

MarketSim

Simultaneous Play Version

Instructor's Manual

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MarketSim Overview:

Thank you for adopting MarketSim for use in your class. We designed the program in the hopes that it would provide students with a fun way of applying many of the concepts covered in microeconomics. MarketSim is divided into two markets – Jeremy's Market and Adam's Market.

In Jeremy's Market a player is responsible for a household and their goal is to maximize utility. Students must decide how to divide their time between producing goods and leisure. They also must decide whether to accept offers to trade.

In Adam's Market players are responsible for both a household and a firm. The goal in this simulation is to maximize your household's utility and maximize your firm's net worth. In their role as a household, the player has to determine how many hours to allocate to leisure and work, what wage they are willing to work for and what combination of goods should be consumed. In their role as a firm, the player must decide how much labor to hire and what price to set for their product. As the instructor you have additional options that you can select from. You can decide whether or not to allow for: the purchase of capital, switching industries, and a bond market

MarketSim is an exciting way for students to learn such economic concepts as marginal utility, marginal product, comparative advantage, utility maximization and profit maximization. In MarketSim, students have a chance to be actively engaged in making utility maximizing and profit maximizing decision. They get actual hands on experience with how markets operate.

The purpose of this manual is to describe the features of MarketSim, provide you with ideas on how to integrate the use of MarketSim into your course, and offer suggestions on how to answer questions your students may have.

Planning for Using MarketSim

Checklist of things to do before the simulation starts:

- ✓ Decide when to run the simulation.
- ✓ Decide if the students will play in the same physical location or at different locations.
- ✓ Decide how long each of the periods will last and distribute the schedule to the students
- ✓ Decide how to include the results of the simulation into the student's grade
- ✓ Schedule a computer lab for an orientation to Jeremy's Market
- ✓ Distribute QuickStart manual and website address to students

The following addresses some of the questions you may have when planning your class schedule:

How much class time do I need to allocate to using MarketSim?

Assuming you are going to have students participate outside of class, you will still need to spend time introducing students to the simulations, answering questions, and relating the simulation to the course content.

For Jeremy's Market, you should allocate an hour to go over the rules of the simulation, talk about the goals the student is trying to achieve, and provide hints on the strategy they should try to follow. It would be helpful to have the class participate in a practice game in a computer lab.

In the class following the game you can discuss the game and its outcome. You can relate the game to the economic concepts of opportunity cost, comparative advantage, gains from trade, and diminishing returns.

When you start Adam's Market, you will again need to spend about an hour orienting students to that simulation. In our opinion it is not critical to take the class to a computer lab for the orientation to Adam's Market. The interfaces of the two simulations are so similar that students typically do not need to have a "hands-on" orientation for the second simulation.

In the class following the Adam's Market game you will want to devote at least 20 minutes to discussing the game. You should talk about the strategy that students pursued, what happened to prices and what happened to wage rates.

How much time will it take to play the games?

The Jeremy's Market simulation runs for four periods. The first two periods should run for about 20 minutes. You can probably shorten the last two periods to 15 minutes. An Adam's Market game with a short-run economy is four periods. An Adam's Market game with a long-run economy is six periods. The first two Adam's Market periods would need to be about 20 minutes and the remaining periods would need to be at least 15 minutes.

When should I start the simulations?

Before students can participate in Jeremy's Market they need to have been introduced to utility theory and production functions. We would suggest that you begin the simulation after covering the chapter on consumer choice and provide a brief introduction to short-run production functions.

You can run an Adam's Market game with a short-run economy after covering profit maximization. You can begin using Adam's Market with the long-run options (capital investment and entry and exit) after discussing the rules for

capital investment. You also have the option of running an Adam's Market game with a bond market if you have time to cover financial markets.

What kinds of technical problems can I expect?

Potential problems:

- The program notifies students that offers have been accepted using popup windows. Students must allow popups from the MarketSim site.
- If a student exits the game they will not be able to rejoin the simulation.
- Each student must use a separate computer. If two students are trying to access the simulation from the same computer the database will not correctly record their actions.
- In rare instances students cannot view the list of offers. This can occur for two reasons:

First, the student may be using a computer that does not have the plug-in needed to run Java applets (in this case the offers box will be empty except for a small red "X"). The plug-in can be installed by going to Sun's Java web site (www.java.com) and downloading the Java Runtime Environment (JRE).

Second, the offers will not be displayed if the security settings on Internet Explorer have been set to block applets from loading. To fix this problem you will need to change the security settings in IE. To change the security settings in IE, click on the Tools menu and select Internet Options. Click on the tab labeled Security. Click on the button marked Custom Level. In the Security Settings dialog box, look for the group labeled "Java Permissions" and make sure the button "Disable Java" is NOT checked. Also, in the group of options labeled "Scripting of Java applets," make sure that Enable is selected. You should emphasize that students should only install the JRE or change the security settings on machines on computers that they personally own.

What topics can I demonstrate with the simulations?

Jeremy's Market can be used to demonstrate decreasing marginal product, decreasing marginal utility, utility maximization, and gains from specialization and trade. Adam's Market can be used to illustrate utility maximization, profit maximization, profit-maximizing level of employment, entry and exit, optimal investment in capital, labor supply and the market for bonds.

Jeremy's Market

Introducing the Simulation to the Class

In the class prior to running the simulation, it is helpful to present the PowerPoint slides describing the software. It is also useful to distribute the QuickStart Manual in the class prior to running the simulation and encourage students to read it.

Before running the simulation, it is very helpful to be able to demonstrate the simulation. In order to demonstrate the simulation, you will need to start a game. One other person must be enrolled for the game to be active. Either have a student register or use another computer to register yourself in the game as a participant. In the demonstration briefly explain the program structure by taking them to the Worksheet and Actions pages and showing them the basic organization of the simulation. Use the Functions and Graphs page to explain how they can tell what good they are best at producing and what good they prefer to consume. Assure them that they don't need to work with the functions and that to find what they prefer to consume they only need to compare the sizes of the weights.

Setting Up the Simulation

The screen below is displayed when you go to www.marketsim.ysu.edu and click on the link "Play a Game."

MarketSim - Simultaneous Play Version

To participate in the simulations you must use Internet Explorer 5.0 or higher on a computer running the Microsoft Windows operating system. Before using the program, you should review the [QuickStart Manual](#). If you would like additional information, you can read the [Instructor's Manual](#) and the [Student Manual](#).

In the Simultaneous Play Version all the participants must be ready to start the simulation at the same time and they must stay logged into the simulation while a game is running (they cannot exit and reenter a game). While there is no upper limit on the number of participants, at least two people must participate in a Jeremy's Market simulation so that offers can be posted and accepted. For an Adam's Market simulation the minimum is four people. One person (typically the instructor) will be the administrator.

The administrator accepts people into the game, starts the game, and ends time periods. The administrator can also generate scores for participants in the game by clicking on the "Administrative Functions" link, and then clicking on "Assign Points."

Note that the administrator and each participant must use a different computer while participating in a game.

Name

Institution

E-mail Address

I will be the administrator for this game

I will be a participant in the game

To set up a game, you will first need to provide information on your name, institution and e-mail address. You will check that you will be the administrator for the game. Then press continue. You will then see the following screen.

MarketSim - Simultaneous Play Version

Instructions

You are the administrator for this game. The names of people who wish to participate in a game are shown below. If someone in your group does not appear on the list, wait a moment for them to sign in and press the Refresh List button.

Check the names of all the people you want to include in your game; do not check names you do not recognize, these people are probably trying to join a different game. Be aware that it will not be possible to add players once the game has started.

After selecting your players, choose which simulation you want to try, Jeremy's Market or Adam's Market. Finally, press the button Start Simulation.

Add Players to Game:

adfsaf

Refresh List

Select Simulation:

- Jeremy's Market (barter economy)
- Adam's Market (short-run economy)
- Adam's Market (with Entry/Exit, Capital purchases)
- Adam's Market (with Entry/Exit, Capital purchases, Bonds)

Start Simulation Demonstration

On this screen you will select the simulation you will use and add players to the game. Once you add the players to the game the game is ready to begin. After you select Start Simulation Demonstration **no additional students can be added**. Stress to students that they must be signed into the game by the time you have scheduled the game to start.

Description of User Interface

C. Program Structure

The user interface of Jeremy's Market consists of four different web pages:

- **Worksheet.** You will use this page to plan your strategy. This page will tell you what your utility will be with different combinations of goods and leisure without having to do the calculations yourself.
- **Actions.** On this page you actually indicate how much you will produce and consume. In Barter mode you can accept offers and post offers.
- **Functions, Graphs.** Your production and utility functions are displayed on this page, as well as the functions for the other groups in your class. The page also displays graphs illustrating information about the simulation such as the rates at which goods were exchanged in the most recent trades.
- **User Record.** This page displays a summary of all the actions you have taken.

To change the page you are viewing, click on a link on the main menu on the left-hand side of the screen. If you click on the "Help" link you will see information

about the page you are viewing. On the login page there is a button marked “New User Help”, which also gives an overview of the program.

The individual pages are described in detail below:

Worksheet

Optimal Combination without Trade

This section shows the combination of goods and leisure time that maximize your utility if you were not able to trade.

Current consumption and stocks

At the top of this page, you can see the number of hours that can still be used either as leisure time or to produce more output. The table provides information about the number of units of goods the student has in stock, the number of units consumed this period, and the amount of time spent this period producing the two goods.

Additional Production

This section allows you to experiment with how your utility will change if you spend additional hours producing one or more of the goods. The calculations take into account how much time you have already spent producing the goods and how much you have already consumed. The dropdown menu allows you to set the number of additional hours you want to spend producing the good (the number of hours is limited to the number of hours that were not committed to producing output or traded away). After you make the selection the marginal product of an additional hour, the number of hours remaining, and the utility after consuming the output are all calculated.

Potential Trades

Pressing the button labeled View Offers allows you to see the exchange rates for the last five trades and all current offers. For example, if 15 units of milk were traded for 10 units of bread, then the exchange rate of milk for bread would be equal to 1.5 (on average, the trader gave up 1.5 units of milk for every unit of bread received).

In the section below the title, you can see how making trades will effect your utility. Use the dropdown menus to indicate what you would like to trade away and what you would like to receive in trade. Fill in the amounts in the text boxes and click the button labeled “Add Trade.” The effect of the trade will be added to the “Consumption After Trade” table, and you can see how your utility would change with the trade. Clicking the “Clear Trades” button removes the trades.

Utility Maximization

Type in values for the exchange rates, and then press the button labeled “Calculate MU per Dollar.” The program will calculate the implicit prices of the goods based on the exchange rates you specified. It will also calculate the

marginal utility per last dollar spent (MU/P). To maximize utility, you should be receiving the same additional utility per dollar spent on each good.

