ELECTRONIC SUPPLEMENTARY MATERIAL

TWO HEADS ARE LESS BUBBLY THAN ONE: TEAM DECISION-MAKING IN AN EXPERIMENTAL ASSET MARKET

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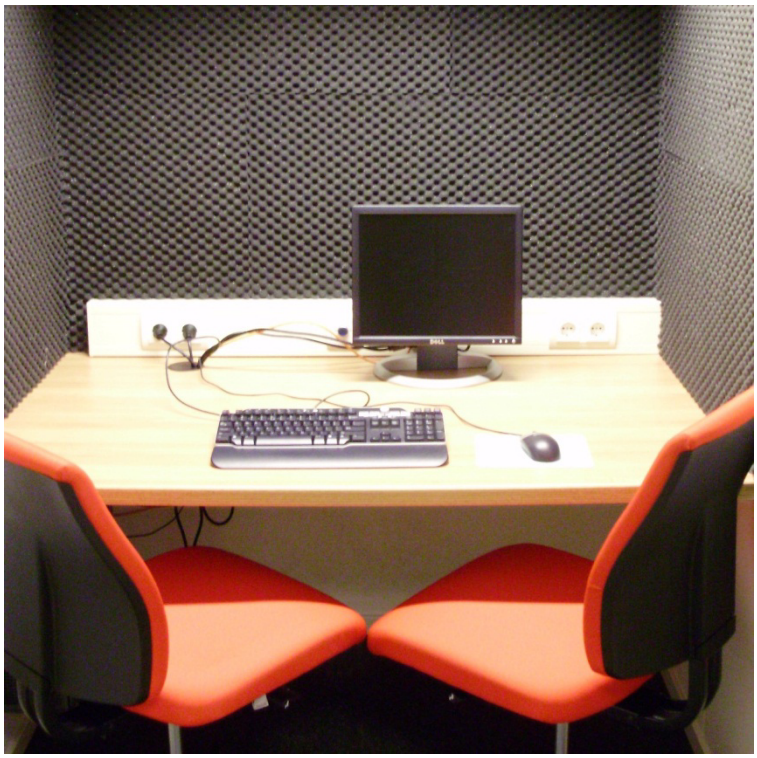
PHOTO OF A CUBICLE IN THE ‘B LAB’



INSTRUCTIONS FOR THE TEAM DOUBLE-AUCTION TREATMENT

1. General Instructions

This is an experiment on decision making in a market. The instructions are simple and if you follow them carefully and make good decisions, you might earn a considerable amount of money, which will be paid to you in cash at the end of the experiment. The experiment consists of a sequence of trading Periods in which you will have the opportunity to buy and sell in a market. The currency used in the market is francs. All trading will be done in terms of francs. The cash payment to you at the end of the experiment will be in euros. The conversion rate is: **100 francs to 1 Euro**.

2. How to use the Computerized Market

In the top right hand corner of the screen you see how much time is left in the current trading Period. The goods that can be bought and sold in the market are called Shares. In the center of your screen you see the number of Shares you currently have and the amount of Money you have available to buy Shares.

If you would like to offer to sell a share, use the text area entitled “Enter offer to sell” in the first column. In that text area you can enter the price at which you are offering to sell a share, and then select “Submit Offer To Sell”. Please do so now. Type in a number in the appropriate space, and then click on the field labeled “Submit Offer To Sell”. You will notice that eighteen numbers, one submitted by each participant, now appear in the second column from the left, entitled “Offers To Sell”. Your offer is listed in blue. Submitting a second offer will replace your previous offer.

The lowest offer-to-sell price will always be on the bottom of that list. You can select an offer by clicking on it. It will then be highlighted. If you select “Buy”, the button at the bottom of this column, you will buy one share for the currently selected sell price. Please purchase a share now by selecting an offer and clicking the “Buy” button. Since each of you had offered to sell a share and attempted to buy a share, if all were successful, you all have the same number of shares you started out with. This is because you bought one share and sold one share. Please note that if you have an offer selected and the offer gets changed, it will become deselected if the offer became worse for you. If the offer gets better, it will remain selected.

When you buy a share, your Money decreases by the price of the purchase. When you sell a share your Money increases by the price of the sale. You may make an offer to buy a unit by selecting “Submit offer to buy.” Please do so now. Type a number in the text area “Enter offer to buy”, then press the red button labeled “Submit Offer To Buy”. You can replace your offer-to-buy by submitting a new offer. You can accept any of the offers-to-buy by selecting the offer and then clicking on the “Sell” button. Please do so now.

