

# Instructions for:

Restiani and Betz:

## The Effects of Penalty Design on Market Performance: Experimental Evidence from an Emissions Trading Scheme with Auctioned Permits

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### General Instructions

You are about to participate in a decision-making experiment. In this experiment you will be randomly assigned to 1 out of 2 groups and each group consists of 8 participants. You will remain in the same group throughout the experiment. The experiment will consist of two separate decision tasks. Your aim in the experiment is to maximise your earnings.

**Task 1** will require you to make a choice between two options for a number of times. You need to fill in your choices in a record sheet. Once the record sheet is completed please raise your hand and an experimenter will collect your record sheet. The earnings from Task 1 will be determined after both tasks are completed.

**Task 2** will require you to interact with other participants only through the computer where you are seated.

Your earnings from Task 2 are based on the decisions that you and 7 other participants in your group make.

**Every decision is confidential and anonymous.**

Your total earnings will be the sum of your earnings in Task 1 and Task 2, and will be paid to you privately in cash at the end of the experiment. This money will be added to the amount of \$5 for your participation in this experiment.

**Your decision and earnings in Task 1 will not affect your earnings in Task 2.**

**Please remain silent throughout the experiment.** If you have any questions, please raise your hand and an experimenter will come to you.

# Instructions for the Lottery Choice Experiment

## Task 1 Instructions: Lottery Choice Decisions

Your decision sheet shows ten decisions listed on the left. Each decision is a paired choice between “Option A” and “Option B.” You will make ten choices and record these in the final column, but only one of them will be used in the end to determine your earnings. Before you start making your ten choices, please let me explain how these choices will affect your earnings for this part of the experiment.

A cage which contains 10 balls will be used to determine payoffs; the balls are numbered from 1 to 10. After you have made all of your choices, we will pick a ball from the cage twice, once to select one of the ten decisions to be used, and a second time to determine what your payoff is for the option you chose, A or B, for the particular decision selected. Even though you will make ten decisions, only one of these will end up affecting your earnings, but you will not know in advance which decision will be used. Obviously, each decision has an equal chance of being used in the end.

Now, please look at Decision 1 at the top. Option A pays 400 cents if the number of the ball is 1, and it pays 320 cents if the number is 2-10. Option B yields 770 cents if the number of the ball is 1, and it pays 20 cents if the number is 2-10. The other Decisions are similar, except that as you move down the table, the chances of the higher payoff for each option increase. In fact, for Decision 10 in the bottom row, the ball will not be needed since each option pays the highest payoff for sure, so your choice here is between 400 cents or 770 cents.

To summarize, you will make ten choices: for each decision row you will have to choose between Option A and Option B. You may choose A for some decision rows and B for other rows, and you may change your decisions and make them in any order.

After Task 1 and Task 2 are completed, a ball will be picked from a cage to select which of the ten Decisions will be used. The number on this ball will be announced and then this ball will be put back in the cage. Then we will pick a ball again to determine your money earnings for the Option you chose for that Decision. Earnings for this choice will be added to your previous earnings, and you will be paid all earnings in cash when we finish.

So now please look at the empty boxes on the right side of the record sheet. You will have to write a decision, A or B in each of these boxes, and then the ball pick will determine which one is going to count. We will look at the decision that you made for the choice that counts, and circle it, before picking a ball again to determine your earnings for this part. Then you will write your earnings in the blank at the bottom of the page.

Now you may begin making your choices. Please do not talk with anyone while we are doing this; raise your hand if you have a question.

Please raise your hand when you have finished with Task 1 and you are ready to proceed to Task 2. We will then collect the Task 1 paper.

Please proceed to Task 1.