Store Target Values

Once you have chosen a strategy, pressing the “Store Target Values” button will create a record of your intended production and trades. When you switch to the “Actions” page to actually produce and trade goods, you can call up the stored values to remind you of the actions you want to take.

Show Graphs

Pressing this button will display a graph of the production possibilities frontier and the indifference curve passing through the combination of goods and leisure that you have selected. It will also display a consumption opportunity curve, which shows the different consumption options available to you given any trades you have made. If you have not made any trades the consumption opportunity curve and the production possibilities curve will be the same.

Actions

Production and Consumption

The top section of this table provides information about how many units of bread and milk you have in stock, the number of units you have consumed this period, and the amount of time you have spent this period producing the two goods.

To produce units of a good, click on a text box in the row labeled “Additional Hours for Production.” Type in the number of hours you want to spend producing the good and press the button labeled “Produce”.

To consume units of a good, click on a text box in the row labeled “Additional Consumption.” Type the number of additional units you want to consume and click on the button labeled “Consume.” If you would like more flexibility with what you can trade, you can elect not to consume anything in the period and the program will automatically consume all your stock at the end of the period.

Accept Offers

In this section you can accept offers made by other students. From the dropdown list, select the item you want to receive in a trade. The current offers for that item will be displayed in the list box below. To accept an offer, click on the offer you wish to accept, and then click on the button labeled “Accept Offer.”

If you receive time in a trade, you are hiring another player to help you produce a good. You have to click on one of the radio buttons below the offers list to indicate which good will be produced with the time you are receiving.

Post Offers

In this section, you can post offers to trade. In the left-hand set of radio buttons, click on a button to indicate what you are offering to trade. Type the number of units you want to trade away immediately below.

In the right-hand side of the box, select a button to indicate what you want to receive in trade, and type the number of units you are asking for in the text box. Note that if you receive time, you must indicate which good will be produced with the time you receive. The amount of output produced will be determined by your production function and the amount of time you have already spent producing the good this period.

Press the button marked "Submit Offer" to add your offer to the list of available offers. You now need to wait and see if someone accepts your offer. At this point you may want to exit the simulation and check back a few hours later.

At the end of a period, all offers that were not accepted are canceled. You should not post offers to trade if they will not be able to honor them. The program records bad offers and the instructor may choose to penalize students who repeatedly make bad offers.

Cancel Offers

If you post an offer and no one accepts it after a reasonable amount of time, you may want to cancel the offer and post a new one. For example, suppose you offered to trade 10 units of bread for 20 units of milk. No one accepted your offer, and in the most recent trades one unit of bread was typically traded for one unit of milk. You might choose to cancel the offer, and then post a new offer to trade 10 units of bread for 10 units of milk.

In the "Cancel Offer" section, the list box displays all of the offers you have posted which have not been accepted. To cancel an offer, just click on the offer to be canceled and click on the button labeled "Cancel Offer."

Functions & Graphs

User Functions

The top of the page displays your utility and production functions, and the functions of students in other groups. Note that you do not need to actually use the functions to calculate anything because the program will do the calculations for you. The functions are displayed just for your information.

Graphs

This section provides you with important information about what other players in the simulation are doing. Select the graph you want to view from the dropdown menu. The menu options are described below:

Production by period: Displays the total amount produced of each good by period.

Consumption by period: Displays the total amount consumed of each good by period.

Current stocks: Displays the total amount of each good currently held in stock.

Total utility (user's attribute group): Displays the utility values for everyone in your attribute group. The utility displayed is the sum of your current utility and lifetime utility. Your performance is evaluated based on how well you do relative to the other students in your group.

Past utility distribution: The graph displays a two-tone bar graph for each user group. The bars represent the sum of the utilities from previous periods. The height of the bar represents the maximum utility value for that group; the height of the dividing line between the two colors represents the median value (the middle value for people in that group).

Exchange rate (milk for bread): Displays the exchange rate for the last 20 accepted offers for milk and bread. The exchange rate is the amount of one good that had to be given up to get one unit of another good. For example, assume someone traded 20 units of milk for 10 units of bread. The exchange rate of milk for bread in that trade would be 2, because two units of milk were traded away for each unit of bread received. The numerical value of the exchange rate tells you how many units of the first good had to be given up to get one unit of the second good mentioned.

User Record

Inventory Record

This table records any consumption, production, and trading of the goods. It displays the amount of leisure time and goods at the start of period and at the end of the period (or the units currently in stock in the case of the current period). The table records the date and time in which you produced, consumed, or traded a good. Deletions in inventory are recorded in red and additions to inventory are recorded in green. For example, if you traded 3 units of bread for 5 units of milk, the table would show a value of -3 in red for bread and a value of 5 in green for milk. Additionally, if you receive time to produce a good in a trade, the amount of output produced is recorded in the table.

Consumption Record

This table records the date and time in which you consumed any milk or bread. It also notes the ending total of milk, bread, and time (leisure). Since all your stock is consumed each period, your ending stock of bread and milk will be zero.

Current Utility

During a current period, you can see your utility based on what you have currently consumed. After the period is over, this information will tell you your utility at the end of that period based on your consumption in that period.

Utility if all stock consumed

This information is only displayed during a current period. It shows you what your utility would be if you consumed the milk and bread you have in stock.

Logins

This table displays the number of times you logged in during the period. Since play is simultaneous and you are not able to close out of the program, your logins will be 1. Remember not to close out of the program or you will be unable to log back in for the remainder of the game.

Help:

On each page there is a link to a help menu. The help menu for each page is specific to that page. Remind the students that these help menus are available. The student will be able to get most of their questions about how the simulation works answered just by reading the help screens. Strongly suggest to the students that if they are having problems with understanding how the simulation works that they should read the help screens.

Administrator Functions:

As the administrator of the game, you will have link in the menu bar labeled "Administrative Functions." When you click on the link the menu will change to the following:

Administration Functions

[Return to User Mode](#)

[Barter Summary](#)

[Pause Simulation](#)

[Display Passwords](#)

[Add or Deactivate
Student](#)

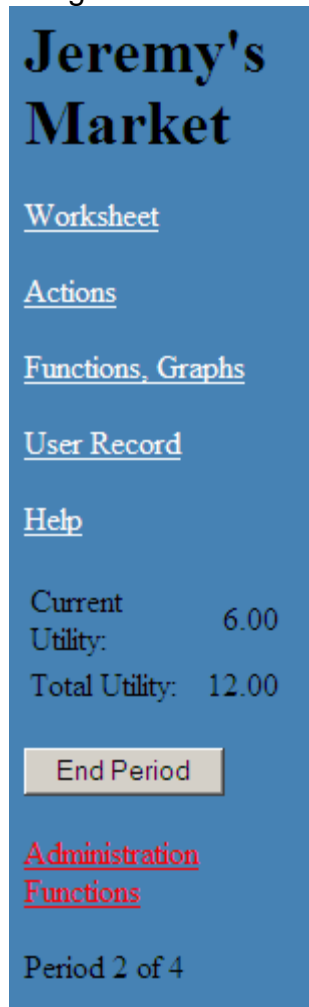
[Modify Simulation
Name](#)

These statistics include production data, consumption data, trades, and individual trades. You can pause the simulation if you need to by selecting Pause Simulation. The last three options listed: Display Passwords, Add or Deactivate Student, and Modify Simulation Name are irrelevant in the simultaneous play version of the simulation. The “Barter Summary” link will allow you to view a summary of the barter statistics.

The Barter Summary is very useful when you are discussing the simulation. Once you log out of the simulation, you will no longer have access to this information. You may want to print this page or do a screen capture and save the screen.

Changing Periods:

To change the period, just click on the End Period button in the left-hand navigation bar.



**Jeremy's
Market**

[Worksheet](#)

[Actions](#)

[Functions, Graphs](#)

[User Record](#)

[Help](#)

Current Utility: 6.00
Total Utility: 12.00

[Administration](#)
[Functions](#)

Period 2 of 4

Assigning Points:

When the simulation is over, you can assign points. Click on the link "Administrator Functions," a new link labeled "Assign Points" will appear at the bottom of the menu bar.

Administration Functions

[Return to User Mode](#)

[Barter Summary](#)

[Pause Simulation](#)

[Display Passwords](#)

[Add or Deactivate
Student](#)

[Modify Simulation
Name](#)

[Assign Points](#)

The following screen will appear:

Assignment of Points

Jeremy's Market

Participation Points

Participation Points per Period:	2
Number of Periods:	4
Total Number of Participation Points:	8

Performance Points

Total number of performance points:	8	
Minimum Periods Participating to Receive Performance Points	1	
Group	Students in Group	Number Receiving Maximum Points
1	1	1
2	1	1

Calculate Points for Jeremy's Market

Points for Jeremy's Market

Name	Attribute Group	Periods Participated	Participation Points	Utility	Performance Points	Total Points
Teresa Riley	2	4	8.0	65.18	8.0	16.0

Group	Number Receiving Max Points	Lowest Utility Receiving Max Pts.	Utility of Student with no Activity
1	2	71.42	24.00
2	2	65.18	24.00

There are two categories of points – participation points and performance points. Participation points are given for each period in which the student participates in the simulation by producing, trading, or consuming goods. A single action of any type qualifies the student for participation points.

Performance points are based on how well the student did relative to other students in his or her group. As the instructor, you choose how many students in a group will receive the maximum number of performance points. All the other students receive points based on how high their utility is relative to the student with the lowest utility who received the maximum number of points.

For example assume that there are 20 students in the group and you have decided that the top three students will get the maximum performance points. Let's assume that the maximum number of points is 8. The three highest utility values are 85, 84.5, and 83. Assume that if a student never participated in the simulation, they would have received a total utility of 20. For a student who received a total utility of 75, their performance points would be calculated as: $(75 - 20) / (83 - 20) * 8 = 6.7$ points.

The figure below shows the screen for assigning points. After you have set the values for participation and performance points and clicked the "Calculate Points for Jeremy's Market", a table with the scores for all students will be displayed. You copy the table and paste it into a spreadsheet for use in grading. **After you log out of the simulation, you will not have access to this information. You must copy and save the points before logging out of the simulation.**

Instructor Tips:

Students have the most difficulty with determining the terms of trade that they should offer and accept. They should use the worksheet to determine what offers to make and which offers to accept. To demonstrate this to the students, bring up the worksheet page during the orientation.

To make the example more specific, let's assume that the production functions used are: Milk = $10L^2$ and Bread = $10L^8$. The first hour producing bread will yield 10 units and the first hour producing milk will yield 10 units. The next hour spent producing milk yields 1.15 units and the next hour spent producing bread yields 7.4 units. The rate at which they can produce the goods themselves is 7.4 units of bread to 1.15 units of milk.

