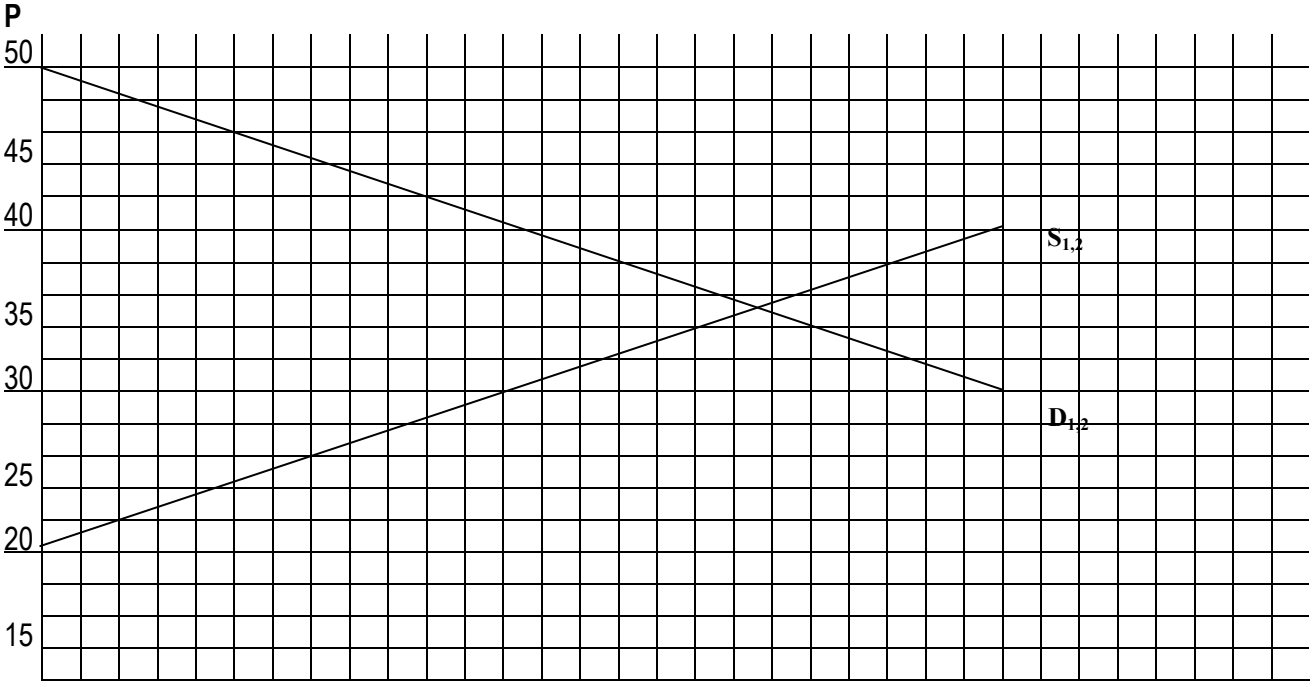
1.14) What were the final prices from round 1? _____

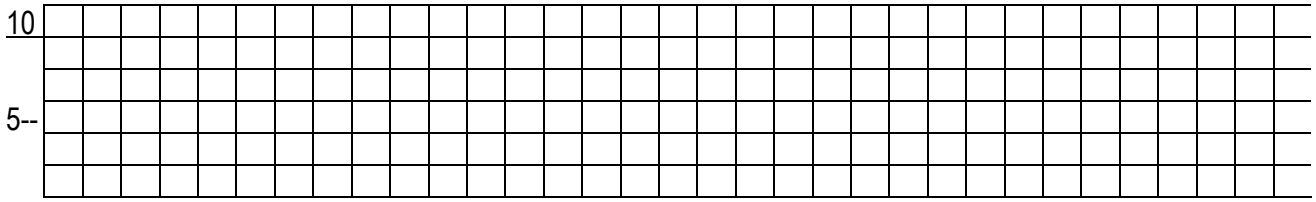
1.15) What were the final prices from round 2? _____

1.16) Comment briefly on your answers to the last five questions. Were the equilibrium prices and quantities from the graph 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 graph 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.