In the middle column, labeled “Transaction Prices”, you can see the prices at which Shares have been bought and sold in this period. You will now have about 10 minutes to buy and sell shares. This is a practice period. Your actions in the practice period do not count toward your earnings and do not influence your position later in the experiment. The only goal of the practice period is to master the use of the interface. Please be sure that you have successfully submitted offers to buy and offers to sell. Also be sure that you have accepted buy and sell offers. If you have any questions, please raise your hand and the experimenter will come by and assist you.

3. Specific Instructions for this Experiment

In this experiment you will be randomly paired with a partner, with whom you will be making decisions jointly as a team of two. It is important that both you and your partner agree on each of the decisions you make over the course of the experiment, as they may influence the earnings that you both receive at the conclusion of the experiment. ***At the end of the experiment both you and your partner will each receive the total value of your team's cash balance, converted into Euros at the conversion rate specified at the beginning of these instructions.***

The experiment will consist of 15 trading periods. In each period, there will be a market open for 5 minutes, in which your team may buy and sell shares. Shares are assets with a life of 15 periods, and your team's inventory of shares carries over from one trading period to the next. Your team may receive dividends for each share in its inventory at the end of each of the 15 trading periods.

At the end of each trading period, including period 15, the computer will randomly determine the dividend value for all shares in that period. Each period, each share your team holds at the end of the period:

- earns a dividend of 0 francs for both you and your partner with probability 1/4
- earns a dividend of 8 francs for both you and your partner with probability 1/4
- earns a dividend of 28 francs for both you and your partner with probability 1/4
- earns a dividend of 60 francs for both you and your partner with probability 1/4

Each of the four dividend values is equally likely, thus the average dividend in each period is 24. Dividends are added to your team's cash balance automatically.

After the dividend is paid at the end of period 15, there will be no further earnings possible from shares.

4. Average Holding Value Table

You can use your **AVERAGE HOLDING VALUE TABLE** to help you make decisions. There are 5 columns in the table. The first column, labeled Ending Period, indicates the last trading period of the experiment. The second column, labeled Current Period, indicates the period during which the average holding value is being calculated. The third column gives the number of holding periods from the period in the second column until the end of the experiment. The fourth column, labeled Average Dividend per Period, gives the average amount that the dividend will be in each period for each unit held in your team's inventory. The fifth column, labeled Average Holding Value Per Unit of Inventory, gives the average value for each unit held in your team's inventory from now until the end of the experiment. That is, for each share your team holds for the remainder of the experiment, both you and your partner will each earn on average the amount listed in column 5.

Suppose for example that there are 7 periods remaining. Since the dividend on a Share has a 25% chance of being 0, a 25% chance of being 8, a 25% chance of being 28 and a 25% chance of being 60 in any period, the dividend is on average 24 per period for each Share. If your team holds a Share for the remaining 7 periods, the total dividend for the Share over the 7 periods is on average $7 \times 24 = 168$. Therefore, the total value of holding a Share over the 7 periods is on average 168.

AVERAGE HOLDING VALUE TABLE

Ending Period	Current Period	Number of Holding Periods	×	Average Dividend Per Period	=	Average Holding Value Per Share in Inventory
15	1	15		24		360
15	2	14		24		336
15	3	13		24		312
15	4	12		24		288
15	5	11		24		264
15	6	10		24		240
15	7	9		24		216
15	8	8		24		192
15	9	7		24		168
15	10	6		24		144
15	11	5		24		120
15	12	4		24		96
15	13	3		24		72
15	14	2		24		48
15	15	1		24		24

5. Your Earnings

Your earnings for the entire experiment will equal the amount of cash that your team has at the end of period 15, after the last dividend has been paid. The amount of cash you will have is equal to:

The cash (called “Money” on your screen) your team has at the beginning of the experiment

