Appendix B: Instructions

General:

This is an experiment in the economics of market decision making. If you follow the instructions carefully and make good decisions, you may earn a considerable amount of money. The currency in these markets is francs. All francs will be converted to dollars at the end of the experiment, at a rate of _____ francs = 1 U.S. dollar. This will be paid to you privately, in cash.

This experiment will consist of computerized markets for the trade of two goods: X and Y.

The Excel spreadsheet on one of your computers has sheet tabs labeled "Main" and "Per 0", "Per 1", etc. You will enter information during the experiment on these pages to calculate and keep track of your earnings. You will earn money trading units of X and Y, and producing and redeeming units of X.

Your Excel spreadsheet describes the value to you of any decisions you might make. You are not to reveal this information to anyone. It is your own private information, and it is not necessarily the same as that of anyone else.

This experiment will consist of a number of periods during which the markets are open. Each period will last ___ minutes.

Market Organization:

There are two types markets in this experiment, a market for X and many markets for Y.

You may trade in any and all markets. It is your decision.

The markets are organized the same way. You should be familiar with how buy orders and sell orders are placed in the computerized market.

All markets will be open for the same length of time. All markets will open simultaneously.

Earnings:

You earn money by a balance of your income and costs. Your income is from three sources. The importance of these sources of income differ from participant to participant. You must determine for yourself which is important for you.

1. One source of income is the redemption of units of X. This can be thought of as selling units of X to the experimenter according to predetermined terms. The section entitled "Redeemed Value of X" on the "Per 0" worksheet on your computer lists the number of francs for which you may redeem each unit of X. The units are redeemed at the end of the period.

2. Another source of income is to sell X and Y from your inventory to other participants. As long as your income from sales exceeds the cost of these units to you, such sales are a source

of earnings. As explained below, you will need to use Y as an "input" in order to produce the "output" X.

3. In some cases you may make profits by buying and selling units of X and Y. Such "trading profits" are also yours to keep.

Against your income you must subtract your costs, which will be explained in the next section. In sum your earnings may be broken into the following components:

Earnings   =   Total Redemption Values of X
               + Total Sales Revenue of X
               + Total Sales Revenue of Y
               - Total Prices Paid for X
               - Total Production Costs
               - Total Prices Paid for Y
               - Total Fines Incurred

Costs:

To produce X, all of you must pay the production technology costs indicated at the top of your "Per 0" worksheet. These costs may be different for each participant in the experiment. Everyone can produce 0, 1, 2, 3, or 4 units of X. Additionally, everyone must have exactly one unit of Y to produce each unit of X. It may be helpful to think of Y as tickets (or "inputs") that are being exchanged after the end of the period with the experimenter in order to produce X. For example, if you hold 3 units of Y at the end of the period then you produce 3 units of X. Note, therefore, that your total cost of each unit of X is given by your production technology costs **plus** the costs needed to obtain each unit of Y.

Accounting:

A note on accounting is important. Your computerized accounts contain 4 units of X at the start of the period. This is the most X any one participant could produce, so we have placed these units in your inventory to make the computer transactions fast. However, some of you may frequently produce less than 4 units of X. Be sure to keep track of the actual amount of X that you produce (which depends directly on the amount of Y that you hold), so that you do not sell more X than you *actually* produce. If you ever sell more X than you actually produce, you have overused the quantity of X in your account. In this case you will be fined at a rate of 100 francs per unit of X that is sold and not paid for. These fines are indicated on the Redeemed Value of X table on your "Per 0" worksheet. Also, some of you start the period with very little cash. Don't worry about this—your cash on hand can become negative, but usually your total earnings will be positive because you will be able to redeem units of X at the end of the period.

You will fill in 3 blanks on your Excel record sheet each period you record your profits at the end of the period. The places where you enter information are highlighted in Yellow. We will now go through an example that should help you better understand your record sheet.

Example (go to the Example tab on your Excel spreadsheet):

1. Suppose that you began the period with 1 unit of Y. Suppose further that you bought 2 additional units of Y at a price of 150 (for the first unit of Y) and 200 (for the second unit of Y), for total Y expenditures of 150+200=350. Record the total units of Y held at the end of the period (3) in line 1 of your Inventory and Production Table.

2. How much X can you produce? Look at your Production Technology table. You have 3 units of Y, so you can produce 3 units of X. This is automatically calculated below your entry on line 1, and the total production costs for 3 units of X produced (700) are automatically calculated from your Production Technology table and entered on line 7 near the bottom of this worksheet.

3. Suppose that your computer inventory of X began at 4 units, and that you sold one unit of X in exchange for 400 francs. Your computer inventory would go down to 3, and your Cash on Hand would go up by 400. Enter the X inventory of 3 in line 2. In the experiment, you will read this X inventory figure off your computer.

4. The remaining lines in your Inventory and Production table adjust your computerized final inventory (which was entered on line 2) because you actually produced 3 (shown on line 1) rather than the 4 that we automatically started you out at. We start everyone out at 4, which is the maximum amount of X that anyone can produce. Many of you may not actually produce 4 in many periods, so your worksheet will automatically make this adjustment. Another way of summarizing this: You actually produced 3 and you sold 1, so you are left with 2. That is why 2 units of X are shown on the bottom of your Inventory and Production table.

5. As we just calculated, you have 2 units left that you did not sell. You will redeem these according to your Redeemed Value of X table. Notice that your first unit of X was worth 950 to you, and your second unit of X was worth 850 to you. This total (950+850=1800) is the total francs you get for redeeming these 2 units of X. This total is shown in the Total Francs column of the Redeemed Value of X table, and your computer automatically transfers this figure down to line 5 in the Earnings Calculations table at the bottom of your worksheet.