Graph 2





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 equaled 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 answer when given **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 graph 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 ¾ as many units can now be traded. This is because only ¾ 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.

2.5) Label the new demand curve $D_{3,4}$.

The supply curve did not move. Therefore 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 down the average of the last prices from round 2. (You may use numerical mean, remove the high and low and average the rest, or eye-ball them for a good guess.)

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 <u>before</u> 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? _____ _____

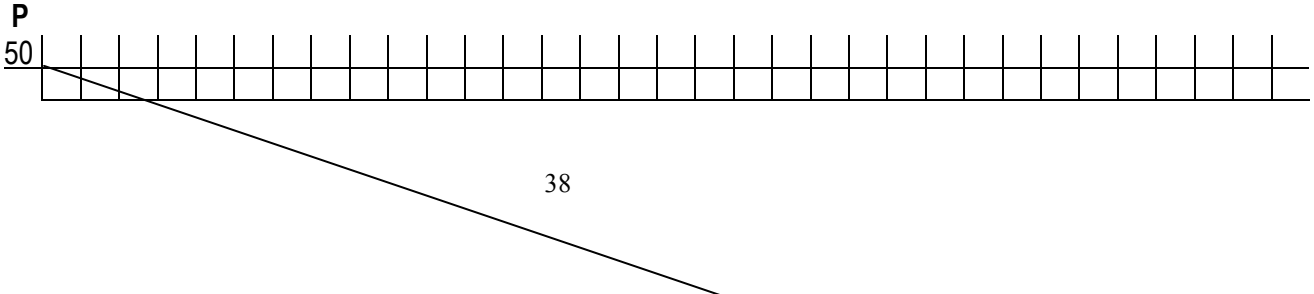
2.18) Did decreasing the demand curve show the correct direction in which price and quantity changed?

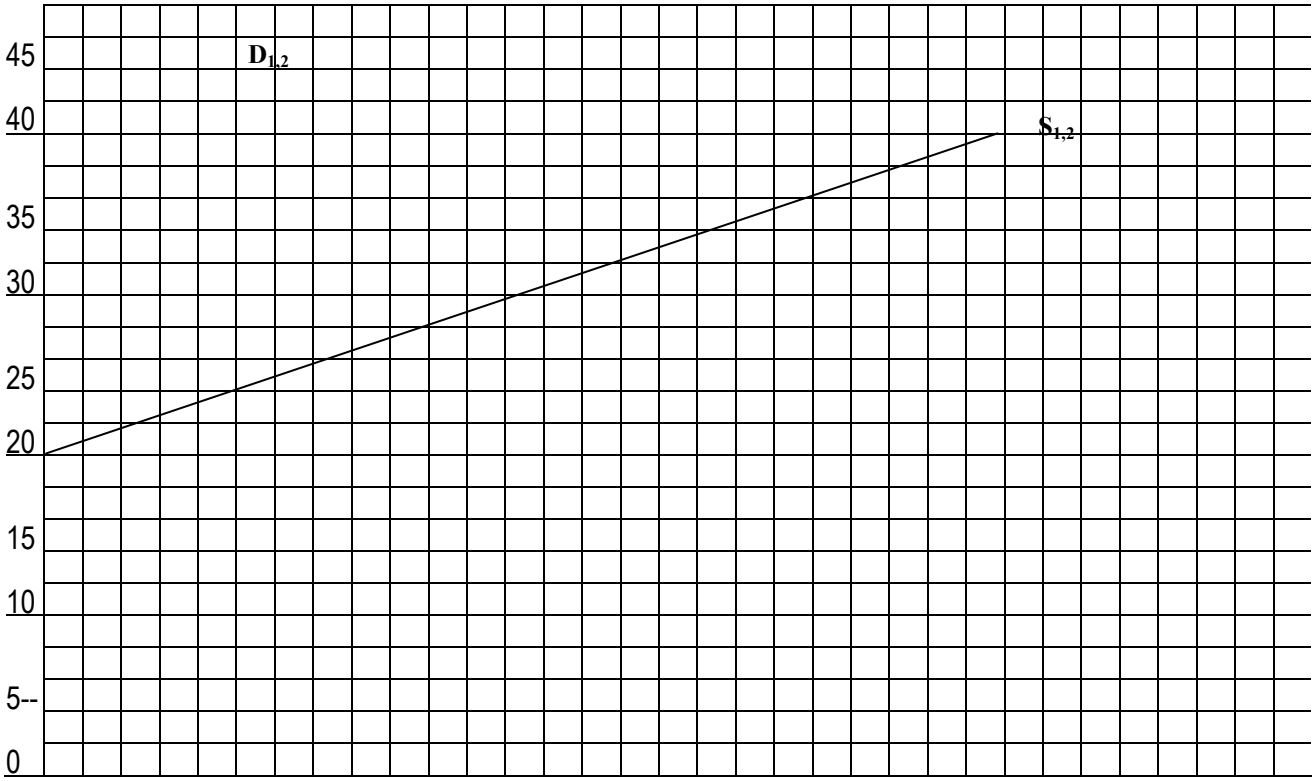
2.19) Compare your answers to numbers 2.7), 2.13) and 2.14). How accurate were $S_{1,2}$ and $D_{3,4}$ in showing the new price?