# RECORD SHEET

Decision Number	Option A	Option B	Your Choice
1	1/10 chance of A\$ 4.00; 9/10 chance of A\$ 3.20	10/10 chance of A\$ 7.70; 9/10 chance of A\$ 0.20	
2	2/10 chance of A\$ 4.00; 8/10 chance of A\$ 3.20	10/10 chance of A\$ 7.70; 8/10 chance of A\$ 0.20	
3	3/10 chance of A\$ 4.00; 7/10 chance of A\$ 3.20	10/10 chance of A\$ 7.70; 7/10 chance of A\$ 0.20	
4	4/10 chance of A\$ 4.00; 6/10 chance of A\$ 3.20	10/10 chance of A\$ 7.70; 6/10 chance of A\$ 0.20	
5	5/10 chance of A\$ 4.00; 5/10 chance of A\$ 3.20	10/10 chance of A\$ 7.70; 5/10 chance of A\$ 0.20	
6	6/10 chance of A\$ 4.00; 4/10 chance of A\$ 3.20	10/10 chance of A\$ 7.70; 4/10 chance of A\$ 0.20	
7	7/10 chance of A\$ 4.00; 3/10 chance of A\$ 3.20	10/10 chance of A\$ 7.70; 3/10 chance of A\$ 0.20	
8	8/10 chance of A\$ 4.00; 2/10 chance of A\$ 3.20	10/10 chance of A\$ 7.70; 2/10 chance of A\$ 0.20	
9	9/10 chance of A\$ 4.00; 1/10 chance of A\$ 3.20	10/10 chance of A\$ 7.70; 1/10 chance of A\$ 0.20	
10	10/10 chance of A\$ 4.00; 0/10 chance of A\$ 3.20	10/10 chance of A\$ 7.70; 0/10 chance of A\$ 0.20	

Session date : \_\_\_\_/\_\_\_\_/\_\_\_\_

Session time : \_\_\_\_\_ am/pm

Desk number : \_\_\_\_\_

Number of the decision : \_\_\_\_\_

Your choice : \_\_\_\_\_

Your earning : \_\_\_\_\_

# Instructions for the Emissions Trading Experiment

## Task 2 Instructions

This experiment consists of a number of repeated rounds, in which each participant represents 1 out of 8 firms in one group. In each round, you will be required to make decisions on behalf of your firm. All monetary value and earnings in the experiment are in Experimental Dollars (EX\$) with a conversion of: **1 Australian Dollar = 900 Experimental Dollars.**

### Structure of Task 2

There will be 6 rounds, in which each round has 2 sub periods. In each round, you will encounter exactly the same sequence of events as shown below.

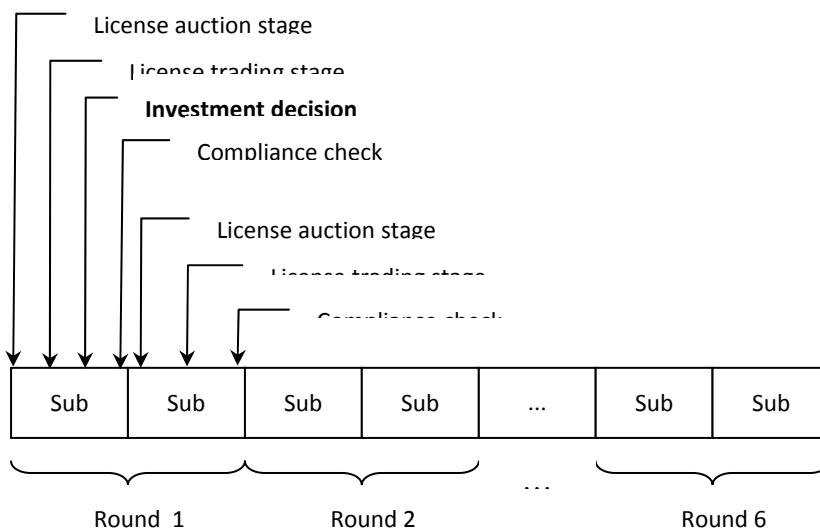


Figure 1. The sequence of Task 2

Sub periods of each round will consist of the following events in order:

1. Auction of licenses to firms.
2. Trading of licenses obtained in the auction.
3. Investment decision (**this will occur only in the first sub period of each round**).
4. Compliance check.

The only difference between the two sub periods is that an investment decision can be made in the first sub period.

Remember, that **each ROUND is not linked to the other rounds**, although the two sub periods of a round are linked.

### **Rules of the Experiment**

**Each firm produces 20 units of a fictitious good X in each sub period**, and this production level remains **fixed for the whole course of the experiment**. Thus, in total, 160 units of good X are produced by 8 firms in each sub period. From this production activity, each firm will receive “Total Revenue”.

$$\begin{aligned} \text{Total Revenue} &= \text{production level of good X} \times \text{Revenue per unit of good X} \\ &= 20 \text{ units} \times \text{EX\$ } 140 = \text{EX\$ } 2800 \end{aligned}$$

You will need to undertake **one** of the two actions:

#### **EITHER**

1. **Purchase and hold a license for every unit of production.**

You can get licenses by buying them during the auction stage or by buying them from other firms during the trading stage. **Each license expires at the end of a sub period and cannot be carried over to the next sub period. If you hold more licenses than you need at the end of a sub period, these licenses have a zero monetary value.**

OR

2. **Make an investment in technology during a round at a cost.**

**If you invest, the required number of licenses that you need to hold is zero. Then you will incur investment costs in each sub period of that round** as follows:

$$\text{Investment Costs} = 20 \text{ units} \times \text{Per Unit Investment Cost}$$

You cannot do partial investment of less than 20 units.

