Online Appendix

1. Compliance Behavior and Hypotheses

To analyse the individual firm's compliance behaviour, we consider a risk-neutral firm operating either under a competitive transferable emission permits system or under a system of emissions standards, along with a fixed number of other heterogeneous firms. We index firms by i and denote the total number of firms as n (whenever possible, we avoid the use of a specific firm index for simplicity). Each firm has an abatement cost function $c(q)$, strictly decreasing and convex in the firm's emissions q [$c'(q) < 0$ and $c''(q) > 0$]. The environmental target is a fixed aggregate level of emissions Q, exogenously determined by the regulatory authority. The enforcement is made by random inspections and fines. Denote π the probability of a firm to be inspected. If the firm is found in violation, it is penalized according to the following penalty function $f(v) = \varphi \times v + (\gamma/2) \times v^2$, with $\varphi > 0$ and $\gamma > 0$.

1.1 Transferable Emission Permits System

Under a system of transferable emissions permits, a total of $L = Q$ licenses are issued by a regulatory authority, each of which confers the legal right to release one unit of emissions to the firm that possesses it. Each individual firm is a perfect competitor in the license market, so the license market generates an equilibrium license price p. Let l_0 be the initial allocation of licenses to the firm, and let l be the number of licenses that the firm holds after trade. When a firm is non-compliant, its emissions exceed the number of licenses it holds and the level of its violation (v) is $v = q - l > 0$, for $q > l$.

In a transferable emission permits system, a firm chooses its emissions and permits to minimize compliance costs: abatement costs, receipts or expenditures from selling or buying

permits, and the expected penalty – taking the enforcement strategy as given. We know that in this system a firm is compliant if and only if $-c'(l) \leq \pi\varphi$. (See for example: (Malik 1990) and (Stranlund and Dhanda 1999)). We also know, that the optimal choice of emissions requires $-c'(q) = p$, which implicitly defines $q(p)$. If compliant, the choice of emissions for firm i equals its demand of permits, that is $q_i(p) = l_i(p)$. The permit market equilibrium condition is $\sum_{i=1}^{n} l_i(p) = L = Q$, which implicitly defines the equilibrium permit price as a function of the total number of licenses; that is, $p(Q)$. Hence, under a transferable emissions permit system, a firm will be compliant whenever $p(Q) \leq \theta$; suggesting that a firm will comply with the regulation when the expected marginal penalty is not lower than the equilibrium price obtained in a competitive permits market.

When the firm is noncompliant, it chooses the demand of permits $l(p, \pi, \varphi, \gamma) < q(p)$, where $l(p, \pi, \varphi, \gamma)$ is the solution to $p = \pi[\varphi + \gamma(q(p) - l)]$, and the level of violation is $v(p, \pi, \varphi, \gamma) = q(p) - l(p, \pi, \varphi, \gamma)$. The permit market equilibrium condition when violations occurs is $\sum_{i=1}^{n} l_i(p, \theta, \tau, \psi) = L < Q$, which implicitly defines the non-compliance equilibrium permit price as a function of the total number of licenses and enforcement parameters; that is, $p^{nc}(L, \theta, \tau, \psi)$, where θ is a vector of monitoring probabilities on regulated firms.

1.2 Emissions Standard

We now consider the case of a prescriptive environmental policy in which each firm faces an emissions standard *s*. This is a maximum allowable (legal) level of emissions for each firm. Emissions standards for all firms satisfy $\sum_i s_i = Q$. In this context, an emissions violation *v*

occurs when the firm's emissions exceed the emissions standard: $v = q - s > 0$. The firm is compliant otherwise. The firm is audited with a random exogenous probability ®. An audit provides the regulator perfect information about firms' compliance status. If the firm is audited and found in violation, a penalty $f(v)$ is imposed. Following Stranlund (2007), we assume that the structure of the penalty function is $f(q - s) = \varphi(q - s) + (\gamma/2)(q - s)^2$, with $\varphi > 0$ and $\gamma > 0$.

Under an emissions standard, a firm chooses the level of emissions to minimize its total expected compliance cost, which consists of its abatement costs plus the expected penalty. As it is known, a risk-neutral firm will be compliant ($q = s$) whenever if and only if $-c'(s) \leq$ ® φ [Heyes (2000), Malik (1992), Harford (1978)]. Thus, a firm will be compliant with the emission standard if the expected penalty for a marginal violation is no lower than the marginal abatement cost at that level of emissions (the benefit of a marginal violation). Otherwise, the firm is going to choose a level of emissions $q(s,®) > s$, where $q(s, ®, \varphi, \gamma)$ is the solution to $-c'(q) = \pi[\varphi + \gamma(q - s)]$.

1.3 Hypotheses

Hypothesis 1: *Under a system of tradable pollution permits the regulator can maintain the individual level of emissions constant by altering the aggregate supply of permits and the monitoring probability according to*

$$\frac{d\pi}{dL_o} = \frac{1}{\sum_{i=1}^{n} \frac{f'}{\pi f''}} = \frac{\pi f''}{n f'} > 0,$$

Proof: Assume that the compliance conditions under a transferable emissions permits system holds, that is $p \leq$ ® φ. We recall that under perfect compliance, p is the implicit solution to $\sum_{i=1}^{n} l_i(p) = L_0 = Q$. Also, under less than perfect compliance, p is the implicit solution to $\sum_{i=1}^{n} l_i(p, ®, ¨, ¥) = L_0$. Then, starting from perfect compliance, it is always possible to reduce both the aggregate supply of permits L_0 and the monitoring probability π, such that the equilibrium price of permits remains the same. If this is the case, then the choice of emissions remains the same, but because of the reduction in the individual permits demand, the firm is now noncompliant.

The equilibrium condition implicitly defines the equilibrium permit price $p(L_0, \pi)$. Moreover, from the full compliance condition of the market for permits, it is easy to show that,

$$\frac{\partial p}{\partial L_0} = \frac{1}{\sum_{i=1}^{n} \frac{\partial l_i}{\partial p}} < 0$$

and that

$$\frac{\partial p}{\partial ®} = -\frac{\sum_{i=1}^{n} \frac{\partial l_i}{\partial ®}}{\sum_{i=1}^{n} \frac{\partial l_i}{\partial p}} > 0 .$$

Writing the equilibrium price of permits as $p(L_0, \pi)$, totally differentiating it, imposing $dp = 0$, and using the above two expressions, we obtain $\frac{d\pi}{dL_o} = \frac{1}{\sum_{i=1}^{n} \frac{\partial l_i}{\partial \pi}} > 0$. From existing results in the literature, we know that $\frac{\partial l_i}{\partial \pi} = \frac{f'}{\pi f''}$. Therefore,

$$\frac{d\pi}{dL_o} = \frac{1}{\sum_{i=1}^{n} \frac{f'}{\pi f''}} = \frac{\pi f''}{n f'} > 0, \qquad (1)$$

Q.E.D.

Hypothesis 2: *Under a system of emissions standards the regulator can maintain the individual level of emissions constant by altering the individual emission standards and monitoring probabilities according to*

$$\frac{d\pi_i}{ds_i} = \frac{\pi_i f''}{f'} > 0$$

Proof: The optimal choice of emissions in a system of emission standards is given by the condition $-c'(q_i) = \pi_i f'(q_i - s_i)$, which implicitly defines the firm's optimal choice of emissions as a function of the monitoring probability π_i and the emission standard s_i, $q_i = q_i(\pi_i, s_i)$. Totally differentiating this function, and imposing $dq_i = 0$, we obtain $\frac{d\pi_i}{ds_i} = -\frac{\frac{\partial q_i}{\partial s_i}}{\frac{\partial q}{\partial \pi_i}}$.

Substituting the numerator and denominator for expressions obtained from the condition $-c'(q_i) = \pi_i f'(q_i - s_i)$ above (see Caffera and Chávez (2011) for details), we obtain:

$$\frac{d\pi_i}{ds_i} = \frac{\pi_i f''}{f'} > 0 \qquad (2)$$

Q.E.D.

2. Proof of theoretical predictions of behaviors with the experiment parameters

As explained in the text, each market was comprised of 8 subjects. Each market had 2 subjects with each of the four possible schedules, as depicted in Table A.1 below.

Table A.1: Assigned marginal benefits of production of the fictitious good

	Marginal Benefits of Production			
Units produced	Type 1: subjects 1 and 2	Type 2: subjects 3 and 4	Type 3: subjects 5 and 6	Type 4: subjects 7 and 8
1	161	151	129	125
2	145	134	113	105
3	130	119	98	88
4	116	106	84	74
5	103	95	73	63
6	91	86	63	54
7	80	79	53	47
8	70	74	44	42
9	61	70	35	38
10	53	67	27	35

Source: Cason and Gangadharan (2006).