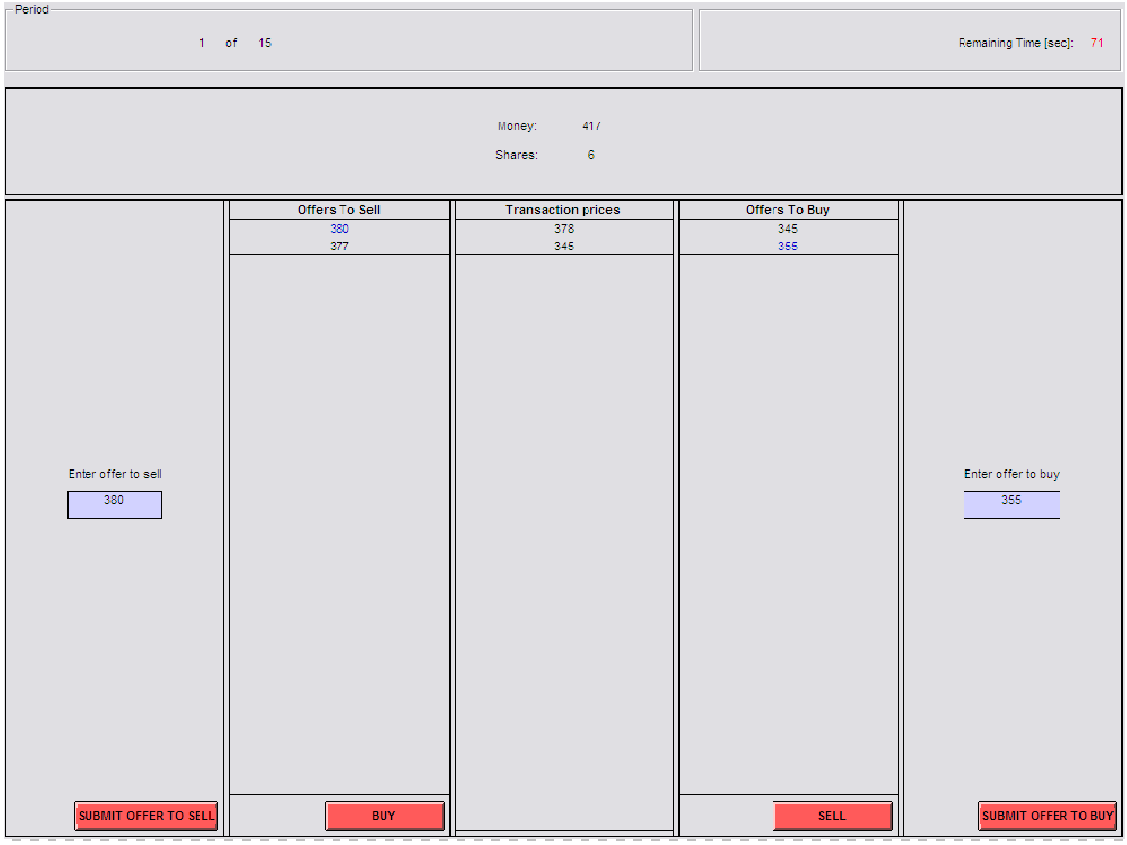
+ dividends your team receives

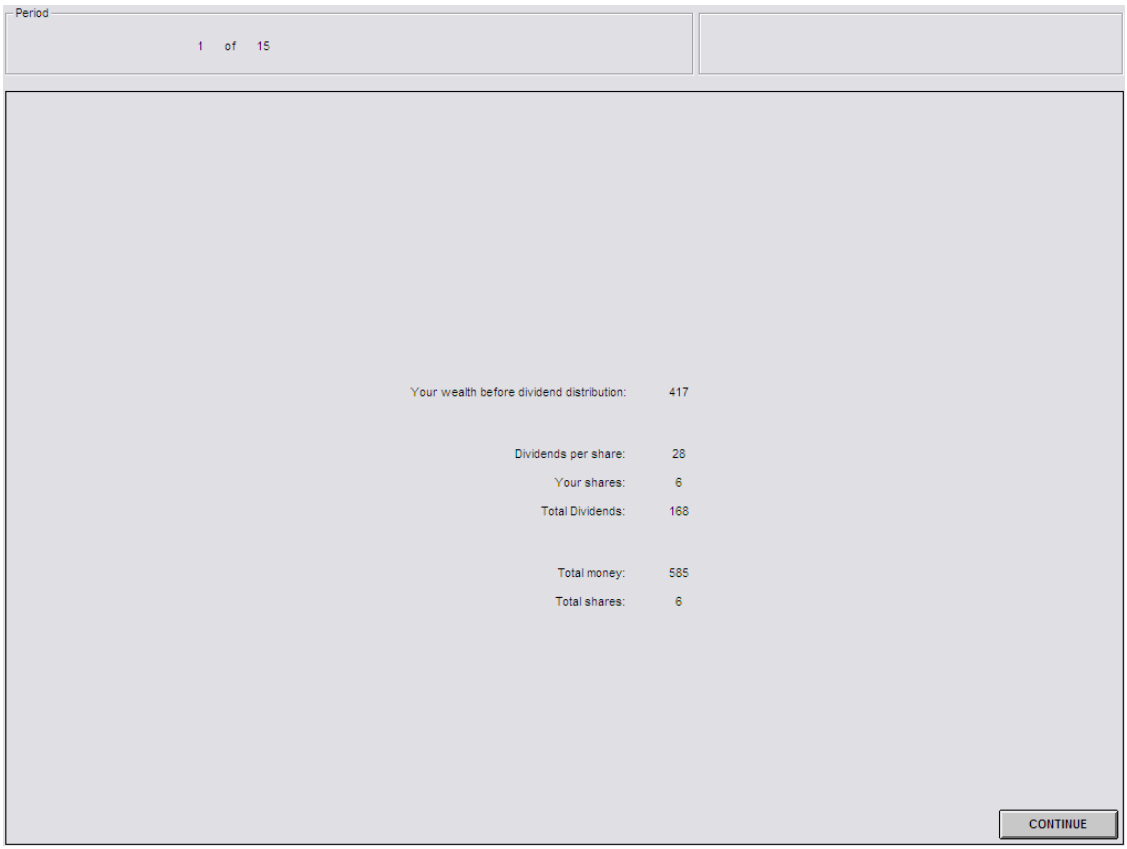
+ money received by your team from sales of shares