6. What is your Cash on Hand after you have completed your trading? During the experiment, this will be easy to read from the upper right corner of your computer screen. We can look back at the earlier steps of this example to see how your trading affected your cash. You began the period with 200 francs in cash (see the upper right portion of the example worksheet). In step 1 above we noted that you spent 350 on 2 units of Y. In step 3 above we noted that you sold one unit of X for 400. Your sales proceeds (400) minus your expenditures (350) = 50 is your change in cash from trading. So your starting francs (200) have increased by 50. Write 250 in line 6.

7. Your computer now has calculated your total profits for the period by adding lines 5 and 6 and subtracting line 7: 1800+250-700=1350. If this were a real period, your computer would automatically copy this onto your Main Earnings Page, denoted "Main" on your spreadsheet.

Frequently Asked Questions:

Q: I ended the period with 5 units of Y, but my Production Technology table indicates that I can only produce 4 units of X. Why can't I make a 5th unit of X?

A: Those are the rules. Nobody can produce more than 4 units of X, so it is unwise to hold more than 4 units of Y at the end of the period.

Q: Why would I want to sell any X, since I can redeem X for money?

A: Sometimes you might be able to sell units of X at prices higher than what you can redeem them for. For example, suppose you bought enough Y to produce 4 units of X, and that you get 650 Francs for the 4th unit of X. (This is the number in the Francs for Each column of your Redeemed Value of X table in the example record sheet we just worked through.) If you can sell this 4th unit of X for a price greater than 650, you earn more francs by selling it than by redeeming it. Maybe you should even sell another, if you can get a price greater than the 3rd unit of X redemption value (which is 750 in the example record sheet).

Q: Why would I buy X from someone else rather than produce it on my own?

A: Because it may be cheaper for you to buy it from someone else rather than produce your own, or because you are producing at capacity (4 units) and you want to redeem a 5th, 6th or even higher number of units. Looking back at the Redeemed Value of X table for the example record sheet, note that the francs value for the 5th unit of X is 600. If you can buy a unit for less than 600, then you earn more money by buying it and then redeeming it. The same goes for additional units you might want to buy.

Q: How can I keep track of how much it costs me to produce an extra unit of X?

A: Your cost of production depends on your Production Technology table and the price of Y. Remember that you need one unit of Y for each unit of X produced, so each additional unit produced has a cost shown in the "Cost for Extra X" column **plus** P_y, where P_y is the price of Y. For example, if Y costs 150, then the extra cost of producing another unit of X in the Example above is 100+150=250 for the first unit of X, 200+150=350 for the second unit of X, etc.

Q: Why are there so many Y markets?

A: We have given participants starting inventory of Y in different Y "markets," but they all count the same when figuring your final Y inventory. You need to add up all the Y column inventory numbers to determine your total holdings of Y.

Q: I don't have any cash on hand. So how can I buy anything?

A: Your cash on hand can become negative, and this is nothing to worry about since you will receive additional earnings from redeeming units of X at the end of the period.

Are there any more questions now? Next we will conduct a practice period to help you get more familiar with trading and record keeping. Then we will begin trading for real money.

Additional Instructions for Remaining Periods
(*Text Shown for the Inspections Treatment in Italics*)

In the final set of periods of this experiment, for those of you who have an inventory of Y at the start of the period, there is a chance that your units of Y "break down" and cannot be used to produce X. If this happens, then whoever holds the units of Y originating in "your" Y market must treat those Y units as 0 when adding up their total final holdings of Y. Either **all** of the Y units in a particular market break down, or **none** of the Y units in a market break down.

Before the period begins, you are able to make an "investment in Y reliability" at a cost. If you pay 20 francs per unit of Y you begin the period with, then there is a **zero** probability that your Y units break down. For example, if you start the period with 3 units of Y, then you can pay 3*20=60 francs to ensure that your three Y units do not break down. You will indicate this choice at the top, right of your Per11 record sheet. Enter 1 for "Yes, invest in Y reliability." The total cost of your reliability investment will be automatically calculated and entered on the new line 8 of the record sheet. You also will submit this decision (whether or not to invest in reliability) on a form before the period begins. Notice that you would pay this cost regardless of what else happens in the period.

Alternatively, you may not wish to pay this reliability investment cost. You would enter 0 for "No, do not invest in Y reliability" on your record sheet to indicate that you do not wish to pay this extra cost. Line 8 will therefore reflect a reliability investment of 0. In this case, there is a **40 percent** (that is, 4 out of 10) chance that **all** of the Y units originating in your Y market break down and cannot be used to produce X. Notice that if you sell some of your Y units during the period, then the person who holds those Y units at the end of the period does not get to count them in her Y inventory for the production of X. We can keep track of who holds the Y units originating in each Y market by noting the market row that each person holds her Y inventory in at the end of the period. This is why we have been using so many different Y markets.

To implement these probabilities, at the end of each period the experimenter will roll a 10-sided die once for each of the Y markets. The sides of this die are marked 0, 1, 2,…, 9. For Y markets where the person with the initial Y inventory made the reliability investment, the Y units do not break down regardless of the die roll. But for Y markets where the person holding the initial Y inventory did not make the reliability investment, all the units of Y in this market break down if a 0, 1, 2 or 3 is rolled. For these markets without the reliability investment, the Y units do not break down if a 4, 5, 6, 7, 8 or 9 is rolled. This is how you know that there is a 4 out of 10 (40 percent) chance that the Y units in a market break down if a person does not invest in reliability.

Also, on your form where you indicate whether you invest in Y reliability, you will check off a box indicating whether you want your investment in Y reliability publicly announced on the whiteboard before the period begins.

Are there any questions before we begin this final set of periods?