If the student prefers to consume milk instead of bread, they should produce bread and then trade it for milk. In order to be willing to trade away 7.4 units of bread they would require at least 1.15 units of milk. This trade would enable them to achieve the same level of utility they would have attained if they had spent an additional hour producing milk and then consumed what they produced. They would obviously be better off if they traded 7.4 units of bread for more than 1.15 units of milk and worse off if they trade 7.4 units of bread for less than 1.15 units of milk. The trades they will be willing to accept will change as they allocate more hours to the production of a good.

Participants seem to be less willing to trade time for goods. If they can produce 7.4 units of bread in one hour, they could trade 1 hour for more than 7.4 units of bread. They could then trade the bread for milk. Or they could offer to trade 1 hour for more than 1.15 units of milk.

Participants will also have to decide the amounts that they want to trade. Some participants want to be able to make one trade and be done trading. So they may offer a trade of 100 units of milk for 80 units of bread. Other participants may be reluctant to accept a trade believing that if they make smaller trades they may be able to get more advantageous terms of trade. Participants should post a few trades with differing quantities and see what trades are accepted. Participants should also be guided by the types of trades they are willing to accept.

Students should not assume that the exchange rates in the simulation will mirror actual exchange rates. Depending on the functions selected, the exchange may be quite different from actual exchange rates. Bread may exchange for 12 pizzas. Students should not use “real-world” prices as a guide to what the exchange rates will be in the simulation.

Common Student Mistakes and Questions:

Some students think that after they identify the optimal allocation of time on the Worksheet page that they are done. Emphasize to them that after finding the optimal allocation they need to go to the Actions page and try to implement their strategies by producing and trading.

Student Strategy Tips:

When a period is just beginning, the participant has to determine what trades to make. The student should allocate a few hours to producing the good for which they have the highest marginal product. Then they should try a few trades by using the potential trades box. This will identify if their utility increases from trade or if they are better off consuming what they produced. The student can also try different exchange rates to determine which exchange rates are favorable. Once they determine what trades they are willing to offer, they should post these trades using the Actions Page. Students may just want to offer one or two trades with a small number of units until they have additional information about the exchange rate.

Timing when to make and accept offers will always be an important part of the simulation. If a participant is the first to make an offer, their offer may get accepted just because there are no other offers available. The first student to make an offer may find it worthwhile to post an offer that is very favorable toward them.

Students will also have to decide whether or not they should accept offers that have been made or whether they should wait to see if more favorable offers are made. They have to trade off the certainty of accepting offers available for the uncertainty that better offers will become available.

Students also have to determine how to make their offers different from other offers. If the current exchange rate is 15 units of milk for 10 units of bread. They could offer to trade 15 units of milk for 9 units of bread. If all the trades are in terms of 10 or 15 units, a student could offer a trade in terms of 30 units of a good. Other students may find this trade attractive because they would have to accept fewer trades.

Class Discussion:

Ask students to record their optimal utility level with no trade (this value is given on the worksheet page) and their utility level after the first period. Also ask them to record the amounts of the two goods and leisure that they consumed.

You will want a record of the production functions and the optimal utility levels without trade including the amounts of each good consumed for each attribute group.

1. Ask a student from each attribute group what their optimal utility without trade was and their utility level after the first period. Ask if anyone had a higher utility level. Record the highest utility level. *(Alternatively, you could find the highest utility level by checking the utility summary provided on the Barter Summary page. You could then just present this information in class.)*

- a. Ask them to explain why they were able to achieve a higher utility level with trade than the optimal utility level without trade.
- b. Ask which groups benefited more – those groups who preferred to consume what they were best at producing or those groups who preferred to consume the good that they were not best at producing. Ask them to explain why utility increased by more for the group who preferred to consume the good that they were not best at producing.

2. Draw the PPF for each attribute group. (You will need the production functions.) Ask a student from each attribute group who had a high utility level to identify the amounts of the two goods that they consumed. Show that this combination of goods is outside the PPF. Discuss why people are better off with trade.

3. Discuss the limits on the terms of trade. Identify someone who was a good milk producer and someone who was a good bread producer. For the good milk producer, if an additional hour of time is spent producing milk how much milk could be produced. If the hour was spent producing bread, how much bread could have been produced? (Let's assume that they could produce either 8 milk or 2 bread.) Do the same for the good bread producer. (Let's assume that they could produce either 8 bread or 2 milk. The good milk producer would be willing to trade 8 milk for 2 bread or 1 milk for $\frac{1}{4}$ bread and the good bread producer would have been willing to trade 1 milk for 4 bread. Therefore, milk should have exchanged for between $\frac{1}{4}$ to 4 units of bread. Identify what the average

exchange rate was. (You can find this on the Barter Summary page.) Was the average exchange within this range? If not, what do you think happened? Discuss what determined the actual exchange rate.

4. Discuss why exchange rates vary during a period. Talk about the role of perfect information. How do some students benefit from luck? Some students will have been able to take advantage of good exchange rates. Are exchange rates in subsequent periods affected by the previous periods?

5. Discuss whether or not students considered colluding to influence the exchange rates. Did they try to find out who the other good producers of a good were? Why or why not? What would have made it more likely that students would collude?

6. Discuss what happened to exchange rates over the course of the simulation. Did exchange rates fluctuate more during earlier periods and less during later period? If so, why?

7. Ask if students changed their strategy over time. Did the offers they made change? If so, why?

8. You may want to identify a few students who are doing well in the simulation and ask them to share their strategies with the class.

Adam's Market

Introduction

In Adam's Market, participants take on two roles – consumer and producer. As a consumer, their goal is to maximize their utility. Consumers derive utility from consuming two goods and leisure time. They earn income to purchase the goods by selling leisure time and by receiving dividends from their firm. They will need to determine the optimal amount of time to allocate to the labor market and the optimal amounts of the goods to consume. As a producer their goal is to maximize profit. They hire labor to produce a product and then offer that product for sale. They will need to determine the optimal amount of labor to hire and what price to charge. They can also transfer income to their household in the form of dividends. As the administrator of the game you can choose scenarios in which participants can purchase capital, switch industries and buy and sell bonds.

Adam's market allows students to actively participate in a labor market and an output market as both a buyer and a seller. They will gain experience on how prices are determined and the factors that cause price to change. They will also experience first hand the impact on consumers and firms if prices do change. One of the exciting aspects of the game is that students face uncertainty as a consumer and as a manager of a firm. Students will have to consider whether or not they should buy goods now or wait and see if prices drop. If they guess incorrectly their utility will be lower than what it could have been. If they expect wages to fall and delay hiring labor and wages increase, they will earn a lower profit than what could have been earned.

Introducing the Simulation to the Class

Before starting the simulation you will want to distribute the QuickStart Manual. You may want to use the PowerPoint presentation to introduce them to the simulation. Prior to running the game, you will want to emphasize the following points:

- 1) The goal of the consumer
- 2) The goal of the firm
- 3) The number of periods and the schedule for the periods
- 4) The login address and a reminder that the simulation must be viewed with Internet Explorer running on a Microsoft Windows operating system.
- 5) An explanation of how you are going to grade their work on the simulation
- 6) A reminder that once you start the simulation, they will not be able to access the simulation. They must be registered before the simulation begins. Make sure you emphasize to them the start time.

Strongly suggest to student's that they review the QuickStart Manual prior to the start of the game. Remind students that they act as both consumers and firms.

As a consumer they are trying to maximize utility and as a firm they are trying to maximize net worth. Students often believe that they only have to participate as either a firm or as a consumer. Emphasize to them that they need to participate in both roles.

Remind students that they should use the firm worksheet page to determine how much labor to hire and what price to charge. The worksheet page allows them to experiment with hiring different amounts of labor and charging different prices. They can see how their profit is changed by changing the wage rate and the output price.

Setting Up the Simulation

Just as you did in Jeremy's Market, go to the URL www.marketsim.ysu.edu, click on the link "Play a Game," and register as the administrator for the game. After you have registered you will have three different Adam's Market scenarios to choose from (see below).

MarketSim - Simultaneous Play Version

Instructions

You are the administrator for this game. The names of people who wish to participate in a game are shown below. If someone in your group does not appear on the list, wait a moment for them to sign in and press the Refresh List button.

Check the names of all the people you want to include in your game; do not check names you do not recognize, these people are probably trying to join a different game. Be aware that it will not be possible to add players once the game has started.

After selecting your players, choose which simulation you want to try, Jeremy's Market or Adam's Market. Finally, press the button Start Simulation.

Add Players to Game:

adfsaf

Refresh List

Select Simulation:

- Jeremy's Market (barter economy)
- Adam's Market (short-run economy)
- Adam's Market (with Entry/Exit, Capital purchases)
- Adam's Market (with Entry/Exit, Capital purchases, Bonds)

Start Simulation Demonstration

In Adam's Market (short-run economy), consumers sell labor time to the firms and buy goods from the firms. Firms are limited to just hiring labor and selling output, the stock of capital is fixed. In Adam's Market (with Entry/Exit, Capital Purchases), firms now have the option of switching industries. They also have the ability to purchase additional units of capital. The third scenario, firms now have the ability to borrow money by selling bonds to consumers and other firms.

As with Jeremy's Market, you need to add the players to your game. After you select Start Simulation Demonstration **no additional students can be added.**

Stress to students that they must be signed into the game by the time you have scheduled the game to start.

Program Structure:

When you log onto Adam's market, you will see a side bar on the left hand side of the screen. This sidebar includes the links for the following pages: Consumer Worksheet, Consumer Actions, Consumer Bonds (if your professor has chosen the scenario that includes the bond option), Firm Worksheet, Firm Actions, Firm Bonds (if your professor has chosen the scenario that includes the bond option), Functions and Graphs, User Record, and Help. In addition, you can see the value for your current utility (utility for the current period), total utility (current utility added to utility from previous periods), total profit (total revenue – total cost), and firm net worth (cash + value of inventory + value of capital stock + present discounted value of bonds). The calculation of firm net worth will change if the price of the good sold by the firm changes. The price of output used is a weighted average of prices over time. In the short run, when capital stock is fixed at the same amount for every firm, the value of capital stock is assumed to be zero. Once firms can purchase capital, the value of producing capital is determined by the capital production function and a weighted average of the price of labor used to produce capital.