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 graph below. Notice that it is the same as the one you used for rounds one and two.

Graph 3





Numerical Scale
0 20 40 60 80 100
Percent scale **Q**

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 graph 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.

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 1: 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 graph 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 actually produce each item: that is 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 S curve this is easy. It is just the area of a rectangle, just Q*MC=VC.

Total revenue is Quantity times the Demand Price, TR = $Q*P_D$,.

Find the profit at Q=40.

Profit = Total Revenue (TR) less Total Cost (TC) =TR-TC.
Total Revenue = TR = $Q * P_D = 40 * 10 = 400$.
Total Cost = TC = FC +VC = FC + sum(MC) = FC + (Q * MC) = 0 + (40*10) = 400.
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?

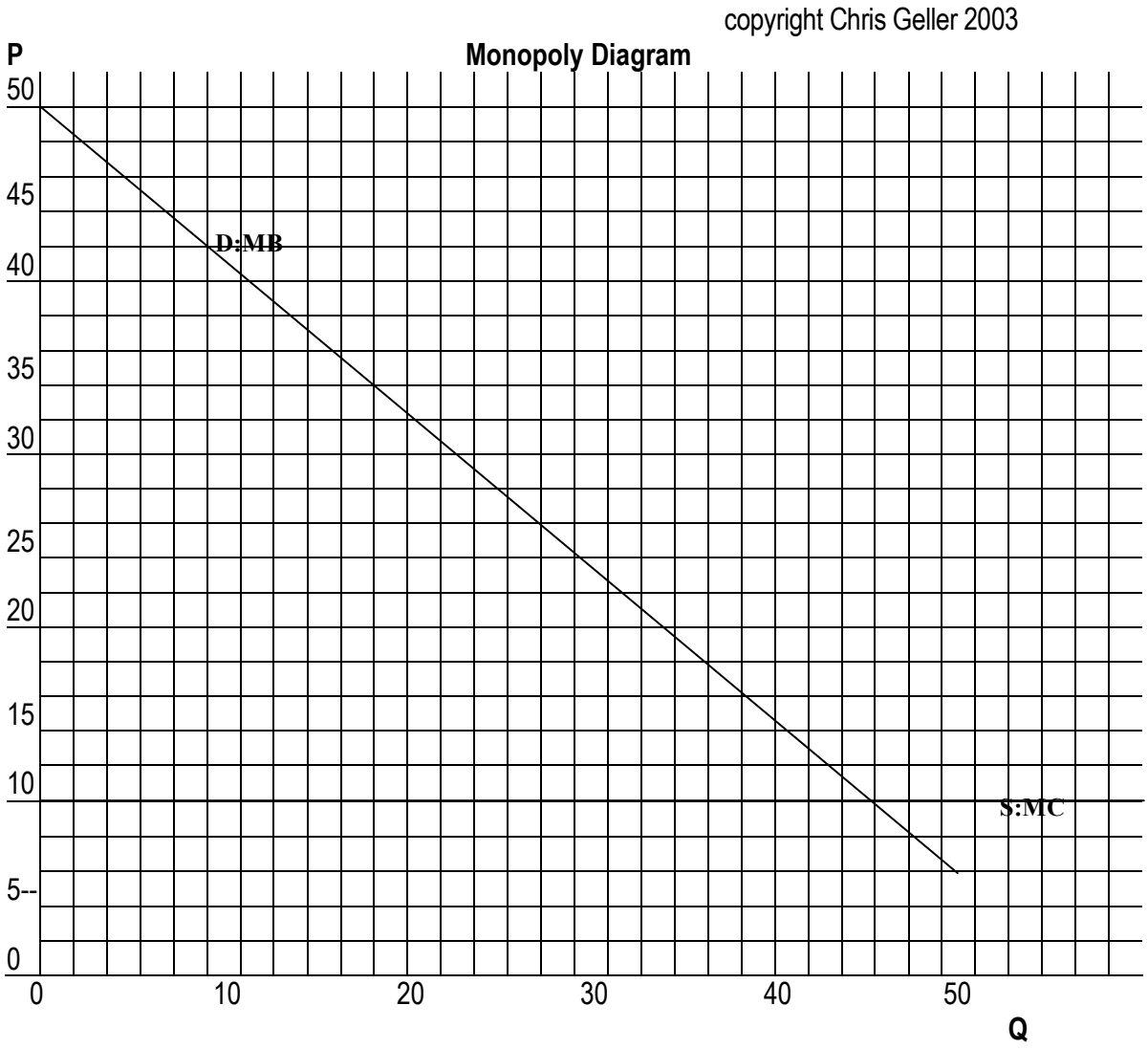
TR

TC

Profit