2.1. Tradable permits

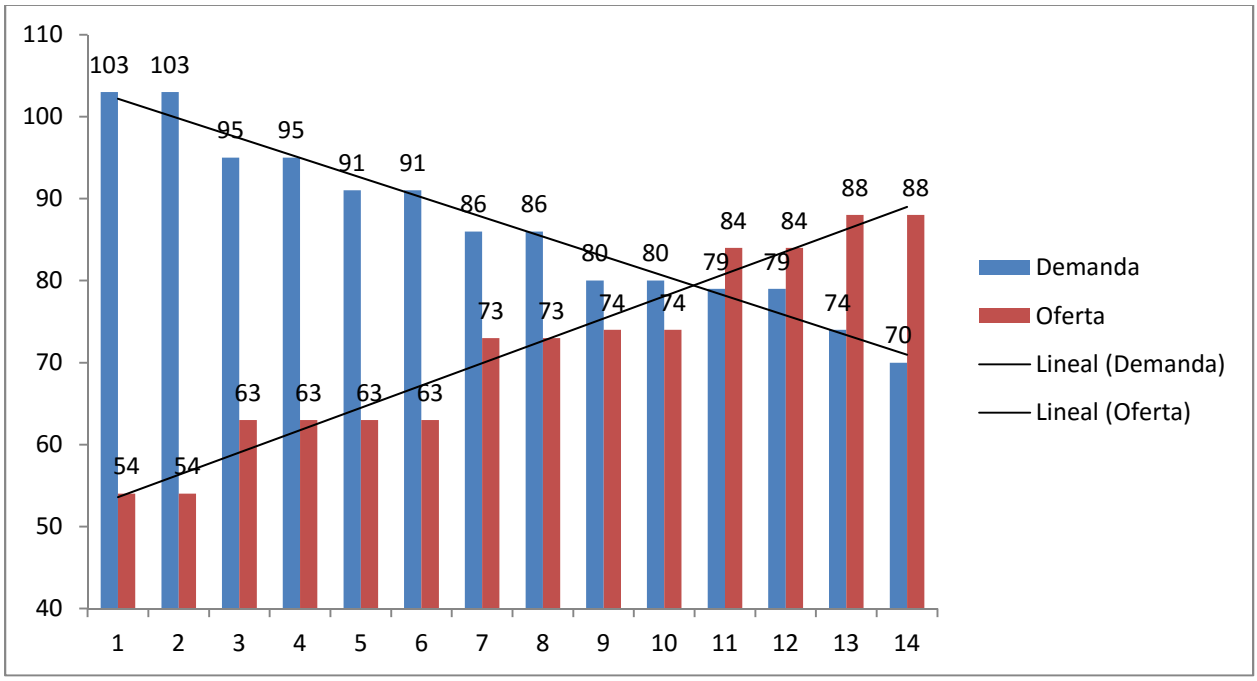
2.1.1. Compliance Treatment (M1)

As stated in the text, in Treatment M1, the total number of tradable permits supplied to each group of 8 subjects was 40. The initial allocation was 4 permits for subjects of type 1 and 2, the prospective buyers, and 6 permits for subjects of type 3 and 4, the prospective sellers. The marginal benefits of each type of subject evaluated at the initial allocation are marked in red in Table A.1. These values correspond to the prospective buyers' maximum willingness to pay for a permit (subjects of type 1 and 2) and the prospective sellers' minimum acceptable price (marginal cost).

Given this initial allocation and the marginal benefits of prospective buyers and sellers, we can construct the demand and supply schedules of the market shown in Figure A.1.

Figure A.1. – Supply, Demand and Equilibrium in the market for permits

Compliance Treatment (M1)



With this Figure, it is easy to see that trades occur up to the 10th unit. These last units (number 9 and 10) are traded at a price between \$80 and \$74. Therefore, in the case of the market experiment, if perfectly enforced, we expect an equilibrium price between \$74 and \$80 experimental pesos. This equilibrium price is reached after ten trades. In the end, the two type-1 firms buy 3 permits each and the two type-2 firms buy 2 permits each. On the other hand, each of the two type-3 firms sell 2 permits and each of the type-4 firms sell 3 permits each.

Again, this is the predicted result of the market if perfectly enforced. As stated in the previous section, a necessary and sufficient condition to assure perfect compliance is $p(Q) \leq \pi\varphi$, where

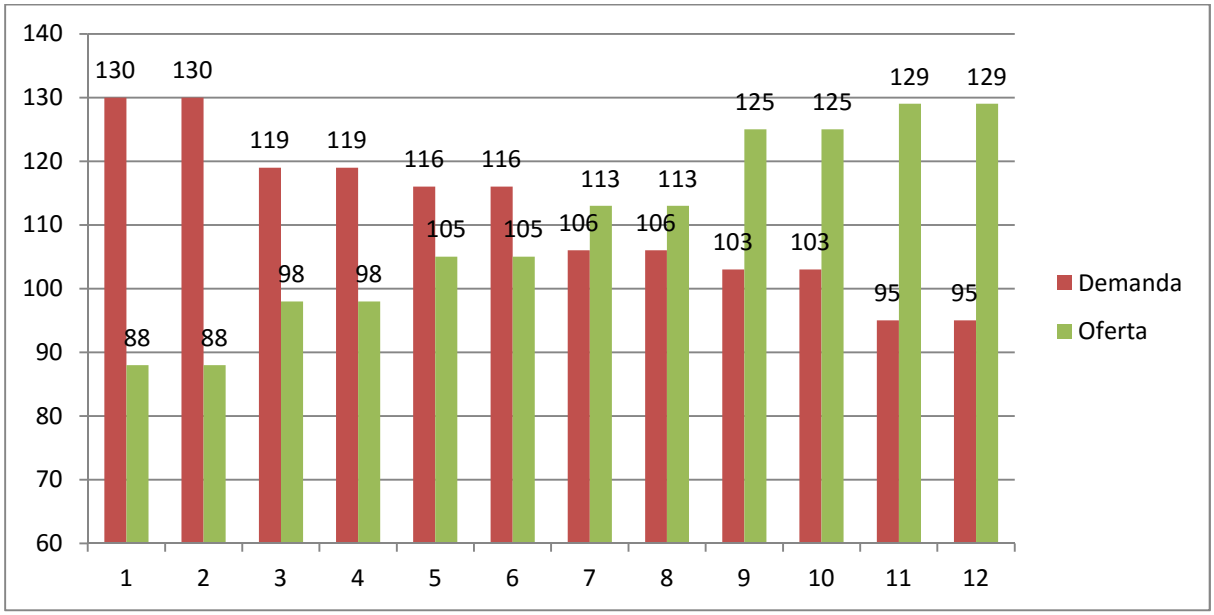
$p(Q)$ is the equilibrium price of the market for permits, and $\pi\varphi$ is the expected marginal fine, comprised by the probability of being inspected (π) and the marginal fine ($\varphi = f'(0)$). As we have just seen, the theoretically expected equilibrium price of the market for permits is between \$74 and \$80. At the same time the probability of being inspected in the M1 treatment (the perfect compliance treatment) is 0.6 and the fine is $f(e-l) = 100(e-l) + \frac{66.66}{2}(e-l)^2$, which produces a marginal fine for the first unit of violation equal to 133.33. Therefore, the expected fine for the first unit of violation is $0.6 \times 133.33 = 80$. Therefore, this expected fine should be enough incentive to make a risk-averse and a risk-neutral subject to comply with its permit holdings, given a equilibrium price of permits between \$74 and \$80.

2.1.2. Violation Treatment (M1)

In the violation treatment M2 the supply of permits and initial endowments are halved. Given this, and the same marginal benefit schedules as in Table A.1, the market now looks as in Figure A.2.

Figure A.1. – Supply, Demand and Equilibrium in the market for permits

Violation Treatment (M2)



Given the initial allocation of permits, the first two units do not sell for less than \$88. The two type-1 firms are willing to pay as much as \$130 for each of these two permits, if the market were perfectly enforced. But it is not. The monitoring probability is now 0.3, which makes the expected marginal penalty for the first unit of violation equal to $0.3 \times f(1) = 0.3 \times 133.33 = 40$. So it is expected-profit-maximizing to violate their permits holdings buy one unit, given than the expected penalty for this unit is less than the minimum possible price. In fact, this is also true for the second unit of violation, since the expected marginal fine for the second unit if violation is $0.3 \times [f(2) - f(1)] = 60$, and for the third unit of violation $(0.3 \times [f(3) - f(2)] = 80)$. This is not true for the fourth unit of violation $(0.3 \times [f(4) - f(3)] = 100)$. So firms of type 1 are going to violate three units. A similar reasoning leads firms of type 2 to violate three units their permits holdings, and types 3 and 4, 2 units. Nevertheless, this is not an equilibrium. Firms of type 1 are willing to pay \$91 and \$80 for two additional permits, respectively. Firms of type 2

are willing to pay \$86 for an additional permit. On the other side of the market, firms of type 3 and type 4 are willing to sell for \$63, \$73, and \$74, respectively. Therefore there is room for trade. In the end, these 6 permits are going to be traded, keeping the number of individual violations constant, such that in the equilibrium the last unit was traded by a price between \$80 and \$74, and $0.3 \times [f(4) - f(3)] = 100 \geq p \in (80,74)$ for subjects of type 1 and 2, and $0.3 \times [f(3) - f(2)] = 80 \geq p \in (80,74)$ for subjects of types 3 and 4. So the results are those summarized in the "Theory" rows of Table 3 in the paper.

2.2. Emission standards

2.2.1 Compliance treatment (S1)

As stated section 1.2, compliance with and emission standard requires $-c'(s) \leq \wp$ for every type of firm. Table A.3 is enough to show up that this is the case in the compliance treatment S1.