The functions of the pages are briefly described below:

- **Consumer Worksheet.** You will use this worksheet to plan your strategy as a consumer. This page will help you to decide how many hours to work and how much of the two goods to purchase. None of the actions on this sheet will be recorded. Remember that all of the calculations are based on the expected prices and wages.
- **Consumer Actions.** This page is where you implement your strategy planned on the worksheet pages. You may post offers to sell labor, accept offers from the firms to purchase goods, and cancel offers that have not been accepted.
- **Consumer Bonds.** This page will only appear if your instructor has turned on the bonds market option. Your consumer may purchase bonds (lend money), sell a bond you currently hold, and cancel offers that have not been accepted.
- **Firm Worksheet.** You will use this worksheet to plan your strategy as a firm. This page will help you decide how much labor to hire, whether you should purchase more capital, and how much output your firm will produce in order to maximize profits. None of the actions on this sheet will be recorded. Remember that all of the calculations are influenced by the prices you specify.
- **Firm Actions.** This is the page where you activate your strategy planned on the worksheet pages. You may purchase labor from the households,

use the labor to produce output, and make and cancel offers to sell the output. You may also choose to distribute profits back to your household in the form of dividends. In later periods, you may also choose to buy capital or switch industries.

- **Firm Bonds.** This page will only appear if your instructor has turned on the bonds market option. Your firm may purchase bonds (lend money), post offers to sell a bond (borrow money), sell a bond your firm currently holds, and cancel offers that have not been accepted. At the bottom of the page, there is a table that summarizes your firm's outstanding bonds.
- **Functions and Graphs.** The top half of the page displays your household's utility function, the utility functions of the other households, your firm's production function, and the product functions of firms in other industries. In the bottom half of the page is a graphing area and a dropdown menu. From the dropdown menu you can pick from a variety of graphs summarizing different results from the simulation. The information displayed includes information on prices, production, consumption, profits, and utility.
- **User Record.** This page displays a summary of all the actions you have taken, both as a consumer and a producer.

To change the page you are viewing, click on a link on the main menu on the left-hand side of the screen. If you click on the "Help" link you will see information about the page you are viewing.

The individual pages are described in detail below:

Consumer Worksheet

Current values

The table in this section displays information about the money you have at your disposal and your consumption in the current period. The row labeled "Cash" displays the amount of money you currently have available to spend. You can carry over cash from one period to another. The next two lines display how much you have consumed this period. Unlike Jeremy's Market, units of the goods are automatically consumed when you purchase them. The last line in the table lists the number of hours available for work or leisure.

Set Prices

To calculate your consumption options you must specify the wage rate you expect to earn and the prices at which you will buy your goods. The table displays the prices and wages paid for the last five purchases. You typically want to choose a price between the highest and lowest prices listed.

Consumption Options

In the menu on the left-hand side, set the division between leisure and work. Combined with the wage rate set in the table above, the program will calculate the expected income. In the right-hand menu, select the amounts to spend on

each good. As you change the amount you work and the amount you spend on the two goods, your level of utility will change in the table below. The table in this section will display the expected amount of income earned and the number of units purchased of each good. You can also see your level of utility as well as the marginal utility per dollar. You want to try different combinations of goods and leisure until you get roughly the same marginal utility per dollar from both goods and from leisure time. You always want to consume more of the item that has the highest marginal utility per dollar (you want to get the most value per dollar spent). When you find your utility maximizing point, you can click on the “Store Target Values” button to save your results.

Store Target Values

Once you have chosen a strategy, pressing the “Store Target Values” button will create a record of your intended work and consumption. When you switch to the “Actions” page to actually sell labor and purchase goods, you can call up the stored values to remind you of the actions you want to take.

Budget Line, Indifference Curve Graph

At the bottom of the Consumer Worksheet page, there is a button labeled “Budget Line, Indifference Curve Graph.” When displayed, you can see the graphical representation of the information in the table. The graph shows a point on the budget line that represents the combination of goods being consumed. Some books use a curve to represent a particular level of utility and the tradeoff from trading one good for another (this curve is called an indifference curve). The goal is to maximize utility (to be on the highest curve possible), given the budget line. When the budget line is tangent to the curve, the consumer is maximizing utility. The curve will be tangent to the budget line when the MU/P is equal for the two goods. Although you have not learned about indifference curves, you can tell if you are maximizing your household’s utility by looking for the tangencies in the graph.

Consumer Actions

View Target Values

If you stored your target values in the worksheet page, you can press the “View Target Values” button in order to view your results from the worksheet page. You will see a popup window labeled Consumer Target Values. The program will display all of the values you selected on the worksheet. You can use this information to help remind you how many hours to work and how many units of each good to buy when you post offers of labor to sell and buy goods.

Current Values

The table in this section displays information about the money you have at your disposal and your consumption in the current period. The row labeled cash displays the amount of money you currently have available to spend. You can carry over cash from one period to another. The next two lines display how

much you have consumed this period. Unlike Jeremy's Market, units of the goods are automatically consumed when you purchase them, it is not possible to save goods for consumption in future periods. The last line in the table lists the number of hours available for work or leisure.

Post Offer to Sell Labor

To post an offer to work for a firm, type in the number of hours you are willing to work and the wage you are asking in the appropriate text boxes. Push the button marked "Post Offer" to make the offer available. Remember that you need to retain a portion of your time for leisure time to maximize your utility. Offers that are not accepted before the end of the period are automatically cancelled.

Cancel Offer to Sell Labor

The table in this section lists all of the offers to sell time you have posted but have not yet been accepted. To cancel an offer, highlight the offer you wish to cancel and click on the "Cancel Offer" button.

Purchase Goods

Click on the radio buttons to select the good which you want to buy. The table below lists the offers posted by firms producing the goods. To accept an offer, highlight the desired offer by clicking on it and press the button labeled "Make Purchase." Note that when you purchase units of a good they are immediately added to your consumption. It is also not possible to resell goods after you have purchased them.

Consumer Bonds

Current Values

The table in this section displays information about the money you have at your disposal and your consumption in the current period. The row labeled "cash" displays the amount of money you currently have available to spend. The last line in the table lists the number of hours available for work or leisure.

Purchase Bonds (Lend Money)

The table in this section lists all of the bonds that are being offered for sale. To purchase a bond, click on the bond you wish to buy and click on the button labeled "Accept Offer". The following characteristics of the bond are listed in the table:

- Price Asked -- This is the amount you must pay for the bond. It is the amount you are lending to the seller of the bond.
- Face Value -- This is the amount that will be paid to whoever holds the bond when it matures.
- Period Matures -- At the end of the period the face value of the bond is deducted from the cash of the firm that originally issued the bond and is added to the cash of the firm or household that owns the bond.

- **Projected Yield** -- A measure of the return received by the purchaser of the bond expressed in percentage terms. The size of the yield depends on the difference between the purchase price and the face value, and the amount of time before the bond matures.

For example, suppose a household bought a bond from a firm for \$200 at the very end of period 3. If the bond matured at the end of period 4 and had a face value of \$220, the bond would have a yield of 10%. The relevant calculation would be: $(220 - 200)/200 = 20/200 = 0.1 = 10\%$. The yield changes to reflect the fraction of the period left.

Sell a Bond You Currently Hold

You have the option of reselling bonds which you have purchased from a firm. The table in this section lists all of the bonds you own. To sell a bond, highlight the bond you wish to sell, type in the price at which you want to sell the bond, and click on the "Post Offer" button. Before you press the "Post Offer" button, you may want to press the "Calculate Yield" button. When this button is pressed the program will display the yield to the new owner of the bond, given your asking price.

Cancel an Offer

You can cancel an offer to sell a bond if the offer has not yet been accepted. Click on the offer you wish to cancel and press the "Cancel Offer" button.

Firm Worksheet

Current Values

This table displays information about your firm. The first line lists the type of product you produce. The second line lists the amount of cash the firm has available to buy labor; money which is not spent by the end of the period is carried over into the next period. The third line lists the number of units of capital available to produce goods in the current period. The amount of capital (minus depreciation) is carried over into succeeding periods. The line labeled "New Capital Next Period" lists the number of units of capital that will be added to the firm's stock of capital in the next period. When a firm buys additional units of capital it has to wait until the following period before it can use the capital to produce output. The next line lists the amount of labor hired so far this period. The last line "Units of Output in Inventory," lists the number of units of output the firm has produced this period but has not yet sold. Inventory is carried over into the following period minus the 10 percent depreciation rate.

Purchase and Offer Information

To help you estimate the price at which you can sell your output and the wage at which you can purchase labor, this table shows the values for the last four accepted offers and the current four lowest offers.

Set Capital, Wage Rate, and Price

Before the program can estimate the costs and revenues earned from different amounts of output you must specify the price at which you will sell the output, the wage rate you will need to pay your workers, and the amount of capital used. Using the information on the prices from the last set of accepted offers, type in the expected prices in the text boxes and press the button marked "Calculate Revenues, Costs, and Profits."

Output, Costs, and Revenues Given Different Amounts of Labor

This section helps you find the profit-maximizing levels of employment and output given some amount of capital. In the jargon of economics, it helps you find the short run profit-maximizing level of output. In the short run firms have a fixed amount of capital to work with but can vary the amount of labor they employ. In the simulation, the length of the short run depends on whether you can purchase capital or not. If you cannot purchase capital, you are always dealing with a "short-run" situation. If you can purchase capital the short run lasts until the end of the current period, because you cannot change the amount of capital in the current period, but you can purchase additional capital for use in the next period. Remember that in the short run firms add to their profits whenever revenues exceed variable costs.

The first table shows cost and revenues for different levels of output. In this table the most important values are marginal cost (MC) and marginal revenue (MR). Firms maximize profits in the short run by hiring up to the point where the additional cost from producing another unit of output (MC) equals the revenue from producing another unit of output (MR). Also keep in mind the shut-down rule, which states that a firm should not produce anything if MR is less than average variable cost (AVC) for all levels of output.

The second table helps you find the profit-maximizing level of output in terms of employment. In this case you want to compare the wage rate and marginal revenue product (MRP). Marginal revenue product measures how much revenues rise when an additional unit of labor is hired; the wage measures how much costs rise when an additional unit of labor is hired. To maximize profits firms should hire labor up to the point where MRP equals the wage. Note that the profit-maximizing levels of output and employment using MR and MC will match the levels found using the wage and MRP.

Once you have found the profit maximizing combination, you can press the button marked "Store Target Values". The information from the output, costs, and revenue table will be stored so you can recall it later.

Production and Cost Graphs

The graphs are based on the information in the previous tables. You can select to display five different types of graphs from the drop-down menu.

Revenues and Costs From Additional Capital

This section of the worksheet helps you decide if you can increase your profits by purchasing capital. Additional capital will increase output and revenue for the rest of the simulation, so you need to compare the cost of the capital against the total value of the additional revenue in all the remaining periods.

To estimate the value of additional capital, pick the amount of capital you think you would like to purchase from the drop-down menu labeled “Capital Purchased”. Type the price you expect to sell your output for in the text box labeled “Output Price”, and type the amount of labor you think you will hire each period in the text box labeled “Labor per Period”. Next, select the rate at which you are going to discount future revenues from the drop-down menu labeled “Discount Rate.” When you press the button labeled “Calculate Net Present Value of Capital” the results are displayed in the table at the bottom of the page.