You can only make investment decision in the first sub period, and the effects will take place immediately for both sub periods. The Per Unit Investment Cost will be different for each participant and ranges from EX\$ 20 to 55 [20, 25, 30, 35, 40, 45, 50, 55]. This cost is randomly drawn and is assigned to each participant in each round. Thus, you will have *the same Per Unit Investment Cost in both sub periods of a round*; but this cost might change in the following rounds. Only you will know your Per Unit Investment Cost for your firm. The range of the Per Unit Investment Cost remains the same in all rounds.

### Penalties

A compliance check is conducted at the end of each sub period to see whether you hold enough licenses OR whether you have made an investment.

- 1) If you do not invest in a new technology AND :
  - a. You hold enough licenses as required, then you are COMPLIANT.
  - b. You do not hold enough licenses as required, then you are NON-COMPLIANT.
- 2) If you invest in a new technology, then you are automatically COMPLIANT.

You will be penalised if you are NON-COMPLIANT.

The penalty for non-compliance is a fixed fine of EX\$ 45 per license that you miss. For example, if you did not make an investment decision and you only hold 17 licenses, then you need to pay:

$$\text{Penalty costs} = (20-17) \text{ missing licenses} \times \text{EX\$ } 45/\text{missing license} = \text{EX\$ } 135.$$

### License Auction

This is the first opportunity for firms to buy licenses. In the auction, each firm is a buyer. **The total quantity of licenses to be auctioned in each sub period, "Total Auction Supply", is 80.** The auction starts at a price of EX\$ 18 and increases in EX\$5 increments. At each price, you **bid the quantity** of licenses that you are willing to buy at that price on the bidding screen (Figure 2). You need to enter the quantity and **click the "Submit" button**. You have 20 seconds to submit your bidding quantity. In making your bid, you need to meet the following requirements:

1. Your bidding quantity must be less than or equal to your previous bidding quantity. The maximum bidding quantity that you can enter is equal to Total Auction Supply.
2. You must have a sufficient cash balance to purchase your bidding quantity at the current bidding price.
3. If you are not willing to buy any licenses at a particular bidding price, you should submit **a zero quantity**. Once you decide to do this, you can only submit a zero quantity in all subsequent bidding prices during the auction.

The sum of bidding quantity from all firms at the last bidding price is the “Total Auction Demand”.

Figure 2. Screenshot for License Auction

When Total Auction Demand is higher than Total Auction Supply, the bidding price is increased and the auction continues. **The auction ends when Total Auction Demand is less than or equal to Total Auction Supply.** The auction price and the number of licenses allocated to each firm are calculated as follows:

1. **If Total Auction Demand equals Total Auction Supply**
  - The auction price is the last bidding price.
  - The number of licenses allocated to each firm is equal to its last bidding quantity.
2. **If Total Auction Demand is less than Total Auction Supply**
  - The auction price is the next-to-last bidding price.
  - Excess supply\* will be allocated in the order of the fastest bidders at the next-to-last bidding price. So the faster you bid, the higher the chance that you receive some allocation of the excess supply. (\*Excess supply = Total Auction Supply - Total Auction Demand)
  - The total number of licenses allocated to each firm is equal to its bidding quantity at the last bidding price PLUS any allocation from the excess supply.

Please note that **until the auction ends, no licenses are allocated to any firms**. The only way for firms to initially obtain licenses is by participating in the auction.

**License Trading Stage**

The trading stage will last for **1 minute** in each sub period. On the screen (Figure 3), there will be different boxes to enable you to **trade a single license at a time**.