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.

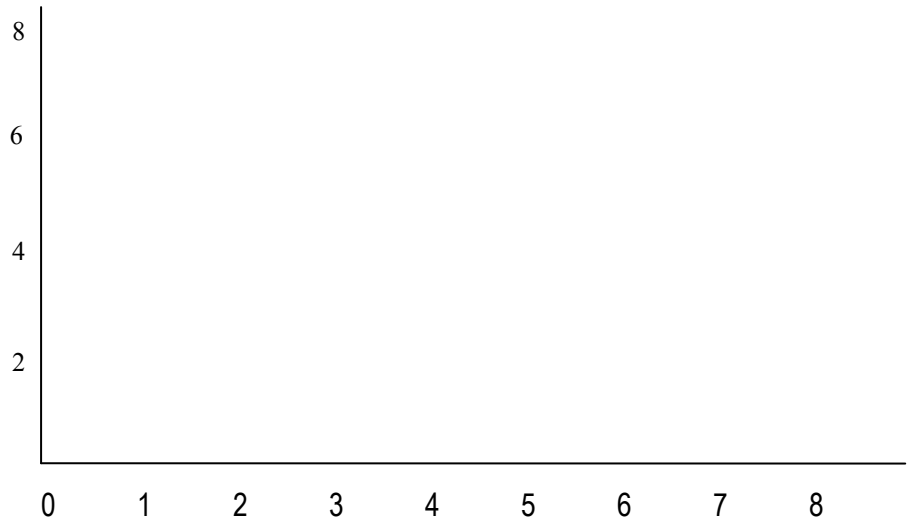
Maximum monopoly profit =


copyright Chris Geller 2003
P
Monopoly Diagram
50
45
40
35
30
25
20
15
10
5--
0
D:MB
S:MC
0
10
20
30
40
50
Q

Appendix 12: 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.



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= 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 traded if marginal cost increased?

Decrease Stay the Same Increase Not enough information Don't know

8) Referring back you 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 traded would:

Decrease Stay the Same Increase Not enough information Don't know

Appendix 13: Evaluation results

Students with no previous economics.

More Comfortable about taking econ?	N	%
Yes	46	68.6
Marginally Yes	13	19.4
No	5	7.5
Not Answered	3	4.5
Total	67	100

Performance of those not more comfortable

	Percent of test questions correct	Drew S&D correctly	Found Equilibrium P&Q
Marginal			
Yes	59	12/13	10/13
No	56	3/5	4/5
Not Answered	67	3/3	3/3