The first column in the table displays your capital stock for each period assuming you do not buy any capital. Economists refer to the rate at which capital wears out as the depreciation rate. If the depreciation rate has been set to zero, the amount of capital will be the same for all the periods. If the depreciation rate is 5 percent, the stock of capital will decrease by 5 percent each period. The second column shows the amount of capital you would have if you did purchase the additional capital.

The third column shows how much more output would be produced if you purchased the additional capital, given the amount of labor you said you would hire. The fourth column shows the additional revenue you would receive, given the additional output and the output price you specified.

The last column discounts the additional revenues. Economists typically assume that money received in the future is not as valuable as money received in the present. If you pick a discount rate of 5 percent, it means that you believe that 95 cents in the current period has the same value as a dollar received in the next period.

In deciding whether to purchase capital, you should compare the difference between the present value of the additional future earnings from buying the capital and the cost of purchasing the capital. Economists would call the difference the net present value of the additional capital. If the net present value of the capital is positive, purchasing the capital will increase your profits if your estimate of the output price is correct.

If you decide you can add to your profits by purchasing more capital, you should go back to the short-run cost and revenue section of the page, and see if the additional capital will change your profit-maximizing level of employment.

Firm Actions

View Target Values

If you stored your target values in the worksheet page, you can press the "View Target Values" button in order to view your results from the worksheet page. You will see a popup window labeled Firm Target Values. You can see the wage, price of output, capital stock, optimal employment, and optimal output. You can use this information to help you determine how much labor to hire and what price to post your output for sale.

Current Values

This section displays information about your firm. The first line lists the type of product you produce. The second line lists the amount of cash the firm has available to buy labor; cash which is not spent by the end of the period is carried over into the next period.

The third line lists the number of units of capital available to produce goods in the current period. Capital (minus depreciation) is carried over into succeeding periods. The line labeled "New Capital Next Period" lists the number of units of capital that will be added to the firm's stock of capital in the next period. When a firm buys additional units of capital it has to wait until the following period before it can use the capital to produce output. The fifth line lists the amount of labor hired so far in this period.

The last line, "Units of Output in Inventory," lists the number of units of output the firm has produced this period but has not yet sold. Inventory (minus depreciation) is carried over into the following period.

Purchase Labor

The table in this section displays the households' offers to sell labor time. To accept an offer, select the offer and press the button marked "Accept Offer." The labor purchased is then automatically used to produce output (it is not possible to "store" labor hours).

Post Offers to Sell Output

In this section you can post offers to sell output. Type in the number of units you want to sell and the price you are asking. When you have filled in all of the information press the button marked "Post Offer." Any offer which is not accepted before the end of the period is automatically cancelled.

Cancel an Offer

The table lists all of the offers that you have made this period that have not yet been accepted. To cancel an offer, click on the offer you want to cancel and press the button marked "Cancel Offer."

Distribute Dividends

You can transfer cash from your firm to your household. Type in the amount of

money you wish to transfer from the firm to your household and press the button marked "Distribute Dividends."

Purchase Capital

The simulation assumes there is a producer of capital who hires labor from the households, makes capital, and then sells the capital to firms. Thus, there may be a small amount of time in the beginning of the simulation when there is no capital available for sale if there are no offers of labor for the capital producer to buy. Whenever a firm buys capital, the capital producer takes the money from the sale and tries to buy labor to produce new capital.

This section of the page displays the current price of capital and a drop-down menu showing the number of units of capital available for purchase. Select the amount of capital you wish to buy from the drop-down menu and click on the button marked "Purchase Capital". The number of units you buy will be added to your capital stock at the start of the next period. If a participant purchases all of the capital, there may be a brief period in which no capital is available.

The price of capital is based on the cost of labor hired and the production function for capital. For example, if it takes two units of labor to produce a unit of capital and the wage rate is \$10, capital will cost \$20 per unit.

Change Industry

If firms in another industry are earning significantly higher profits than the firms in your industry, you may want to consider switching industries.

To change industries, select the industry you wish to enter from the drop-down menu and press the button marked Change Industry. Starting in the next period, you will be producing the product you selected.

There are two consequences to changing industries. First, your inventory will be set to zero when you start producing the new product because you cannot carry over inventory from your old industry. In other words, if you are producing bread and in period 3 you indicate you want to switch to producing milk, none of your bread inventory can be carried over into period 4. In this case you would want to have sold all of your bread inventory by the end of period 3.

The second consequence to changing industries is there will be a reduction in your stock of capital by 15%. The reduction in capital is justified since changing industries would most likely cause a need for different equipment and retraining of workers.

Firm Bonds

Current Values

This table displays information about your firm. The first line lists the type of product you produce. The second line lists the amount of cash the firm has available to buy labor; money which is not spent by the end of the period is

carried over into the next period. The third line lists the number of units of capital available to produce goods in the current period. The line labeled "New Capital Next Period" lists the number of units of capital that will be added to the firm's stock of capital in the next period. The next line lists the amount of labor hired so far this period. The last line "Units of Output in Inventory," lists the number of units of output the firm has produced this period but has not yet sold.

Purchase Bonds (Lend Money)

The table in this section lists all of the bonds that are being offered for sale. To purchase a bond, click on the bond you wish to buy and click on the button labeled "Accept Offer."

The following characteristics of the bond are listed in the table:

- Price Asked -- This is the amount you must pay for the bond. It is the amount you are lending to the seller of the bond.
- Face Value -- This is the amount that will be paid to whoever holds the bond when it matures.
- Period Matures -- At the end of the period the face value of the bond is deducted from the cash of the firm that originally issued the bond and is added to the cash of the firm or household that owns the bond.
- Projected Yield -- A measure of the return received by the purchaser of the bond expressed in percentage terms. The size of the yield depends on the difference between the purchase price and the face value, and the amount of time before the bond matures.

For example, suppose a household bought a bond from a firm for \$200 at the very end of period 3. If the bond matured at the end of period 4 and had a face value of \$220, the bond would have a yield of 10%. The relevant calculation would be: $(220 - 200)/200 = 20/200 = 0.1 = 10\%$

Post Offer to Sell a Bond (Borrow Money)

You may decide to borrow money so you can invest in additional capital. If you borrow to purchase capital you want to be sure that the return on your investment is greater than the amount you have to pay to borrow the money. One approach to finding if you want to borrow money to invest is to first find the yield on the bond you are going to offer. Next go to the capital section of the firm worksheet page. Use the estimated yield of the bond as the discount rate in calculating the net present value of the additional capital. If the present value of the investment is positive, and all your other assumptions are correct, it will be profitable to issue the bond.

To post an offer to sell a bond, select the period in which the bond will mature, the price you are asking for the bond, and the amount you promise to pay when the bond matures (the face value). You should then press the "Calculate Yield"

button to find out what the expected yield on the bond will be. Finally, click on "Post Offer".

Sell a Bond You Currently Hold

You have the option of reselling bonds which you have purchased. The table in this section lists all of the bonds you own. To sell a bond, highlight the bond you wish to sell, type in the price at which you want to sell the bond, and click on the "Post Offer" button. Before you press the "Post Offer" button, you may want to press the "Calculate Yield" button. When this button is pressed the program will display the yield to the new owner of the bond, given your asking price.

Cancel an Offer

You can cancel an offer to sell a bond if the offer has not yet been accepted. Click on the offer you wish to cancel and press the "Cancel Offer" button.

Bonds Outstanding

This table lists the bonds you have issued, when they mature, and the face value (the amount you will need to pay when they mature). You want to be sure to have enough cash to pay the holder of the bond when the bond matures.

Functions, Graphs

Functions

This section displays your household's utility function and your firm's production function for output. It also displays the utility functions of the other household groups and the production functions of other industries. Note that you do not need to directly use these functions when participating in the simulation. You can use the worksheets, which are based on the functions, to plan your strategy.

Graphs of Simulation Data

You can display a variety of information about the simulation on a graph. The information that can be displayed includes:

Production by period: Bar Chart displaying the total number of units produced by all of the firms in each industry for each period.

Units sold by period: Bar Chart displaying the total number of units sold by all firms in each industry for each period.

Output prices paid: The prices charged for the last twenty sales of each product.

Current inventories: Bar Chart displaying current inventories for each industry.

Wages paid and Capital prices paid: Wage rates paid for the last twenty sales of labor and Prices paid for the last twenty sales of capital.

Total Utility by Group: Bar chart displaying the total utility by user group. The user group is sorted by both household utility group and the product you produce. The bar chart labels the maximum total utility value and median* total utility value for each user group.

Current utility (user's group): Bar chart showing the rank of your current utility compared to all other households in your user group. The user group is sorted by both household utility group and the product you produce. This graph shows how your current utility ranks compared to other similar households who also happen to produce the same good as you do.

Total utility (user's group): Bar chart showing the rank of your total utility (current utility added to past utility from previous periods) compared to all other households in your user group. The user group is sorted by both household utility group and the product you produce. This graph shows how your total utility ranks compared to other similar households, who also happen to produce the same good as you do.

Profit by industry, Previous period: Bar chart displaying the profit (previous period) by industry. The maximum profit value and median profit value for each industry group are labeled in the chart.

Firm Net Worth (user's industry group): Bar chart displaying the rank of your firm's net worth (defined as cash + value of inventory + value of capital stock + present discounted value of bonds) compared to all other firms in your industry group.

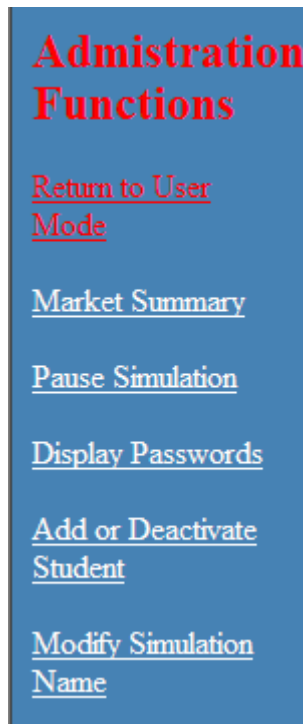
Firm Net Worth by industry: Bar chart displaying the net worth (defined as cash + value of inventory + value of capital stock + present discounted value of bonds) by industry. The maximum net worth value and median net worth value for each industry group are labeled in the chart.

*: The median is the middle value in a set of numbers. For example, in the set of numbers: 10, 9, 8, 3, 3, the median value is 8.

Administrator Functions:

As the administrator, you will have access to the administrator functions. The last three options are not available in the simultaneous play version. Market Summary will give you summary statistics on the labor market, output market, capital market, bond market, utility and profit statistics, and student records. The Market Summary section includes information on hours worked, wages, output produced, output sold, prices of output, purchases of capital, student log-ins, utility, and net worth. You can also view the records of individual students and the functions assigned to the different attribute groups from this section.