– money spent by your team on purchases of shares

Both you and your partner will each receive the total value of this cash balance, converted into Euros at the conversion rate specified at the beginning of these instructions.

SCREEN SHOTS OF THE DOUBLE-AUCTION TRADING PROGRAM





INSTRUCTIONS FOR THE TEAM CALL MARKET TREATMENT

1. General instructions

This is an experiment on decision making in a market. The instructions are simple and if you follow them carefully and make good decisions, you might earn a considerable amount of money, which will be paid to you in cash at the end of the experiment. The experiment consists of two sequences of fifteen periods in which you have the opportunity to buy and sell in a market. The money used in this market is called francs. All buying and selling will be done in francs. The cash payment to you at the end of the experiment will be in Euros.

The conversion rate is: **260 francs to 1 Euro**.

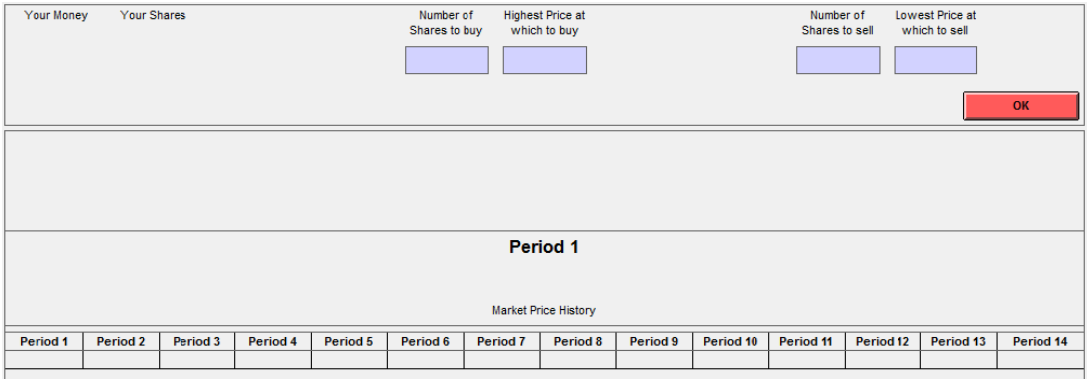
2. How to use the computerized market

In each period, you will see a computer screen like the one shown below. The items that you can buy and sell in the market are called shares. In the top left corner of your screen you will see the number of shares you currently have and the amount of money you have available.

- If you would like to buy shares, you can submit a **buy order**. Your buy order indicates the number of shares you would like to buy and the highest price that you are willing to pay for each share that you buy.

- If you would like to sell shares, you can submit a **sell order**. Your sell order indicates the number of shares you would like to sell and the lowest price that you are willing to accept for each share that you sell.

In each period, you may submit both a buy order and a sell order. The price at which you offer to buy must be less than the price at which you offer to sell. The price that you specify in your order is a per-unit price, at which you are willing to buy or sell *each* share.



Once you click on the OK button, your buy and sell orders for this period are final and can no longer be revised. The period will end after everyone has clicked OK.

The computer will then organize the buy and sell orders and use them to determine the **market price** at which shares will be bought and sold in this period. All transactions in the period will occur at the market price. This will generally be a price such that the number of shares with sell order prices at or below this price is equal to the number of shares with buy order prices at or above this price. Those who submit buy orders at prices above the market price will make purchases, and those who submit sell orders at prices below the market price will make sales.

At the end of each period you will see a results screen. This screen will show the market price, the value of any dividends you earned, and your new balance of money and shares. When you have finished reading this information, please click on the Continue button.