Table A.2: Marginal benefits and marginal expected fines per type of firm at the predicted level of emissions
Compliance treatment (S1)

Type	Emission standard	Marginal benefit of first unit of violation	Expected marginal penalty for first unit of violation
1	7	70	$0.6 \times 133.33 = 80$
2	6	79	$0.65 \times 133.33 = 86$
3	4	73	$0.63 \times 133.33 = 84$
4	3	74	$0.66 \times 133.33 = 88$

2.2.2 *Violation treatment (S2)*

As stated section 1.2, if the compliance condition $-c'(s) \leq \varphi$ is not met for a polluting firm, that firm is going to violate the standard s and violate up to the emission level e in which $-c'(e-s) \leq \varphi \times f'(e-s)$. Therefore, in order to prove that each type of subject is going to emit the level predicted in Table 2, we show in Table A.3 below that the previous condition holds for the four types of subjects at the predicted levels of emissions and violation.

Table A.3: Marginal benefits and marginal expected fines per type of firm at the predicted level of emissions

Violation treatment (S2)

Type	Emission standard	Predicted level of emissions	Marginal benefit of and additional unit of violation	Expected marginal penalty for an additional unit of violation
1	4	7	70	$0.6 \times (\frac{\quad}{f\,c4}) - \frac{\quad}{f\,c3}) = 80$
2	3	6	79	$0.65 \times (\frac{f\,c4}{f\,c4}) - \frac{f\,c3}{f\,c3}) = 86$
3	2	4	73	$0.63 \times (\frac{f\,c4}{f\,c3}) - \frac{f\,c3}{f\,c2}) = 84$
4	1	3	74	$0.66 \times (\frac{f\,c3}{f\,c3}) - \frac{f\,c2}{f\,c2}) = 88$

3. Instructions[1]

Introduction

You are about to participate in a decision-making experiment. The experimental session in which you will participate today includes a total of fourth activities. At the end of the session you will be paid cash for your participation. Different participants can earn different amounts of money. What you earn will depend on the decisions you make during the experiment as well as the decisions of the other participants.

In this experiment you will participate in a market. The interaction among the participants (a process of "negotiation" to buy and sell) will take place through the computer terminals against which you are sitting. It is important that you do not speak or otherwise communicate with other participants in this experiment. If you break the rules, we'll have to ask you to leave the experiment.

We will begin with a brief description of the experiment, and then we will give more details on how to enter your decisions on the computer.

If you have any questions while we explain in detail the experiment and the software, please raise your hand. If any difficulties arise after the experiment has begun, raise your hand in silence and an attendant will come and help you.

[1] We thank Jim Murphy and John Stranlund for supplying their set of instructions for (Murphy and Stranlund 2006), on which this set is built on.

General description of the experiment

In today's experiment, participants in the room are divided into groups of eight members each. The experiment consists of fourth activities.

The first three activities consist of a number of periods in which you are a producer of a fictitious good and must decide how many units of this good to produce. Each unit produced generates an income. So the more units you produce the more income you receive.

You can produce as many units as you want of this fictitious good. But you need a permit for each unit you produce. Otherwise, you could face a fine. At the beginning of each period you will receive a number of free permits and during the period you may buy additional permits or sell permits, as deemed appropriate. Finally, the controller monitors the production permits tenure through inspections and fines.

In the fourth and final experiment activity today you must answer a questionnaire.

Description of the experiment first activity

The first activity of the experiment is a training activity; consequently, you will not receive payment for your decisions.

In the first experiment activity today you are one of eight participants. The activity is divided into a number of periods of five minutes each. At the beginning of each period, you will receive an initial amount of permits for free. Additionally, you will begin the series of periods that make up the first activity today with an initial working capital endowment (or cash balance) of $E 525 (five hundreds and twenty-five experimental pesos).

During each period you would have the chance (1) to produce units of the fictitious good, and

(2) to buy or sell permits in a market for permits.

In each period, you can produce a minimum of 1 unit and as many units as possible within your capacity. For every unit you produce, you earn a certain amount of money, expressed in "experimental pesos" ($ E). The more units you produce, the greater your income in $ E.

However, you must have a permit for each unit of the good that you produce. Otherwise, you could face a fine. To be fined, apart from producing an amount greater than the permissions you have, you must be inspected. You could see on your screen the "probability of being inspected", i.e. the "chance" that you face of being inspected in each period. This value remains fixed throughout the periods.

If you are inspected, the computer will compare the units you decided to produce in that period with the number of permits that you have. If your level of production in that period is greater than the number of permits, you will be fined. The total value of the fine, also in experimental pesos ($ E), depends on the number of units you produced in excess of the number of permits. The greater the difference between your production level and the number of permits the greater the penalty.

If, however, upon inspection the computer finds that you produced a number of units of the fictitious good that is below or equal to the number of production licenses you own, then you will not be fined.

Finally, if you are not inspected you will not be fined (even if you are producing above the number of licenses you own). This is because you have to be inspected for the computer to see how many units of fictitious good you are producing, and compare them with the amount of permits.

In each of the periods, you can make money in two ways:

1. Producing units of a fictitious good. For every unit you produce, you will earn a certain amount of money that will be added to your cash balance.

2. Selling permits in the permits market. The sale price received by each of the permits that you sell will be added to your cash balance.

Money will be deducted from your cash balance if:

1. You choose to buy additional permits. The purchase price you pay for each of the permits that you purchase will be deducted from your cash balance.

2. You are inspected, it is found that the total number of units produced exceeds the number of licenses you own, and you are fined. The total amount of the fine will be deducted from your cash balance.

In sum, your net profit for each period is calculated as follows:

+ Revenues from the production of the fictitious good

+ Proceeds from sale of permits

- Expenditure from buying permits

- The corresponding fines, if you produce over the number of permits, and you are inspected

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= Total Profit for the period

Profits of each period are added to the working capital and profits from previous periods to comprise the accumulated earnings up to that period.

However, it is important that you keep in mind that in the case you get negative accumulated earnings in a given period, you will not be able to continue participating in the activity. In this case you will see a screen like the one shown in Figure 1 below with the message: "Please wait until the experiment continues." You will have to wait for the next task of the experiment sat silently at your post.

Figure 1

Let's see now how to enter your decisions on the computer.

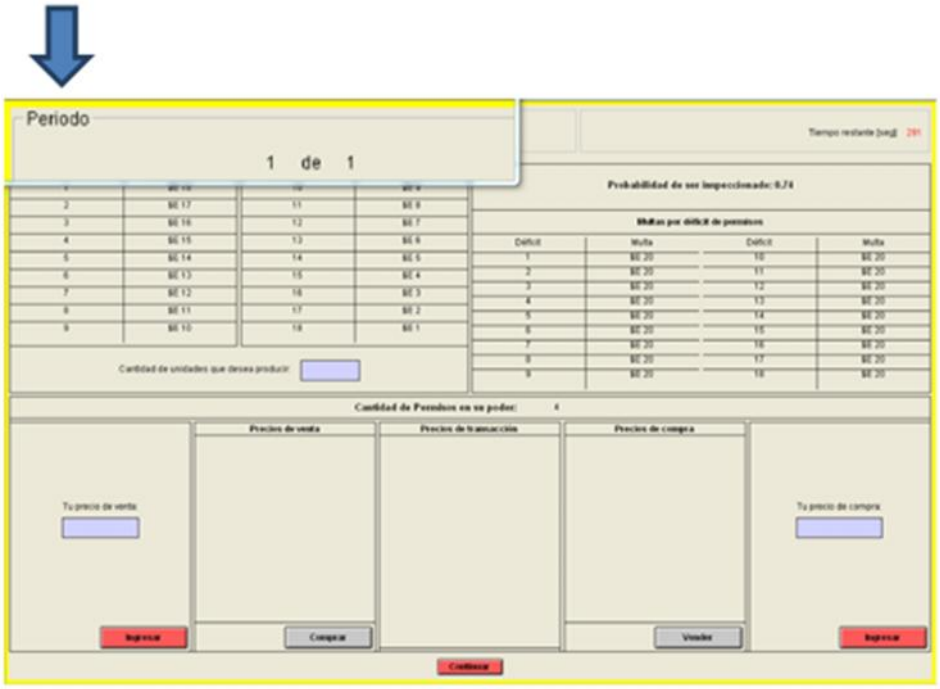
Entering your decisions on the computer

On the next page you can see a purely hypothetical example of the main screen you will see during this experiment. The screen is divided into several parts. Here we will explain each of these parts.

Period

At the top left, where the blue arrow points, you can see the number of the current period of the experiment and the total periods. (See blue arrow in Figure 2). In this hypothetical example, it is reported that you are in period 1 and the total periods is 1.