The market summary will not be available once you log out. You may want to copy this information and paste it into a spreadsheet to use in a class discussion of the simulation.



End Periods:

You change the period by clicking on the end period button on the left-hand navigation bar. As the administrator, you are the only one who has access to this tool.

Assigning Points

Assign Points will appear as an option in the Administrator functions once the game has ended. Since students will want to know how they will be graded, we suggest that you determine how the points will be assigned before you start the simulation. You can then tell your students how many points they will be given for participation and performance.

The number of participation points per period ranges from 1 to 10. The number of periods will equal the number of periods that you selected when you set up the simulation. A student will be given participation points if they were active either as a consumer or as a firm. They will either earn either zero points or the number of points you specify. If they do not meet the minimum requirements, they earn zero points. If they meet or exceed the minimum requirements, they earn the

number of points that you specified. The total number of participation points is the sum of the number of points they earn per period. You want to make it clear that participation points do not depend on the intensity of use.

Participants earn performance points from their actions as a consumer and as a firm. You need to determine the total number of performance points from each activity. Performance points for a consumer depend on the consumer's lifetime utility. For a firm performance points are based on the firm's net worth. Points range from 1 to 50. You also need to determine the number of periods in which they must participate before they can earn performance points. The number of periods ranges from 1 to the number of periods in the simulation. We would not suggest requiring participation in each period. Students may have legitimate reasons for not being able to participate each period. We would suggest participation in more than half of the periods to earn performance points. You will also need to select the number from each group earning the maximum number of performance points. This will depend on the number of participants in each group. You may want to give the top 10 – 15% of the students, the maximum number of performance points.

The performance points a student receives as a consumer will be calculated relative to the utility levels achieved by other participants in the same consumer and firm attribute groups. The comparison value is the utility level of the last person to receive the maximum number of performance points. For example assume that there are 20 students in the group and you have decided that the top three students will get the maximum performance points. Let's assume that the maximum number of points is 8. The three highest utility values are 85, 84.5, and 83. If a student never participated in the simulation, they would have received a total utility of 20. (This will be determined by their utility function.) For a student who received a total utility of 75, their performance points would be calculated as:

$$(75 - 20) / (83 - 20) * 8 = 6.7 \text{ points.}$$

When students view their utility level relative to other members in their consumer attribute group, that doesn't necessarily tell them what their actual ranking is. The consumers will have firms that can produce different goods. Since profit levels from industry to industry will vary, the dividends transferred back to the household will differ. The performance points that a student earns for utility will therefore depend on where they rank relative to other participants with the same utility function and who produce the same good.

You want to emphasize to students that their performance points are assigned relative to the consumer and industry groups they belong to. They are only competing against students with the same characteristics.

Performance points for the firm are based on the firm's net value. The net value of the firm will include the value of the firm's cash, inventory, and capital stock.

Students are rewarded for their firm's net value as a way of giving credit for assets held by players at the end of the game. The points assigned should be equivalent to the performance points for utility divided by the number of periods.

The figure below shows the screen for assigning points. After you have set the values for participation and performance points and clicked the "Calculate Points for Adam's Market", a table with the scores for all students will be displayed. You should copy the table and paste it into a spreadsheet for use in grading.

Adam's Market

Participation Points

Participation Points per Period:	2
Number of Periods:	0
Total Number of Participation Points:	0

Consumer Performance Points

Total number of performance points:	8
Minimum Periods Participating to Receive Performance Points	
Group	Number Receiving Maximum Points
Consumer Group	Initial Industry Group
Students in Group	

Firm Performance Points

Total number of performance points:	8
Minimum Periods Participating to Receive Performance Points	
Group	Students in Group
	Number Receiving Maximum Points

Strategy Tips for Students:

Short-run (no capital purchases, no industry switching and no bonds)

1. After they determine the optimal amount of labor to hire, they should not hire all the labor at once. Wages may fall or prices may change and they may want to adjust their strategy.

2. When a student is trying to find the optimal amount to produce they should vary the wage and output prices to determine how sensitive their decision is to changes in wages and prices. Typically, prices will fall during the period.
3. Warn students not to wait too long before hiring labor and making offers to sell. In order for other people to buy their product, they need to sell their labor. If they wait too long to hire labor and offer output, they may not be able to sell all of the output before the period ends.
4. Talk with students about whether it would be good to be first in the market or last. Who is going to get to set the price, and why?
5. Students should be encouraged to offer the product for sale in units that consumers can purchase. When students first start playing the game, they tend to offer all of the units they produce in one lump-sum. Consumers will usually not have enough cash to purchase such large amounts of a good. The number of units they should offer for sale will depend upon a number of factors. These include the price of the product, the other offers, whether households start with any non-labor income and after the first period whether dividends have been transferred back to consumers. Students can compete with other offers on the basis of price and quantity that they offer. They need to think about both variables before making offers. The actions they take as a firm should be guided by what they would like to see as a consumer. If as a consumer they want to buy products in increments of 5, then as a firm they should be offering increments of about 5. Students may want to try offering different quantities to determine how many units consumers want to purchase at once. Students should also be reminded that consumers' preferences may change during the game. At first consumers may be cautious about how many units they purchase, but as the game progresses and especially if the price stabilizes consumers may want to purchase larger quantities. Also the amounts that participants will be able to purchase will depend on the amount of cash they have. Larger quantities may be more attractive as participants sell their labor and transfer dividends from their firm to their household.
6. Caution students to be careful about distributing dividends to themselves as consumers. Once the dividend is transferred to their household, it can't be transferred back. The firm may need this cash in the future to purchase additional units of capital or labor. The student has to determine the best strategy in terms of distributing dividends. If dividends are distributed back to the household each period, their utility will increase because they can purchase more goods and work less. It also gives the consumer the advantage of being able to smooth their consumption over time and increase their lifetime utility. But, if the price of capital and labor increase

- and the student has distributed all the dividends back to their household, they are not going to be able to buy additional inputs and produce additional output.
7. Students are sometimes reluctant to distribute dividends to their household because it reduces their net worth as a firm. Stress to them that there are more performance points for utility than net worth. So if they are able to raise their utility by a substantial amount by transferring dividends, they are probably better off following that strategy.
 8. If you are going to allow your students to switch industries later in the game, advise them to pay attention to the prices in the other industries, the amounts being sold, and the profits in that industry. They need to be aware of the profit level in their industry relative to the profit in the other industries.
 9. In order to sell their firm's output, they may want to offer the product for a lower price than the lowest offer. But advise students that they don't have to lower the price by much. Or it may be that the other offers are for quantities that are too large. They could try a strategy of offering the product at the same price (or maybe even a little higher) but selling fewer units.
 10. Explain the rate at which capital depreciates. They will need to keep this in mind when they are able to purchase capital later in the game. If you are not going to allow for capital purchases, then students may want to produce more at the beginning of the game before capital depreciates. They can keep the stock in inventory and sell it late in the game. This is risky, however, since they don't know what will happen to prices over the course of the game.

Teaching Strategies:

Topics that can be discussed using the simulation:

- circular flow
- utility maximization with money
- labor supply
- profit-maximizing level of output in the short un
- profit-maximizing level of employment, short run
- profit-maximizing level of capital
- depreciation
- entry and exit
- bonds

To demonstrate most of these concepts you will need to have a simulation set up. You could ask three people to register for a simulation and then start it in class.

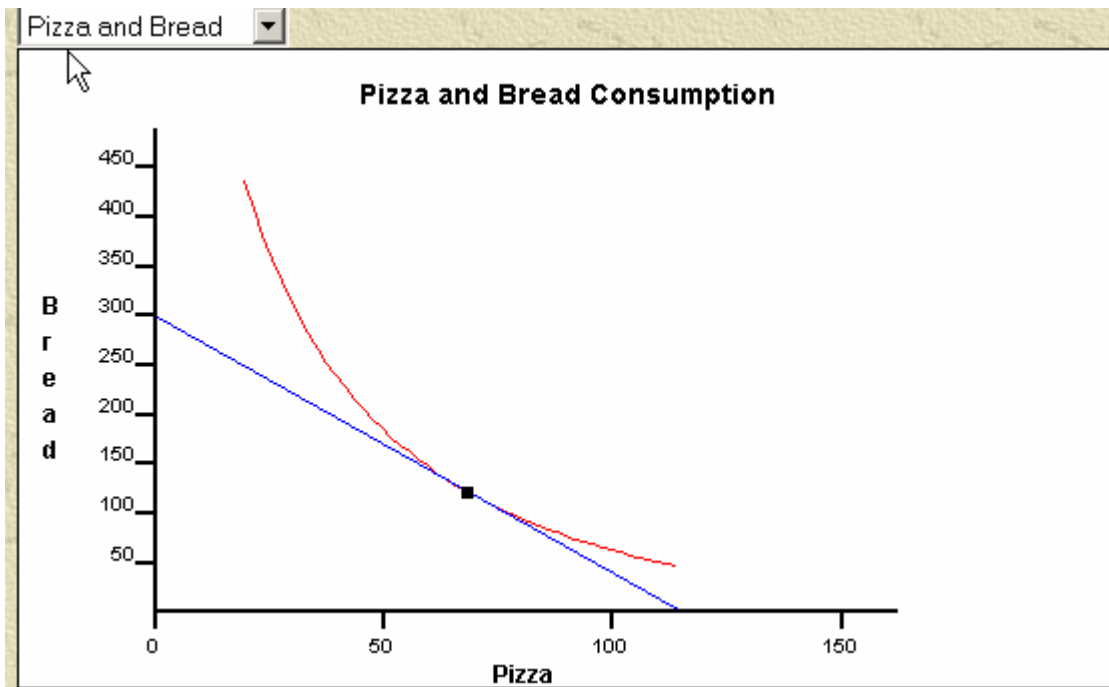
Circular Flow:

The simulation can be used to explain the concept of circular flow. As a consumer, the student will supply labor to firms through the resource market and receive wage payments from the firms. They will then use this money to purchase goods from the firms through the product markets. Firms can also buy capital through the resource markets. After the resources are purchased, output will be produced which is sold through the product markets. Participants can transfer dividends from their firm back to their household. This will enable households to use both investment income and wage income to purchase goods.

If students transfer dividends back to their household and they use this income to buy additional goods their utility will increase. To demonstrate this to students set prices and the wage rate in the set prices box.