3. Specific instructions for this experiment

In this experiment you will be randomly paired with a partner, with whom you will make decisions jointly as a team of two. It is important that both you and your partner agree on each of the decisions you make, as they will affect the earnings that you both receive from the experiment. ***At the end of the experiment both you and your partner will each receive the total value of your team's money balance, converted into Euros at the rate specified at the beginning of these instructions.***

The experiment will consist of three sequences of fifteen periods. In each period, there will be a market, operating under the rules explained above, in which your team may buy and sell shares. Shares are assets with a life of fifteen periods, and the shares that your team holds will carry over from one period to the next within each fifteen-period sequence.

Your team may receive dividends for each share that it holds at the end of each period. At the end of each period, including period fifteen, the computer will randomly determine the dividend for all shares in that period. In each period, each share that your team holds at the end of that period will pay:

- a dividend of 0 francs for both you and your partner with probability 1/4
- a dividend of 8 francs for both you and your partner with probability 1/4
- a dividend of 28 francs for both you and your partner with probability 1/4
- a dividend of 60 francs for both you and your partner with probability 1/4

Since each of the four dividend values is equally likely, the average dividend for each share in each period is 24 francs. Dividends will be added to your team's money balance automatically after each period. After the dividend has been paid at the end of period fifteen, the sequence ends and there are no further earnings possible from shares.

After the first sequence of fifteen periods has finished, a second sequence will begin. The amount of money and shares that your team has at the beginning of the second sequence will be the same as what it was at the beginning of the first one. The same goes for the third sequence of fifteen periods.

4. Average Holding Value Table

You can use the Average Holding Value Table to help make decisions. It indicates how much, on average, each share will pay in dividends if it is held until the end of the fifteenth period.

The first column shows the ending period of the sequence. The second column shows the current period for which the average holding value is being calculated. The third column shows the number of holding periods from the current period to the ending period. The fourth column shows the average dividend per period for each share that your team holds. The fifth column shows the average holding value per share that your team holds from the current period until the end of the fifteenth period.

That is, for each share that your team holds until the end of period fifteen, both you and your partner will each earn on average the amount shown in column five. The value in column five is calculated by multiplying the values in columns three and four.

5. Your Earnings

Both you and your partner will be paid for your decisions in both sequences of fifteen periods. In each sequence you will each earn the total amount of money that your team has at the end of period fifteen, after the last dividend has been paid. This will be equal to:

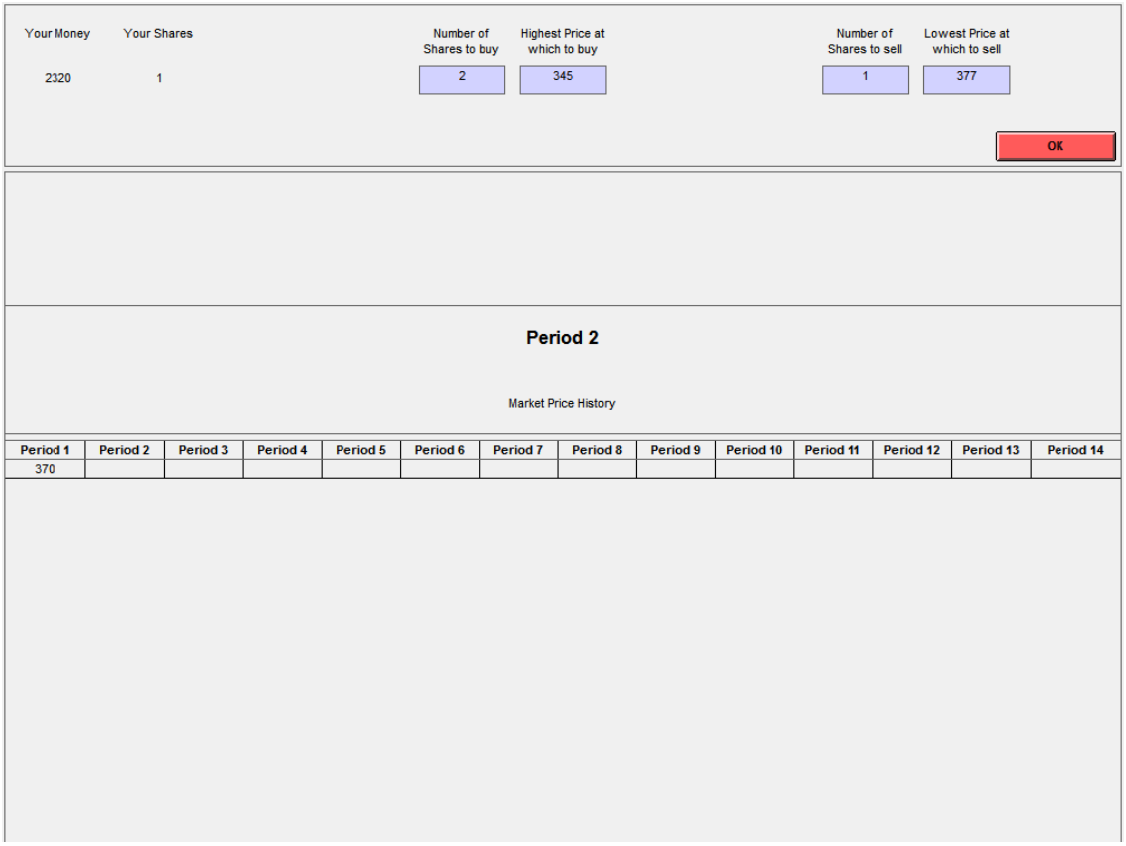
The money your team had at the start of period one
+ Dividends your team received
+ Money your team received from sales of shares
− Money your team spent on purchases of shares