Figure 2



Production Gains

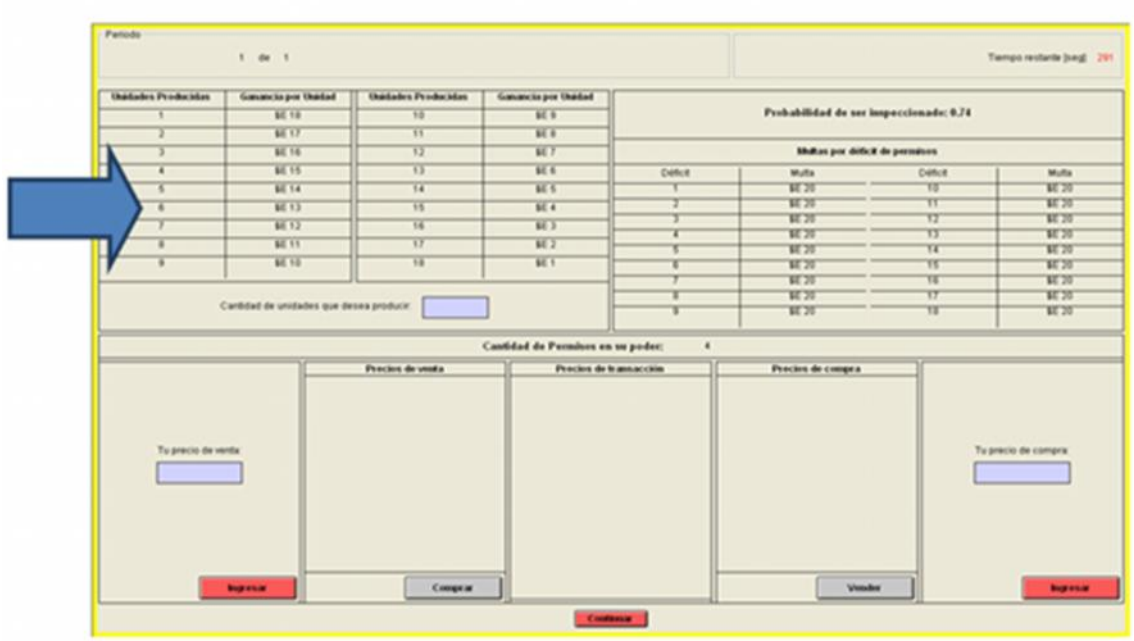
As explained previously, during each period you will have the opportunity to produce units of a fictitious commodity. In the case shown in Figure 3, you can produce a minimum of 1 unit and a

maximum of 18 units. For every unit you produce, you earn a certain amount of money in "experimental pesos" ($ E). So, the more units produced, the greater your income in $ E.

The amount of experimental pesos you get for each unit produced is shown in the left quadrant in the center of your screen. (See Figure 3).

Every unit you produce generates profits automatically. You can think of this as a "sale" of the units you produce to the researcher / experimenter. This "sale" is performed automatically as soon as the production of each unit is completed. We will refer to this income as "Earnings of Production."

Figure 3



See Figure 3. Let's say you decide to produce 3 units. You will receive $E 18 for the first unit produced, plus $E 17 for the second unit, plus $E 16 for the third unit. Total revenues for the three production units are $E 51 (= 18 +17 +16).

If you decide to produce a fourth unit you will receive additional $E 15, and a total of $E 66 for the four units (51 + 15).

Note that you may receive a different amount of money for each unit produced.

Remember that these values are hypothetical and may not look anything like the values that you see during the experiment.

The choice of the number of units to produce

Now that we have shown how to calculate the amount of money you get from the production, we will show how to choose your level of production. This is done as follows. On the screen where the blue arrow points in Figure 4, you can see a cell next to the title "Number of units to produce." In that cell, you must enter the number of units that you decide to produce.

The number of units you can enter must be between 1 and the maximum production capacity, which is 18 in this hypothetical example.

Fines for non-compliance

On the right side of the screen, you will see another table (see Figure 5). This table tells you the amount of money (in experimental pesos) that you must pay for each unit of production for which you do not have a permit, if inspected.

Figure 4

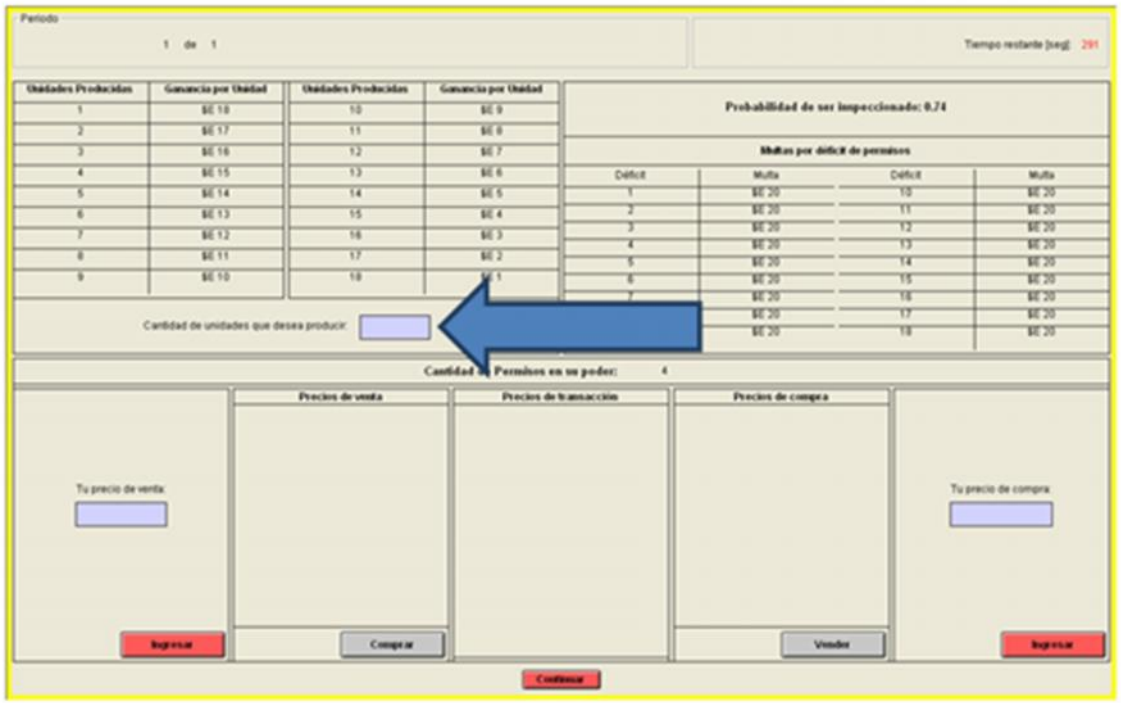
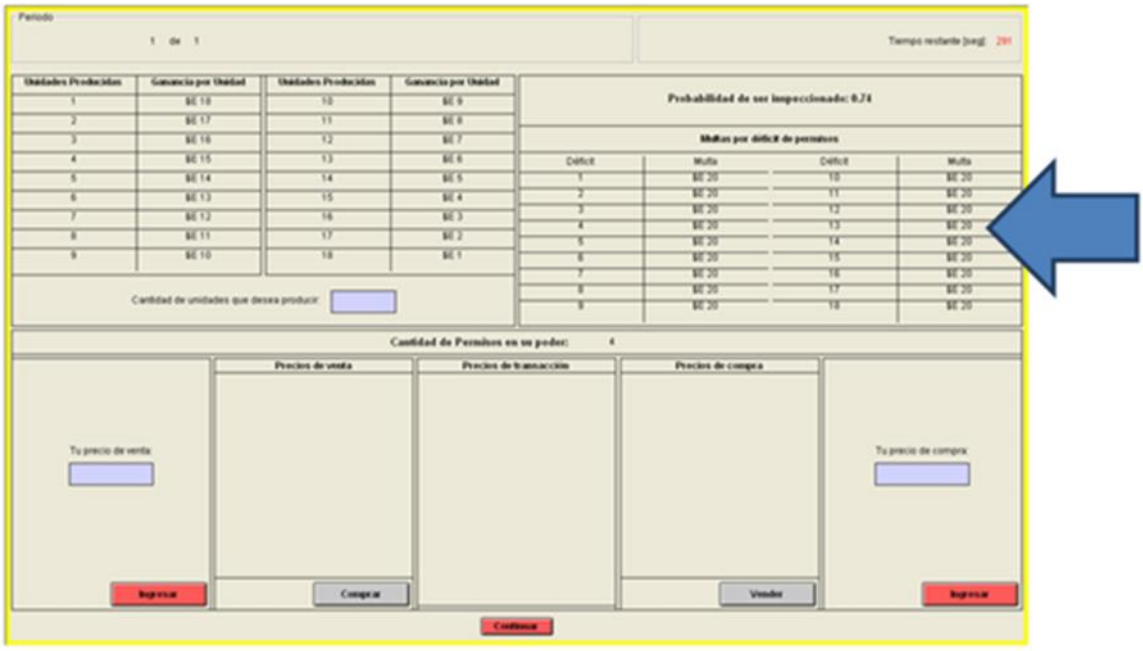

Periodo
1 de 1
Tiempo restante [seg]: 291
Unidades Producidas
Ganancia por Unidad
Probabilidad de ser inspeccionado: 0.74
Multas por déficit de permisos
Déficit
Multa
Cantidad de unidades que desea producir:
Cantidad de Permisos en su poder: 4
Precios de venta
Precios de transacción
Precios de compra
Tu precio de venta:
Tu precio de compra:
Ingresar
Comprar
Vender
Continuar