Set Prices		Prices, last five purchases:				
Prices						
Milk	<input type="text" value="2"/>	N/A	N/A	N/A	N/A	N/A
Bread	<input type="text" value="3"/>	N/A	N/A	N/A	N/A	N/A
Wage Rate:	<input type="text" value="5"/>	N/A	N/A	N/A	N/A	N/A

Then adjust the number of hours of leisure and the percentages spent on each good to find the utility maximizing combination. Record this information and show them the budget constraint by clicking on Budget Line, Indifference Curve graph. Select the graph for the two goods. A graph such as this will be displayed:

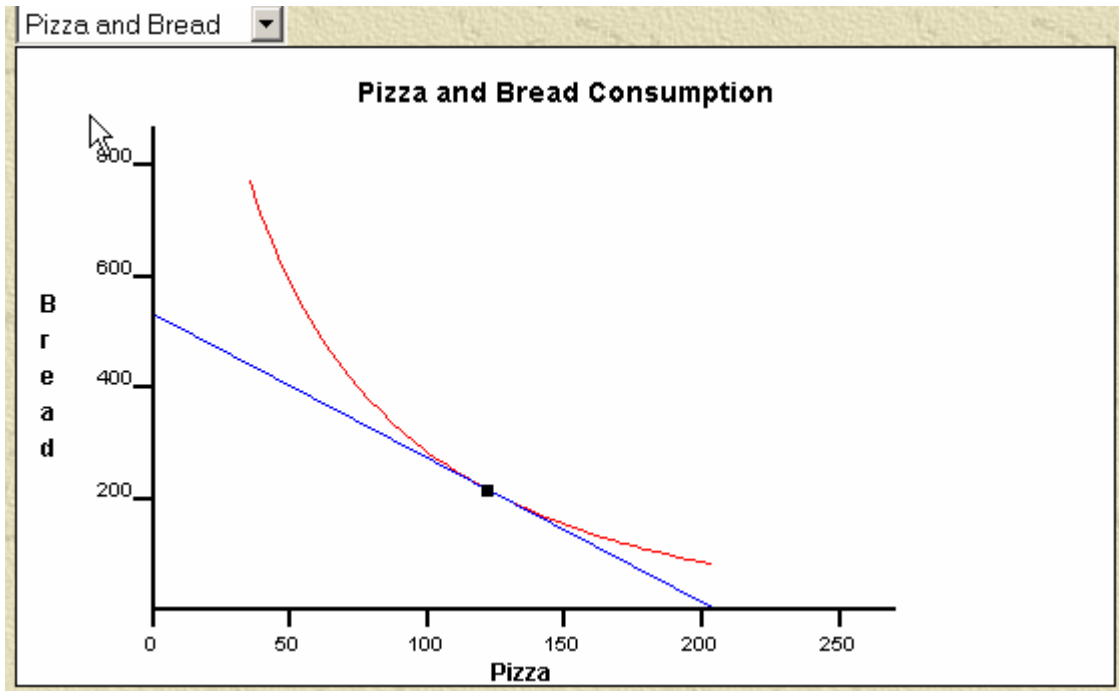


Even if you don't teach indifference curves you can still use this graph to demonstrate the budget line.

Keeping the same wage and prices of the goods, enter in a negative amount of savings. This amount equals the dividends they can spend.

Net Savings: (Type a positive number if you want to add to your savings, a negative number if you want to spend out of your savings.)

Now find the new utility maximizing combination. Stress to students that they may maximize utility by working fewer hours once they have savings to spend. Graph the new budget line.



You can compare the original budget line and new budget line to show them how their consumption possibilities have changed.

Discuss what would happen in the economy if none of the dividends were transferred back to households.

Utility Maximization with money:

One of the student's goal is to maximize utility the utility of their consumer. The performance points that they are given are based on total lifetime utility. They will be evaluated only against other students with the same two attribute groups – consumption and production.

For a student to determine the optimal combination of leisure and the two goods, they should use the Consumer Worksheet Page. On this page they can enter different values for the wage, and the prices of the two goods, net savings, and alter the allocation of their time till they find the optimal combination.

Set Prices

Prices		Prices, last five purchases:				
Milk	<input type="text" value="2"/>	N/A	N/A	N/A	N/A	N/A
Bread	<input type="text" value="3"/>	N/A	N/A	N/A	N/A	N/A
Wage Rate:	<input type="text" value="5"/>	N/A	N/A	N/A	N/A	N/A

Consumption Options

Leisure 95 hours, Work 5 hours ▲	5% of Expenditures For Milk, 95% For Bread ▲
Leisure 90 hours, Work 10 hours □	10% of Expenditures For Milk, 90% For Bread □
Leisure 85 hours, Work 15 hours	15% of Expenditures For Milk, 85% For Bread
Leisure 80 hours, Work 20 hours ▼	20% of Expenditures For Milk, 80% For Bread
Leisure 75 hours, Work 25 hours ▼	25% of Expenditures For Milk, 75% For Bread ▼

Net Savings: (Type a positive number if you want to add to your savings, a negative number if you want to spend out of your savings.)

	Milk	Bread	Leisure
Units Consumed	9.38	18.75	85.00
Expenditures	\$18.75	\$56.25	
MU	0.20	0.07	0.03
MU/P	0.10	0.02	0.00
Wage Income: \$75.00	Expenditures: \$75.00	Utility: 1180.50	

The easiest way to use this table is to first find the combination of leisure and work that yields the highest utility and then to change the percentage of expenditures on each good until the highest utility level is obtained. They are trying to find that combination that equalizes the MU/P for all goods.

Clicking on the budget line, indifference curve graph will give the students the budget line and indifference curve associated with the utility maximization combination.

By clicking on store target values, this information can be saved and referred to later.

Remind students that their utility values calculated are calculated on the basis that all hours are sold at the same wage rate and all units of the goods are purchased at the prices specified. This will probably not be the case unless they make all of their purchases at the same time. Since prices will vary over time, the actual utility the student achieves may be either higher or lower than what is calculated in the table.

You may want to suggest to students that they try different relative prices so they can determine how sensitive their optimal combination is to the variation in relative prices.

The concept of diminishing marginal utility is critical to the student's decision making. They want to try to maximize lifetime utility. To do this they should spread their consumption relatively equally across all periods. They do not want to accumulate a lot of cash as a household to spend during the last period. They should also transfer dividends to their household throughout the game instead of waiting until the last period.

Oftentimes students are reluctant to transfer dividends because it reduces their firm's net worth. But if they don't transfer dividends it reduces their purchasing power, they buy less, firms sell less and therefore they hire less labor. The transfer of dividends to the household is critical to the functioning of the simulation. That is why we recommend that in your grading, you place much more weight on lifetime utility than on net worth. Remind them of this each period.

You may want to discuss with your students the fact that some consumers do better simply because of luck. They were able to be the first to accept an offer at an unusually low price.

Talk with students about the strategies they employed to try to maximize their utility.

The simulation also provides a good opportunity to discuss how uncertainty affects decision making as a consumer. Why is it problematic not knowing how prices and wage rates will change over time? Did students develop strategies to deal with the problem of uncertainty?

Demand, Price Elasticity and Income Elasticity:

The simulation is a good way to discuss demand and the responsiveness to price changes, expectations of price change, and changes in income. You can use the simulation to trace out a demand curve. On the consumer worksheet page, set values for each price, the wage rate, and net saving and find the utility maximizing combination. Record the number of units of one of the goods purchased. Now change the price of that good. Keeping the number of hours worked constant (so that income stays the same), find the highest utility possible at that level of income and price combination. Record the quantity of the good consumed. Repeat this at least twice. You can use these price and output combinations to plot a demand curve. You can also use this information to calculate values for price elasticity of demand.

If in your class you teach budget lines and indifference curves you can use the information from the simulation to derive the demand curve from the budget lines and indifference curves. For each price of the good, draw the budget line and indifference curve that maximizes utility given the relevant constraints and trace out how the amount of the good purchased changes as the price changes.

If you don't have that much class time to devote to reviewing demand, you can still discuss with students how they responded when prices changed. How did they respond when prices were different from what they expected or if prices were above what they were in previous periods? How did their expectations change over the course of the simulation? What information did they use to formulate their expectations? If the price of one good they bought fell relative to the price of the other good, how did they respond? Did this affect their utility-maximizing decision?

Discuss with the students how their behavior changed as they are able to transfer dividend income to their household. What happened to their utility-maximizing combination of goods as non-labor income increased? As their non-labor income increased, did this reduce their price sensitivity?

Labor Supply:

The student will have to determine the optimal allocation of time between labor and leisure. To illustrate the relationship between the wage rate and the number of hours a participant will work, on the Consumer Worksheet fill in prices for the two goods and pick a very low wage rate (\$1). To simplify matters initially keep net saving at \$0. Identify the number of hours worked to maximize utility. Then raise the wage rate (\$5) and record the number of hours worked to maximize utility. Raise the wage rate once again (\$10) and record the number of hours worked to maximize utility. By plotting these numbers, you can trace out a labor supply curve.

You can discuss the relationship between the wage rate and an individual's willingness to work. You can also examine what happens to a consumer's utility level when the wage rate increases and the other prices remain constant.

To discuss the effects of nonlabor income on labor supply, select an initial set of prices and a wage rate. Set the value for net saving at 0 and then record the utility maximizing amount of labor and leisure. Keep the prices and wage rate constant and reduce the amount of net saving. To quickly illustrate the point, use large changes in net saving (0, -500, -1000, -2000, etc.). You can use this information to discuss the pure income effect of an increase in nonlabor income.

Labor Market:

In the simulation participants are only competing on the basis of the wage they are willing to work for and the number of hours they are willing to work. Use this to discuss the characteristics of a perfectly competitive labor market.

Discuss why wage rates might vary during the simulation. As the simulation ends, would you expect wage rates to increase or decrease? Either may occur. If participants have already sold all the labor they wanted to, they may be willing to offer more hours at higher wages. If participants could not sell all the labor they wanted they may reduce the wage at which they are willing to work. The wage rate will also be affected by firm behavior. If firms have a large amount of inventory, they may only be willing to hire labor if the wage rate is very low. Alternatively, if their inventory is low, they may be willing to pay high wage rates.

Use the simulation to discuss why some wage offers are never accepted. Discuss the kind of signal that this sends.

Profit-Maximizing level of output, short run:

Emphasize the following points to students:

1. Explain to students that fixed costs are zero and therefore $TR - TVC$, measures profit.
2. When they use the worksheet to calculate profit, the profit is calculated on the basis of selling all output at the price selected and hiring all labor at the wage specified. If they have to sell at a lower price and/or hire labor at a higher wage, their profit will be lowered.

Strategy Tip for profit maximization:

You may want to suggest to students that they determine whether or not to hire additional labor by selecting a wage offer and clicking on accept offer. A box will be displayed that identifies the amount of additional output produced and the cost of hiring the labor.