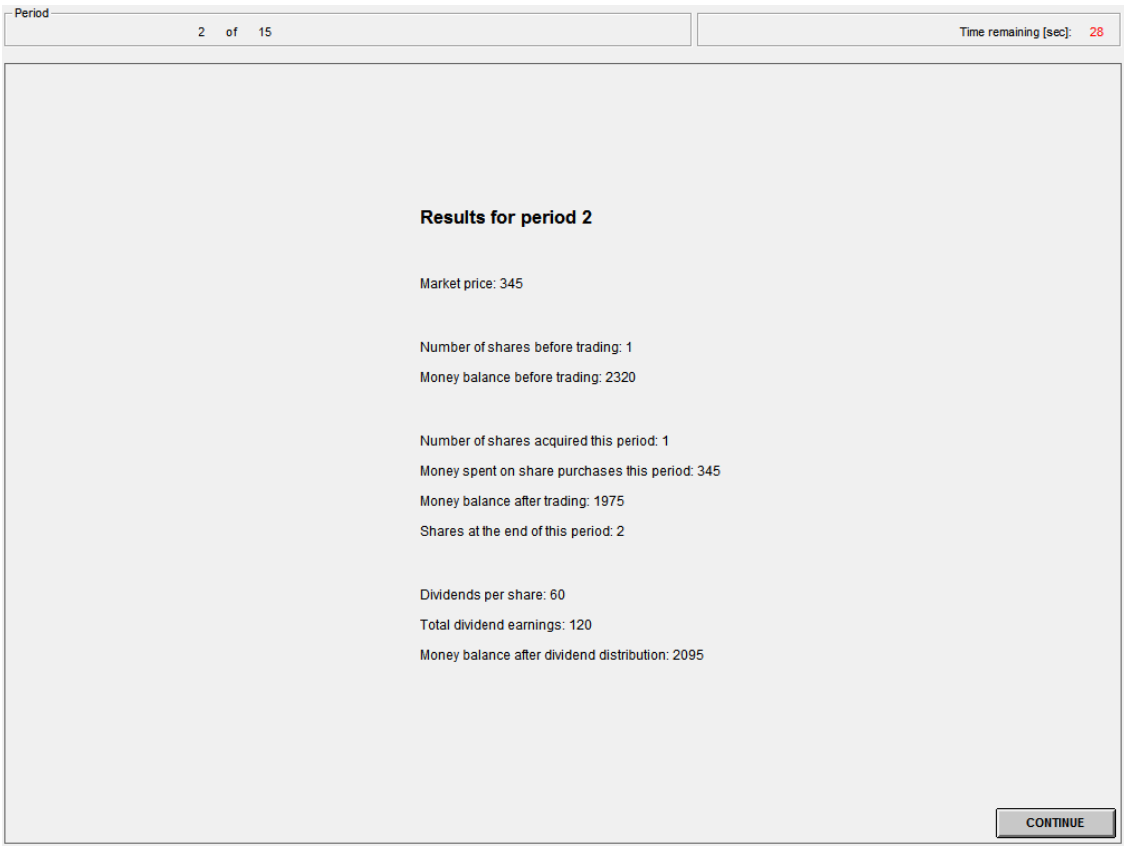
At the conclusion of the experiment, both you and your partner will each receive in cash the total value of this money balance, converted into Euros at the rate specified on page one of the instructions.