Figure 5


Periodo
1 de 1
Tiempo restante [seg]: 291
Unidades Producidas
Ganancia por Unidad
Probabilidad de ser inspeccionado: 0.74
Multas por déficit de permisos
Déficit
Multa
Cantidad de unidades que desea producir:
Cantidad de Permisos en su poder: 4
Precios de venta
Precios de transacción
Precios de compra
Tu precio de venta:
Tu precio de compra:
Ingresar
Comprar
Vender
Continuar

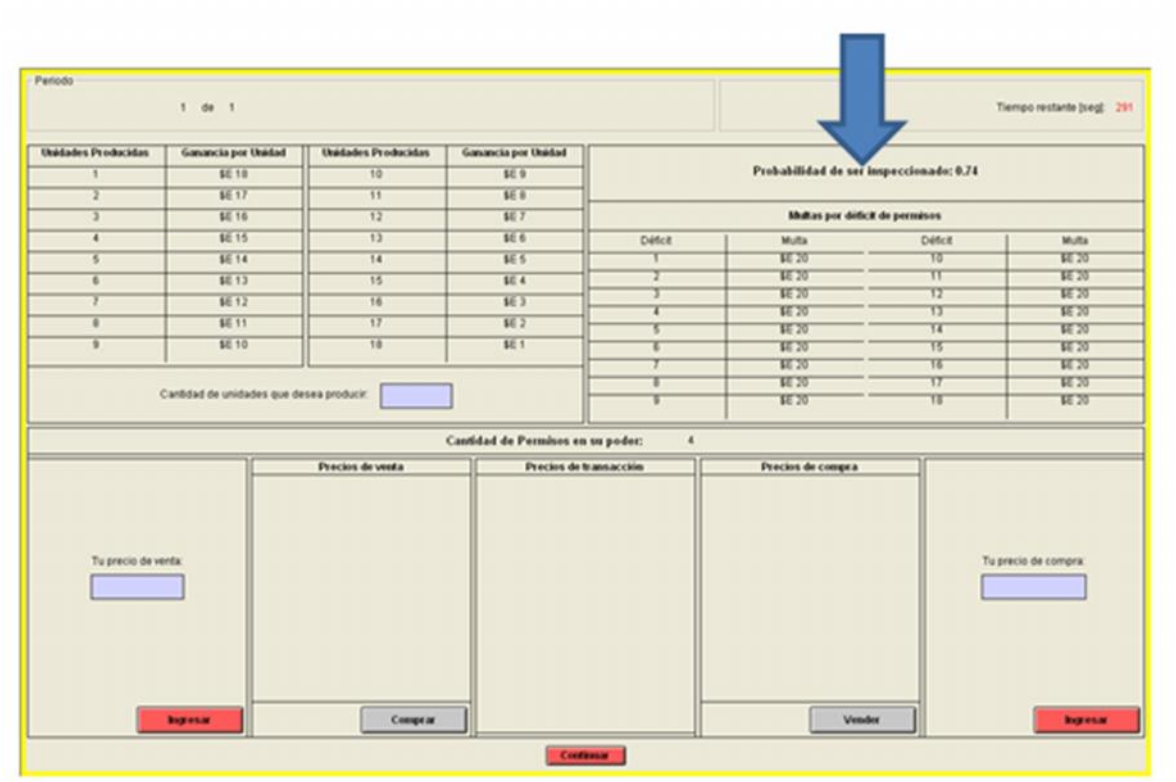
In this hypothetical example you pay $E 20 for the first unit produced without a permit, $ E 20 for the second, $ E 20 for the third. As your production capacity is 18 units, this table considers up to 18 units.

The total fine you pay is the sum of the fines for each unit of produced without a permit. An example: Suppose you decide to produce 5 units, and you have three permits. Your deficit is 2 permits. If you are inspected, you will be penalized $ 20 for the first unit missing permit, and $ 20 for the second unit of permits deficit. Therefore, the total fine of a deficit of 2 permits is $ 40. If you are not inspected, you will not be fined.

The probability of being inspected

Immediately above the table of fines, you will see the "probability of being inspected." (see Figure 6 below).

Figure 6



This is a number between zero and one (0 and 1) indicating the likelihood that you are inspected. If the number is zero (0), you would never be inspected. If the number is one (1), you would be inspected for sure in each period.

In the hypothetical example of Figure 7 above, the probability of being inspected is 0.74. This means that you face a 74% chance of being inspected in each period.

The possibility of being inspected materializes or not according to the following procedure: at the end of each five-minute period, after you and the rest of the subjects participating in the experiment have decided their level of production and purchase or sell of permits for that period, the computer will produce a random number between zero and one for each of the participants. If the number that the computer throws is less than your "probability of being inspected," then you will be inspected. If the number the computer throws is higher than your "probability of being inspected," you will not be inspected.

You will be informed if you are inspected or not.

If you are inspected, the computer compares the units you decided to produce in that period with the number of licenses that you own at the end of the period.

There are two possible outcomes of the inspection:

1. If your level of production in that period is greater than the number of permits you have at the end of each period, you will be fined.

2. If, however, upon inspection the computer finds that you produced a number of units of the fictitious good that is below or equal to the number of licenses that you own at the end of each period, then you will not be fined.

If you are not inspected you will not be fined even if you produced above the number of licenses you own. This is because you have to be inspected for the computer to see how many units of the fictitious good you produce, and compare it with the number of permits you have in each period.

Permit Market

This section describes the permits market where you can buy and sell permits.

In the center of the screen, next to the words "number of permits in your possession", you can see the number of permits that you possess at any time during the period. See Figure 7 below. At the beginning of each period, this amount is equal to the initial free allocation of permits that you receive. During the period, this amount will be updated automatically as you buy / sell permits.

In the Permits Market you can do four things:

1. Make a bid to purchase a permit,

2. Make an ask to sale a permit,

3. Buy a permit at the Selling Price,

4. Sell a permit Buying Price.

Now we will show how to do each of these things.

Suppose that you decide you want to sell one of their permits for $ 17.

To enter your ask to sale, type "17" in the cell that is located at the bottom left of the screen, along with the caption "Your selling price." This cell is indicated by a blue arrow in Figure 8.

Figure 7

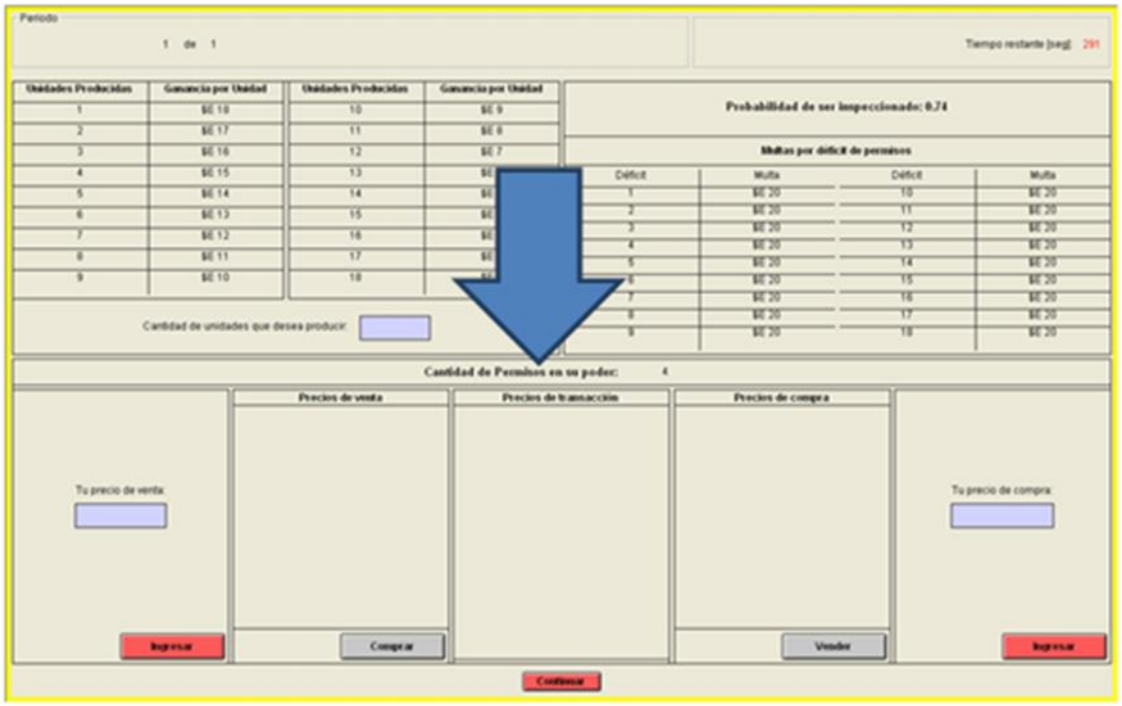
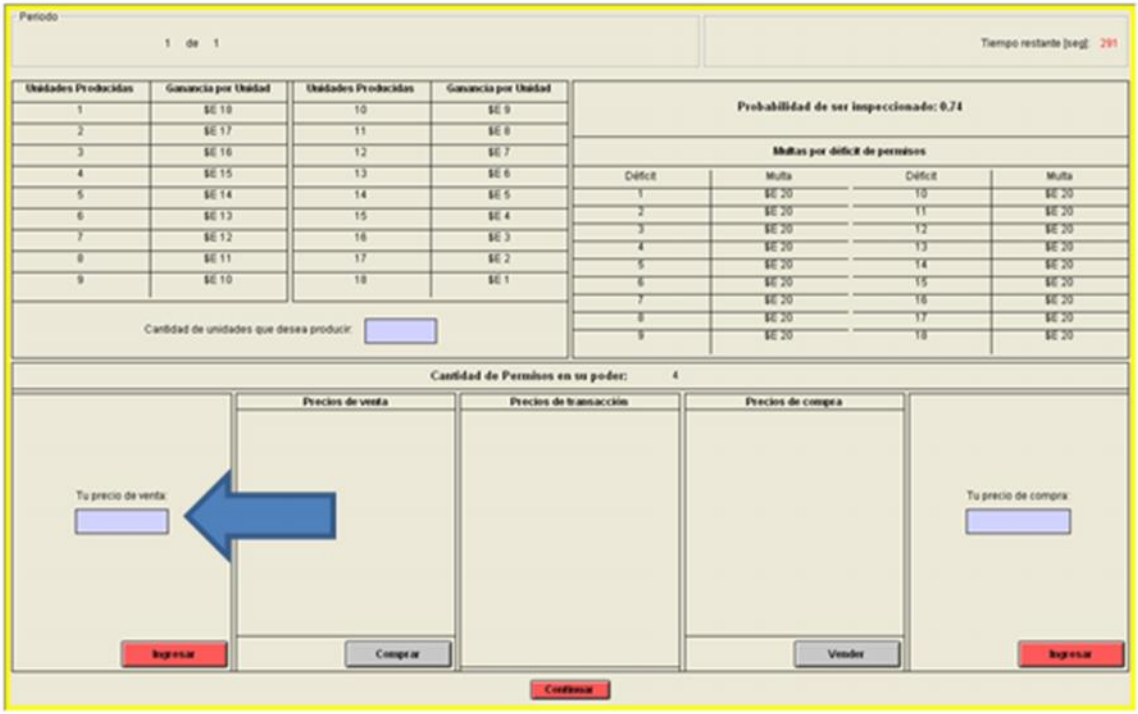