The student can then use this information to calculate the additional revenue from hiring the additional labor. For example if output is currently selling at \$5 a unit, the student's firm could earn \$66.10 from selling all the output and the cost would be \$50.20. If the output actually is sold at \$5, the student will make an additional profit of \$15.90. This approach allows the student to analyze each marginal employment decision they make. You should advise students to be conservative about the output price they select. If prices fall to \$3, this student will not cover their labor costs. So, they need to be realistic when they are making their decision.

Discussion Ideas:

You can use the simulation to explain how firms determine how much labor to hire and what output level to produce to maximize profit. The tables on the worksheet page allow students to experiment with different wage rate and price combinations to determine how to maximize profit. To show students how to use this information, enter in the amount of capital currently in stock and values for the wage rate and output price. Stress to students that when they do this they will need to select realistic values for wage and output price. Show them the resulting table. Use the table to reinforce the relationship between MR and MC. When MR is greater than MC, profit is rising and when MR is less than MC, profit is falling.

Set Capital, Wage, and Price

Capital Stock: Wage Rate: Output Price:

Output, Costs and Revenues With Different Amounts of Labor

Labor	Output	TR	VC	AVC	MC	MR	TR-VC
48.00	151.00	1026.78	432.00	2.86	5.63	6.80	594.78
51.00	155.64	1058.38	459.00	2.95	5.81	6.80	599.38
54.00	160.16	1089.06	486.00	3.03	5.98	6.80	603.06
57.00	164.54	1118.90	513.00	3.12	6.15	6.80	605.90
60.00	168.82	1147.97	540.00	3.20	6.32	6.80	607.97
63.00	172.99	1176.32	567.00	3.28	6.48	6.80	609.32
66.00	177.06	1204.00	594.00	3.35	6.63	6.80	610.00
69.00	181.04	1231.06	621.00	3.43	6.79	6.80	610.06
72.00	184.93	1257.54	648.00	3.50	6.93	6.80	609.54
75.00	188.75	1283.47	675.00	3.58	7.08	6.80	608.47

You can also discuss this in terms of MRP and the wage rate. In the table below, the student can find that level of labor that maximizes profit. Reinforce the concept that the firm can approach the profit-maximizing decision by first determining the output level at which $MC = MR$ and then determining employment or by finding the level of labor where $MRP = \text{wage}$ and determining the output to produce.

Labor	Output	MP	MR	MRP	Wage	TR-VC
48.00	151.00	1.60	6.80	10.87	9.00	594.78
51.00	155.64	1.55	6.80	10.53	9.00	599.38
54.00	160.16	1.50	6.80	10.23	9.00	603.06
57.00	164.54	1.46	6.80	9.95	9.00	605.90
60.00	168.82	1.42	6.80	9.69	9.00	607.97
63.00	172.99	1.39	6.80	9.45	9.00	609.32
66.00	177.06	1.36	6.80	9.23	9.00	610.00
69.00	181.04	1.33	6.80	9.02	9.00	610.06
72.00	184.93	1.30	6.80	8.83	9.00	609.54
75.00	188.75	1.27	6.80	8.64	9.00	608.47

You can also use this table to review the concept of diminishing marginal productivity and the calculation of MRP. You can also reinforce the concept that when price is constant price and MR are equal.

Again caution students that their actual profit level may differ from the one shown in the table if they can't buy all their labor at the wage they specified or sell all their output at the price specified.

To show students how a firm's decision making will change in response to changing output prices and wage rates, record the firm's original decision. Ask students how they think the firm will respond if the output price stays the same, but the wage rate rises. (Make the change in the wage rate large enough so that the change in the firm's decision is noticeable.) Then enter the new value for the wage rate and find the new profit-maximizing level of output.

Record the original wage, level of capital and output price. Now ask students how they think the firm will respond if the wage rate remains the same, but the output price increases.

You can also use the simulation to show the product and cost curve graphs. Although, the AVC, and MC cost curves will not have the standard U-shape.

Use the simulation to discuss why some offers of the product are never accepted. Discuss the kind of signal that this sends. Ask students how long they waited before revising their offers.

Ask students whether or not they chose to collude with other producers of their product to set price and output. If they did, discuss why they did. If they didn't, discuss why collusion didn't occur. Ask the students what would have made collusion more likely to occur?

Use the simulation to explain that in this market firms are only competing on the basis of price and the number of units offered for sale. There are no quality or location advantages of firms.

The simulation can be used to discuss how firms make decisions under the condition of uncertainty. Discuss how their actions would have been different had they known for certain what the values for output price and the wage would have been during the simulation.

Capital Investment:

Tips on finding the optimal level of investment:

If your game set-up allows students to purchase capital, emphasize that the capital they purchase is not available until next period. Recommend that they start investigating the impact of purchasing capital the period before they actually can. To show the effects of adding capital use the Firm's Worksheet page. Enter values for the amount of capital, output price, and wage rate.

Click on calculate revenues, cost and profits. Use the second table displayed and isolate a level of labor and record the output produced. (Use at least 12 units of labor. As you increase capital, the lowest labor level displayed in the table keeps increasing.)

Labor	Output	MP	MR	MRP	Wage	TR-VC
6.00	56.12	9.35	5.00	46.77	5.00	250.62
12.00	79.37	3.87	5.00	19.37	5.00	336.86
18.00	97.21	2.97	5.00	14.87	5.00	396.06
24.00	112.25	2.51	5.00	12.53	5.00	441.25
30.00	125.50	2.21	5.00	11.04	5.00	477.50
36.00	137.48	2.00	5.00	9.98	5.00	507.39
42.00	148.49	1.84	5.00	9.18	5.00	532.46
48.00	158.75	1.71	5.00	8.54	5.00	553.73
54.00	168.37	1.60	5.00	8.02	5.00	571.87
60.00	177.48	1.52	5.00	7.59	5.00	587.41

Change the level of capital keeping everything else constant. Record the new output level. Repeat the process a few times. You can trace out the MP of capital by using this approach.

Discussion ideas:

Discuss the costs of adding capital. The firm's cash will be reduced. The value of capital will be included in net worth. Remind students to keep enough cash in the firm so that they can purchase capital. The benefit of buying capital is that they can produce more output with the same amount of labor and therefore increase their revenue.

Again, the firm has to deal with uncertainty. They will need to decide how much capital to buy based on what they expect the price of the output to be and how many units they think they can sell.

Once capital purchases are allowed in the simulation the student can use another tool to analyze the impact of buying capital. On the Firm Worksheet page, the student can use the Revenue and Costs from additional capital. In this box, they can select an additional amount of capital, levels of labor, the output price, and the depreciation rate. Initially, I would recommend keeping the discount rate at 0 and tell students to ignore the last column in the table for now.

Revenues and Costs from Additional Capital

Current Capital Stock: 33.72 Depreciation Rate: 0.05
 Capital Purchased: Labor per Period:
 Output Price: Discount Rate:

Period	Units of Capital, No New Capital	Units of Capital With New Capital	Change in Output	Change in Revenue	PV Change in Revenue
5	32.03	34.03	9.53	76.25	76.25
6	30.43	32.33	9.29	74.32	74.32
Present Value of Additional Revenues:					150.57
Cost of Additional Capital:					62.52
Net Present Value:					88.05

This table will tell the student how much output can be produced in the remaining periods if capital is purchased. The additional output in latter periods is reduced because of the depreciation rate. The change in output is dependent on the amount of labor selected. The change in revenue is dependent on the amount of labor selected and the output price. The student can now compare the change in revenue each period to the cost of the capital. Discuss the rule for investing in additional capital that you are using in class and show them how to apply it to this table. Emphasize that the costs occur in one period and that the benefits accrue in successive periods.

If you use the concept of present value in your class, you can select a value for the discount rate and show students how the present value of the change in revenue in latter periods differs from the change in revenue.

You may want to suggest to students that they be conservative in their choice of output price. If the price falls below what they expected, they may have purchased too much capital.

Discuss strategies for when to buy capital. Should they buy all their capital as soon as capital purchases are available? Should they spread out their capital purchases? Have students discuss the strategies they used and how they would have changed their strategy if they had had additional information such as the actual output price, wage rate, and capital prices over the course of the simulation.

Discuss what should happen to output prices as investment in capital takes place. Examine whether or not output prices fell as capital investment took place. You can use the price statistics from the market summary to see what happened to output prices.

Discuss whether there were different levels of investment in the different industries. Was there more investment in the more profitable industries? The market summary statistics will allow you to determine how much capital was purchased in each industry.

You can again use the simulation to talk about uncertainty. Students will have to make decisions about how much capital to buy not knowing what the output price will be or how much output they can sell.

Depreciation:

Discussion idea:

Discuss how the firm's productivity is affected by depreciation. Discuss what will happen to output prices if capital depreciates and firms don't add additional capital.

Entry and Exit:

Deciding whether to switch industries:

If your game set-up allows for entry and exit, remind them of the penalties of switching – the amount of capital they will lose and that none of their inventory will carry over. They need to keep this in mind as they make decisions. They don't want to produce more than they can sell if they plan on switching industries because they will lose the value of their inventory.

Ask students what information they would need to determine if they should switch industries. Remind them to look at the prices of the other products and the profit of the other industries. They can see the profit from the Functions and Graphs page and by clicking on profit by industry previous period.

Based on this information, students may want to enter the milk industry. They may also want to check production and inventory levels in all the industries.

Students will have to make this decision under uncertainty. They will not know how many firms are going to switch. You can find out how many students switched industries from the market summary page.

Discussion ideas:

Ask students how they made their decisions. How did their aversion to risk factor into their decision? How did their expectations about a “reasonable” level of profit affect their decision? What information would they have needed to definitely decide to switch industries?

Discuss what should happen to prices after firms can switch industries. Did prices change in the expected directions? How might inventories keep prices from adjusting as expected?

Bonds**Tips on using the bond market:**

In the simulation you can allow firms to issue bonds to raise money to purchase capital. Households can purchase bonds as a way of investing. When a firm issues a bond they will have to identify when the bond matures, the asking price, and the face value. Remind students that the asking price should be less than the face value. By clicking on the calculate yield, they can determine the yield on the bond. Remind students that they will have to be able to pay off the bond at the maturity date. They need to make sure that they have the cash available to do this.

You can illustrate how the yield on the bond is affected by keeping the asking price and face value the same but by changing the maturity date. Or you can keep the maturity date and asking price constant and change the face value.

Households can buy bonds. Remind students that they want to consider not only the yield, but also the maturity date. They want to be able to spread their consumption over time so they don't want all the bonds to come due in the same period. Discuss with students why they decided to buy and sell bonds.

Concluding Discussion:

Ask students to discuss the strategies that they used. How did they decide how much labor to hire or how much output to produce? How did they decide what price to charge? How did they decide what wage rate to offer? What might have caused them to change their minds about these variables?