AVERAGE HOLDING VALUE TABLE

Ending Period	Current Period	Number of Holding Periods	×	Average Dividend Per Period	=	Average Holding Value Per Share
15	1	15		24		360
15	2	14		24		336
15	3	13		24		312
15	4	12		24		288
15	5	11		24		264
15	6	10		24		240
15	7	9		24		216
15	8	8		24		192
15	9	7		24		168
15	10	6		24		144
15	11	5		24		120
15	12	4		24		96
15	13	3		24		72
15	14	2		24		48
15	15	1		24		24

SCREEN SHOTS OF THE CALL MARKET TRADING PROGRAM





POST-EXPERIMENT QUESTIONNAIRE FOR TEAMS TREATMENTS

Team-ID:

Are you:

[0. female; 1. male]

Your age:

Are you a:

[0. domestic student; 1. international student]

Your native language:

[0. Dutch; 1. other (please specify)]

In what level of degree program are you currently enrolled?

[0. Bachelor's; 1. Master's; 2. M.Phil; 3. PhD; 4. other (please specify)]

What is your current year of enrolment in this degree?

What is your major field of study?

What is your annual income in Euro? (Consider all forms of income, including salaries, tips, interest and dividend payments, scholarship support, student loans, parental support, social security, alimony, child support and others.)

[0. Less than 7,500; 1. 7,501 to 12,500; 2. 12,501 to 17,500; 3. 17,501 to 22,500; 4.More than 22,500]

What is the combined annual income of yourself and all of your family members who live with you at the same residence in Euro? (Consider all forms of income as defined above.)

[0. Less than 20,000; 1. 20,001 to 40,000; 2. 40,001 to 60,000; 3. 60,001 to 80,000; 4. More than 80,000]

What was your strategy during the experiment?

Do you believe that you acted rationally and that you maximized your profit?

[0. Do not agree at all; through to 4. Agree completely]

Did you ever make a mistake in entering a price, or clicked a wrong button? If so, please tell us exactly what went wrong and in what period!

Out of the 9 teams, which rank do you think your team has attained with regard to your earnings ("1" signifying the best, "9" the worst result)?

Do you think your decisions were better or worse than if you had had to reach your decisions alone?

[0. Much worse than alone; through to 4. Much better than alone]

How much did you contribute to the joint decision?

[0. 0%; through to 10. 100%]

Was it easy for you to come to a joint decision?

[0. Not at all easy; through to 4. Very easy]

How did you solve conflicts if you could not agree?

Financial Literacy Questions (All treatments except HNP baseline)

Suppose you had €100 in a savings account and the interest rate is 20% per year and you never withdraw money or interest payments. After 5 years, how much would you have on this account in total?

- ☑ More than €200;
- ☐ Exactly €200;
- ☐ Less than €200;
- ☐ Do not know.

Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account?

- ☐ More than today;
- ☐ Exactly the same;
- ☑ Less than today;
- ☐ Do not know.

Suppose that in the year 2010, your income has doubled and prices of all goods have doubled too. In 2010, how much will you be able to buy with your income?

- ☐ More than today;
- ☑ The same;
- ☐ Less than today;
- ☐ Do not know.

Which of the following statements describes the main function of the stock market?

- ☐ The stock market helps to predict stock earnings;
- ☐ The stock market results in an increase in the price of stocks;
- ☑ The stock market brings people who want to buy stocks together with those who want to sell stocks;
- ☐ None of the above;
- ☐ Do not know.

Which of the following statements is correct? If somebody buys the stock of firm B in the stock market:

- ☑ He owns a part of firm B;
- ☐ He has lent money to firm B;
- ☐ He is liable for firm B's debts;
- ☐ None of the above;
- ☐ Do not know.

Which of the following statements is correct?

- ☐ Once one invests in a mutual fund, one cannot withdraw the money in the first year;
- ☑ Mutual funds can invest in several assets, for example invest in both stocks and bonds;
- ☐ Mutual funds pay a guaranteed rate of return which depends on their past performance;
- ☐ None of the above;
- ☐ Do not know.

Which of the following statements is correct? If somebody buys a bond of firm B:

- ☐ He owns a part of firm B;
- ☑ He has lent money to firm B;
- ☐ He is liable for firm B's debts;
- ☐ None of the above;
- ☐ Do not know.

Considering a long time period (for example 10 or 20 years), which asset normally gives the highest return?

- ☐ Savings accounts;
- ☐ Bonds;
- ☑ Stocks;
- ☐ Do not know.

Normally, which asset displays the highest fluctuations over time?

- ☐ Savings accounts;
- ☐ Bonds;
- ☑ Stocks;
- ☐ Do not know.

When an investor spreads his money among different assets, does the risk of losing money:

- ☐ Increase;
- ☑ Decrease;
- ☐ Stay the same;
- ☐ Do not know.