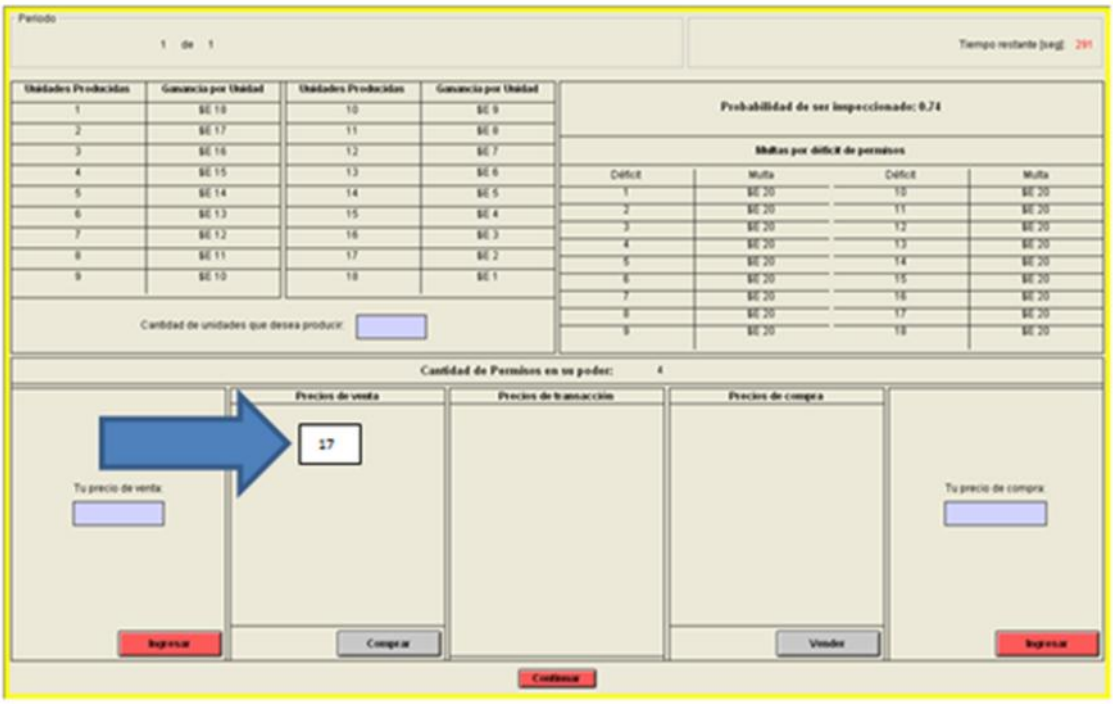
Figure 8



Then enter the price at which you want to sell, click the red utton located below the cell with the caption “Enter”.

When you enter your selling price of $17, if there is no lower selling price, your price of $17 is shown I the “Selling Price” column (see Figure 9), turning into the selling price of the market- This information is shown for all subjects that form your group in the experiment.

Figure 9



Suppose know that someone decides to put a bid for a permit for $ 10.

The bids are introduced similarly to the sales offers. To do this, you enter the price at which you want to buy in the cell under the caption "Your buying price" at the bottom right of the screen and click on the red button marked "Submit" (see Figure 10).

This buyer's bid of $ 10 is now shown to the entire market in the "Buying Price" (see Figure 11).

At any time, only the lowest ask and the highest bid will be active in the market. These are the lowest value that you can see in the "Selling Price" column and the highest value that you can see in the "Buying Price" column.

Any bid must be higher than the maximum "Buying Price". Similarly, any ask must be lower than the minimum "Selling Price".

In this hypothetical example, any bid that is higher than $ 10 will become the new buying price. Any new ask that is lower than $ 17 will become the new selling price.

You can only enter bids or asks in whole numbers (no decimal). Your bids or asks are shown in blue.

Suppose you decide you're willing to accept the buyer's bid of $ 10 for a permit. To sell your permit for this price, click on the 'Sell' button.

Figure 10

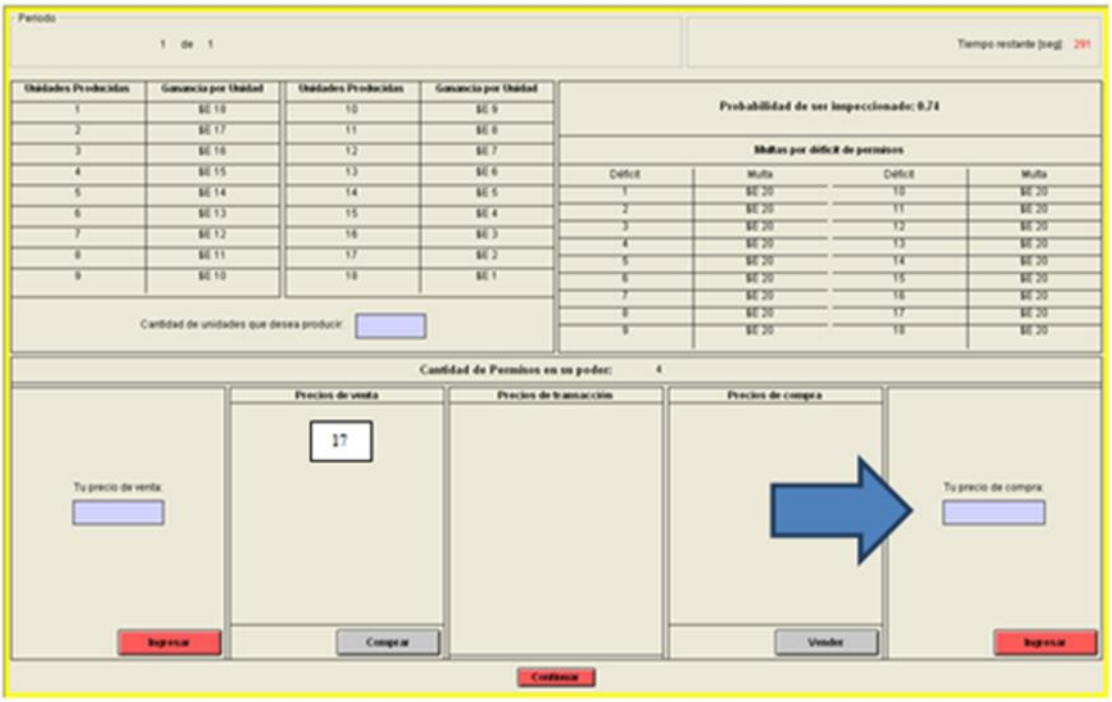
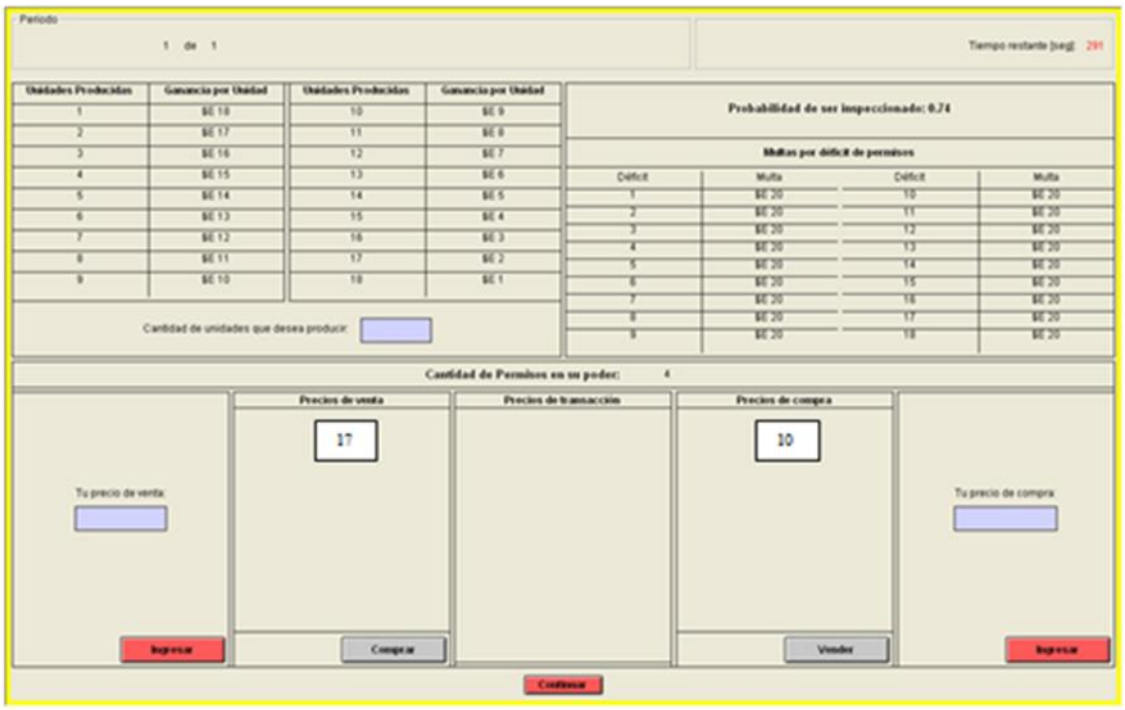