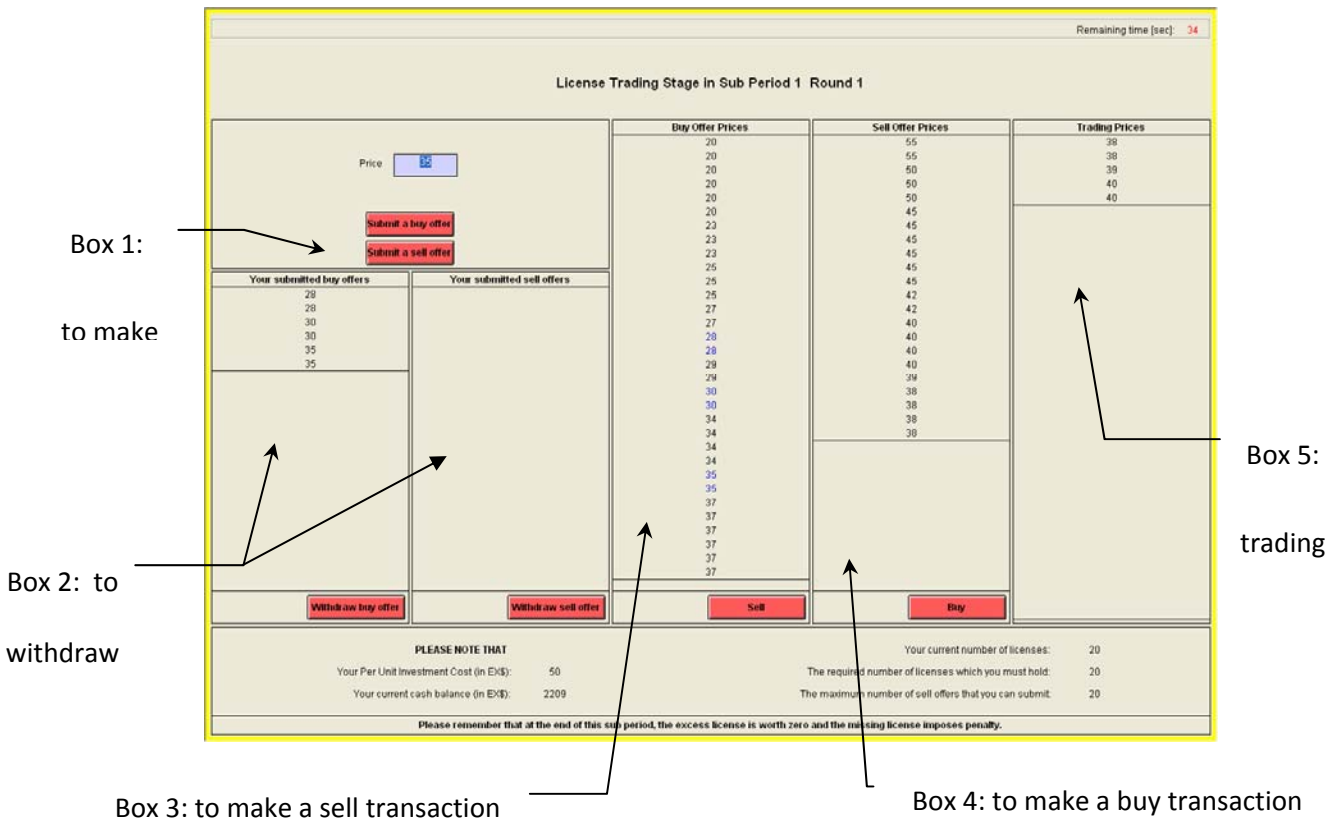


Figure 3. Screenshot for License Trading

1. **Box 1: to make a sell or a buy offer**  
 A buy or a sell offer is a price signal that you give to other firms. Thus **no transaction is made yet when you submit an offer**.
  - a. **To sell a license**



**Enter the price** at which you are willing to sell and **click the “Submit a sell offer” button**. Your submitted offer is valid if:

- 1) You actually hold a license. *You can only submit one sell offer for each license.*
- 2) The price you offer is less than or equal to the current lowest standing sell offer.

b. **To buy a license**

**Enter the price** at which you are willing to buy and **click the “Submit a buy offer” button**. Your submitted buy offer is valid if:

- 1) You have a sufficient cash balance to purchase at the price you enter.
- 2) The price you offer is greater than or equal to the current highest standing buy offer.

2. **Box 2: to withdraw your offers**

This box **displays only those offers which are not yet traded** and allows you to withdraw those offers.