DETAILED SUBJECT POOL ANALYSIS

Table S.1 reports summary statistics of the observable demographic characteristics of the subjects, disaggregated by treatments. For age, financial literacy and income, data are not available for the HNP baseline treatment because these items were not included in their questionnaire. The final two columns of the table report *p*-values for Fisher exact tests of the association between the respective characteristics and the assignment of subjects to, respectively, the HNP baseline vs. team double auction and individual vs. team call market treatments.

In the two double-auction treatments, we find that there are no significant differences between the subject pools with regard to gender and international student status. This is again the case for the two call market treatments. For the call market treatments, we also find no significant differences with respect to age, financial literacy, and personal or family income. (We are unable to report the latter comparisons for the double auctions because the data are not available from the HNP questionnaire.)

We turn next to the specific issue of Business and/or Economics majors vs. all other majors. The relevant results are reported in the bottom three rows of Table S.1. If greater knowledge of Business and/or Economics were responsible for the diminution of price bubbles that we observe, there should be a larger fraction of Business and/or Economics majors in the two treatments in which we observe smaller bubbles, i.e. the team double-auction markets (vs. the HNP baseline) and team call markets (vs. individual call markets). This is not the case. In particular, the fraction of Business majors cannot explain our results, since there is a (not significantly) larger fraction of Business majors in both the HNP baseline and individual call market treatments. This would imply that a larger fraction of Business majors is associated with larger bubbles, which runs counter to intuition. Similarly, the proportion of Economics majors also cannot explain our results, since there are more Economics majors in the team double-auction sessions (which produce smaller bubbles than the HNP baseline) and also more Economics majors in the individual call markets (which exhibit larger bubbles than the team call markets). Finally, when the Business and Economics majors are pooled, the findings mirror those for the Economics majors alone.

On the basis of this analysis, we conclude that there are no significant differences between individual and team subjects with respect to any observable demographic characteristics. We also conclude that there is no consistent association between the proportion of subjects who are Business and Economics majors and the direction of our treatment effects across the two market institutions.

Prompted by a query from a referee, we also searched for subject pool differences within the team double-auction treatment that might account for the comparatively large price bubbles in markets 3 and 6 (relative to the other markets in the same treatment). However, we found no significant differences with regard to age, team gender composition, nationality, financial literacy, personal or family income, or major in markets 3 and 6 compared to markets 1, 2, 4 and 5.

TABLE S.1: SUBJECT POOL COMPARISON

	(1) HNP baseline (*n*=51)	(2) Team double auction (*n*=108)	(3) Individual call markets (*n*=36)	(4) Team call markets (*n*=54)	(1) vs. (2)	(3) vs. (4)
Age (years)	n/a	22.7	23.0	22.8	n/a	0.812
Female (%)	52.9	58.9	44.4	46.3	0.497	1.000
International (%)	80.4	81.5	83.3	79.6	0.917	0.662
Financial Literacy	n/a	7.71	7.22	7.43	n/a	0.694
Personal income (categorical)	n/a	75/37/ 11/2/1	23/10/ 3/0/0	30/18/ 6/0/0	n/a	0.429
Family income (categorical)	n/a	58/22/ 13/9/6	19/6/ 6/3/1	27/12/ 6/5/3	n/a	0.802
Business	45.1%	37.0%	36.1%	35.2%	0.386	1.000
Economics	19.6%	48.1%	41.7%	20.4%	0.001***	0.035**
Economics or Business	64.7%	85.2%	77.8%	55.6%	0.006***	0.043**

Columns 2 to 5 report summary statistics for the subject pools, by treatment. n/a indicates that data are not available for the HNP baseline condition because the relevant item was not included in their questionnaire. Row 1 reports the average age of the subjects in years, row 2 reports the percentage who are female, row 3 reports the percentage who are international students, and row 4 reports the average score on a ten-item test of financial literacy. Row 5 reports the distribution of responses to a measure of personal income elicited on the following ordinal scale: 0 [< € 7500], 1 [€ 7501–€ 12500], 2 [€ 12501–€ 17500], 3 [€ 17501–€ 22500] and 4 [> € 22500]. Row 6 reports the distribution of responses to a measure of family income elicited on the following ordinal scale: 0 [< € 20000], 1 [€ 20001–€ 40000], 2 [€ 40001–€ 60000], 3 [€ 60001–€ 80000] and 4 [> € 80000]. Columns 6 and 7 report two-sided *p*-values from Fisher exact tests of the association between the respective characteristics and the assignment of subjects to the individuals and teams treatments. **/*** denotes significance at the 0.05/0.01-level respectively.