Figure 11



Once the exchange is done, the "number of permits in your possession" is automatically updated to reflect this transaction. If the initial allocation of permits in your possession was 4 units, as shown in Figure 11, this amount will now be 3 units since you sold a permit. Keep attention on this cell because it is not always obvious when you close a transaction.

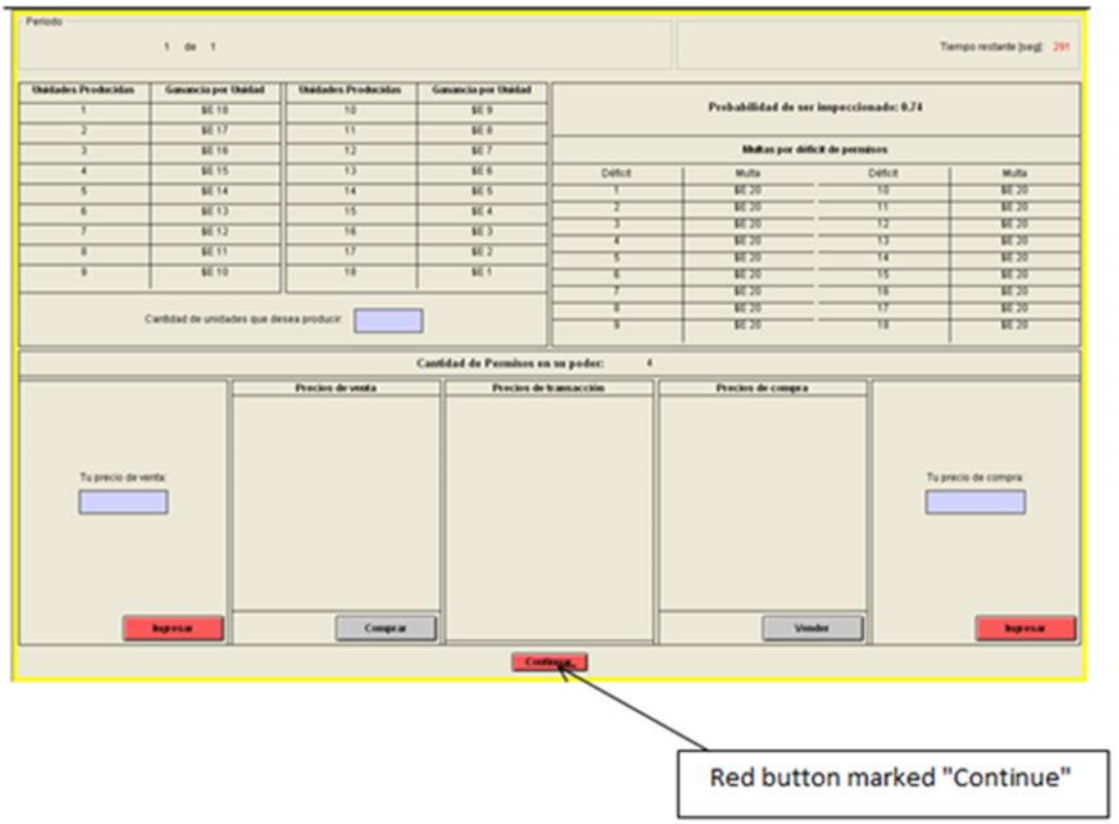
Finally, the price of $ 10 will appear in the middle column under "transaction prices". This column shows the price history at which permits were traded during the period.

After exchange occurs the selling price and the buying price go back to zero and the price negotiation process begins again. In other words, one permit at a time is traded in the market.

Time left

At the top right of the screen, where the blue arrow points in Figure 12 (see below), you can see the remaining time, in seconds, for the end of the period. In this hypothetical example illustrated in Figure 12, you are left with 291 seconds to decide the number of units that will produce.

Figure 12



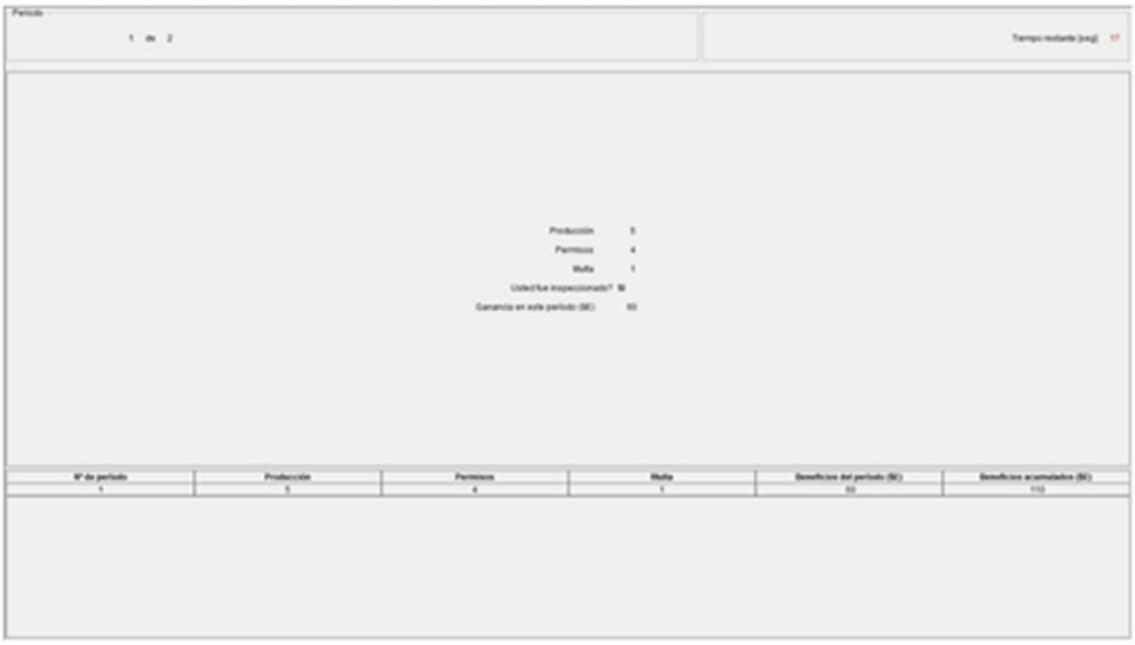
In each period of the activity, you will have a total of 5 minutes (300 seconds) to make your decisions. Once past the 300 seconds, the timer will stop at 0 and below the timer a warning in red will appear, flashing, that will tell you to finish the decision making.

Once you have decided how many units to produce and how many permits to buy / sell, you must press the red button marked "Continue", located below the screen to move to the next stage of the experiment.

Revenue in the period

After the inspection stage is complete, you will receive a summary of your income for the period. This summary is provided in a new screen that opens when you press the "Continue" button. A hypothetical example of this screen is shown below in Figure 13.

Figure 13



This second screen has two parts. In the center of the screen, it tells you:

(A) the number of units you decided to produce in the period (to the right of the words "Production"),

(B) The number of permits you possess at the end of the period (to the right of the caption "Permits"),

(C) The results for this period of the random process (described above) by which the computer decides whether you are inspected or not (to the right of the caption "Were you inspected?" And

(D) The number of permits you hold below your production level and for which you are fined, if you are fined in the period (to the right of the caption "Fines"), and

(D) Your profit in the period in experimental pesos.