3. **Box 3 and Box 4: to trade (make a transaction).**

a. **Box 3: to make a sell transaction**

From the **“Buy Offer Prices”**, **select the price** at which you are willing to sell your license, and then **click the “Sell” button**. The Buy Offer Prices are sorted in an ascending order. Thus, higher and more recent prices are shown at the bottom of the list.

b. **Box 4: to make a buy transaction**

From the **“Sell Offer Prices”**, **select the price** at which you are willing to buy, and then **click the “Buy” button**. The Sell Offer Prices are sorted in a descending order. Thus, lower and more recent prices are shown at the bottom of the list.

**In both boxes, your own offers are shown in blue font.** You cannot accept your own offers.

4. **Box 5: to view trading prices.**

The higher and more recent prices are shown at the bottom of the list.

### **Payment**

Your cash balance will be automatically updated after each decision you make. Your cash balance at the end of Sub Period 1 will be added to your initial cash balance at the beginning of Sub Period 2. **At the end of Sub Period 2 of a round, your cash balance represents your “Earnings” of that round.** Your earnings are calculated as follows:

Earnings =

- + Total Revenue
- + cash balance of Sub Period 1 of the same round
- number of licenses bought in auction \* auction price
- investment costs
- trading price of licenses bought during trading stage
- + trading price of licenses sold during trading stage
- penalty costs

At the end of Task 2, you will be paid the value of your Cumulative Earnings.

**Cumulative Earnings = Sum of "Earnings" from all rounds**

### **Summary of Task 2**

In each round you need to make decisions that will maximise your Earnings by either:

1. Making a technological investment, OR
2. Holding the required number of licenses

Please note that:

1. If you invest in a round, you will spend investment costs for both periods of that round. There are no additional benefits that you receive from investing.
2. If you hold more licenses than what is required, those licenses will worth zero by the end of a sub period.
3. If you have fewer licenses than what is required, you are penalised with a fee of EX\$ 45/missing license.

### **Preliminary of Task 2**

Before Task 2 starts, you will take a **short quiz** to assess your understanding of the task. You need to answer each question correctly in order to continue to the next question. You can enter answer more than once if necessary, until you arrive at the correct answer. After you complete the quiz, there will be a **Practice Round**. The earnings from this

round will not be taken into account in your final payment. **The actual experiment will begin immediately following the Practice Round.**

## Demographic Survey

Session Date: ...../...../..... (dd/mm/yy)

Session Time: ..... am / pm

Subject Number: .....

*Please fill in your demographic details below. All information will be kept and treated with confidentiality.*

(A) Birth: In what year were you born? .....

(B) Household Budget: Who in your household would you consider to be primarily in charge of expenses and budget decisions?

self       spouse       parent       other(specify)       do not know

(C) Gender: What is your gender?       male       female

(D) Race:                      What                      is                      your                      ethnic                      background?

.....

(E) Marital Status: What is your marital status?

single       married       divorced       widowed       other

(F) Employment: How would you best describe your current employment situation?

student only       work at university as a tutor/research assistant/casual employee

full-time employment outside university

part-time employment outside university       other

(G) Household Income: Please indicate the category that best describes your household income from all sources before all taxes in 2008.

5,000 and under     5,001-15,000       15,001-30,000       30,001-45,000

45,001-60,000     60,001-75,000,     75,001- 90,000       90,001-100,000

over 100,001.

(H) Number in Household: How many people are in your household? (Yourself and those who live with you and share your income and expenses) .....

(I) Own Income: Your own income from all sources before taxes in 2008. Do not include income from other household members.

5,000 and under     5,001-15,000       15,001-30,000     30,001-45,000

45,001-60,000     60,001-75,000       75,001- 90,000

90,001-100,000     over 100,001.

(J) Income Source: How do you receive your income?

fixed source (salary)       hourly rate       loans/scholarships

parents       other

(K) Student Status: What is your student status?

full-time student     part-time student

(L) Main field of study

What is your main field of study?

Undergraduate programme       Master's programme

Other, specify: .....

In which area .....

(M) Year in School: What year are you in the current semester?

Year 1     Year 2     Year 3     Year 4     over year 4

(N) Tuition Source: Who is primarily responsible for your tuition and living expenses?

self       parent       shared between self and parent

scholarship/grant       loans       combination/other

(O) Vote Participation: Have you ever voted in an election?  yes       no

(P) Social Activity: What club or extracurricular activity that you are part of? (more than one answers is allowed)

sports       culture, music, art       advocacy/political groups

university/faculty/school student organisation     environment     other

(Q) Country background: Please state the country where you were raised.

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