In the hypothetical example shown in Figure 13 above, you produced 5 units, had 4 permits, were inspected and fined for one permit. Your profit in the period was $ 60 E.

Further down in the same Figure 13, you can see a table. This table tells, for the last period (and earlier): the number of the period, the level of production, the benefits of the period and finally, the accumulated profits up to that period.

In the first period, the accumulated profits differ from profits in the first period in an amount equal to the initial working capital with which you began the experiment (in the hypothetical example of Figure 13, in the first period earnings were E $ 60, but its benefits are accrued $ E 110, the sum of $ 60 plus a working capital of $ 50).

Finally, this screen will be active for a period of 25 seconds, after which it automatically closes and the main screen where you must choose the level of production and the number of licenses you want to own opens again and the next period begins.

This process is repeated for a certain number of periods.

Your "Earnings per Production", the initial amount of permits at the beginning of the period, the "probability of being inspected," and the amount of "fines for permit deficits" are constant during all periods.

Calculator, pen and paper

In case you need it, we have provided you with a calculator, two sheets of paper and a pencil.

We have reached the end of the explanation of the first activity of the experiment. We summarize the key aspects of it.

Summary of the first activity of the experiment

• The first activity of the experiment is a series of periods in each of which you must decide how many units of a good fictional produce.

• For every unit you produce, you will earn a certain amount of money, expressed in "experimental pesos" ($ E). The more units you produce, the higher your profits.

• The table "Earnings per production" tells you how much you will earn per unit produced.

• You can produce as many units as you want, regardless of the number of licenses you own, but you could face a fine if you do not have a permit for each unit produced.

• You will be given the opportunity to buy and / or sell permits in the permits market.

• Once you and the other individuals involved in this experiment decide how much to produce in the period and how many permits to possess, the computer produces a random number to decide whether or not you will be inspected. To be inspected the number between 0 and 1 randomly generated by the computer must be less than the "probability of being inspected" that you see on your screen.

• If are inspected and produced more units than the number of permits held, you will be fined under according to the fines table that you can see at the right of your monitor.

• If you are inspected and produced less or an amount equal to the number of permits in your possession, you will not be fined.

• You will not be fined if you are not inspected.

• Your net profit for each period is calculated as follows:

+ Revenues from the production of the fictitious good

+ Proceeds from the selling of permits

- Expenditures for buying permits

- The corresponding fines, if you produce over the number of permits, and you are inspected

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= Total Profit for the period

• The earnings of each period are added to the working capital and earnings of prior periods to comprise the earnings accumulated up to that period.

We reviewed all components of the first activity of the experiment. If you have a question, please do so at this time, otherwise it will start the first activity.

A2.1.2 Second experiment activity

We will now proceed to explain the second experimental activity.

The second activity of the experiment is exactly equal to the first activity, except that:

1. The earnings accumulated in this activity expressed in experimental pesos ($ E) will be converted to Uruguayan pesos ($ U) at an exchange rate of one Uruguayan peso ($U 1) for forty experimental pesos ($E 40). That is, $E 40 = $U 1. These gains in Uruguayan pesos will be part of your actual earnings that you will receive at the end of the experiment.
2. You may face different values of the following variables:
    - The initial quantity of permits you received for free

- “Production benefits”
- "Probability of being inspected"
- "Fines per unit of violation"

We have finished explaining the second experimental activity. If you have a question, please do so at this time, otherwise we will start with the second activity.

A2.1.3 Third experiment activity

We will now proceed to explain the third experimental activity.

The third activity of the experiment is exactly equal to the second activity, except that you may face different values of the following variables:

- "Probability of being inspected"
- The initial quantity of permits you received for free

Earnings obtained in this third activity will be accumulated to determine the total quantity of cash (Uruguayan pesos) that you will received once all the activities of the experiment are finished.

If you have a question, please do it in this moment, otherwise we will start with the fourth activity.

A2.1.4. Fourth activity of the experiment

The fourth activity of the experiment consists of answering a questionnaire.

Some of these questions involve additional decisions by which you can also make money.

A2.2 End of Experiment

Upon completion of the questionnaire, a screen will tell you the amount of total earnings in the experiment in Uruguayan pesos. We will tell you how to proceed to collect the money immediately.

We have completed the explanation of the fourth experimental activity. If you have a question, please do so at this time, otherwise we will start the fourth activity.

4. Supplementary Tables

Table A.4.1: Comparison of predicted theoretical values of relevant variables with their summary statistics.
Permits Experiments
Treatment M1 is played first

Market Treatment 1 - Compliance Treatment		Mean Price per Period	Number of transactions per period	**Type 1 (l_0=4)**			**Type 2 (l_0=4)**			**Type 3 (l_0=6)**			**Type 4 (l_0=6)**		
				q	**l**	**v**	**q**	**l**	**v**	**q**	**l**	**v**	**q**	**l**	**v**
Theory		**74-80**	**10**	**7**	**7**	**0**	**6**	**6**	**0**	**4**	**4**	**0**	**3**	**3**	**0**
Experiments	Mean	75	9,8	6,3	5,8	0,5	6,6	5,9	0,7	4,8	4,5	0,3	4,1	3,8	0,3
	Std. Dev.	5,9	2,3	1,4	1,6	0,8	1,5	1,8	2	0,8	0,7	0,6	1,2	1	0,6
	Conf. Int. / Mode	[73.5, 76.6]	(8.0, 9.0)	7	7	0	6	6	0	5	4	0	3	3	0
	Median	76,6	10	6	6	0	6	6	0	5	4	0	4	4	0
	# Obs.	58	58	116	116	116	116	116	116	116	116	116	116	116	116
Market Treatment 2 - Violation Treatment		Mean Price per Period	Number of transactions per period	**Type 1 (l_0=2)**			**Type 2 (l_0=2)**			**Type 3 (l_0=3)**			**Type 4 (l_0=3)**		
				q	**l**	**v**	**q**	**l**	**v**	**q**	**l**	**v**	**q**	**l**	**v**
Theory		**74-80**	**6**	**7**	**4**	**3**	**6**	**3**	**3**	**4**	**2**	**2**	**3**	**1**	**2**
Experiments	Mean	109,1	6,4	5,8	2,8	3	4,8	2,9	1,9	3,6	2,1	1,5	3,5	2,2	1,3
	Std. Dev.	11,1	2,6	1,9	1,5	2,4	2,1	1,1	2,3	1,8	1,5	1,3	1,3	1	1,1
	Conf. Int. / Mode	[105.7, 112.5]	[5.6, 7.2]	5	4	1	4	3	0	3	2	2	3	3	1
	Median	111,7	6	5	3	2,5	4	3	1	3	2	1	3	2	1
	# Obs.	44	44	88	88	88	88	88	88	88	88	88	88	88	88

Table A.4.2: Comparison of predicted theoretical values of relevant variables with their summary statistics.
Permits Experiments
Treatment M2 is played first

Market Treatment 1 - Compliance Treatment		Mean Price per Period	Number of transactions per period	**Type 1 (l_0=4)**			**Type 2 (l_0=4)**			**Type 3 (l_0=6)**			**Type 4 (l_0=6)**		
				q	**l**	**v**	**q**	**l**	**v**	**q**	**l**	**v**	**q**	**l**	**v**
Theory		**74-80**	**10**	**7**	**7**	**0**	**6**	**6**	**0**	**4**	**4**	**0**	**3**	**3**	**0**
Experiments	Mean	85,4	7,3	6,7	5,7	1	6,4	5,8	0,6	4,8	4,4	0,4	4,5	4,1	0,4
	Std. Dev.	17,4	2,3	1,2	1,7	1,7	1,3	1	1	1,5	1,3	0,6	1,5	1,3	0,6
	Conf. Int. / Mode	[80.9, 89.9]	(6.6, 7.8)	6	7	0	6	5	0	4	4	0	3	3	0
	Median	82,9	7	7	6	0	6	6	0	4	4	0	4	4	0
	# Obs.	60	60	120	120	120	120	120	120	120	120	120	120	120	120
Market Treatment 2 - Violation Treatment		Mean Price per Period	Number of transactions per period	**Type 1 (l_0=2)**			**Type 2 (l_0=2)**			**Type 3 (l_0=3)**			**Type 4 (l_0=3)**		
				q	**l**	**v**	**q**	**l**	**v**	**q**	**l**	**v**	**q**	**l**	**v**
Theory		**74-80**	**6**	**7**	**4**	**3**	**6**	**3**	**3**	**4**	**2**	**2**	**3**	**1**	**2**
Experiments	Mean	99,2	5,8	5,1	3,3	1,8	4,9	2,6	2,3	4,2	2,3	1,9	3,2	1,8	1,4
	Std. Dev.	8,4	3,6	1,3	1,5	1,4	1,7	1,4	1,8	1,9	1	1,9	1,5	0,8	1,2
	Conf. Int. / Mode	[96.5, 101.8]	[4.7, 6.9]	5	4	1	4	3	2	3	3	1	2	2	1
	Median	101,2	5	5	3	1	5	3	2	4	3	2	3	2	1
	# Obs.	42	42	84	84	84	84	84	84	84	84	84	84	84	84