Lecture 5 (JK, March 19)

Environmental Policy in the Central European Context

Time: Thursdays 3 p.m. – 6 p.m.
Location: at CERGE-EI, Room # 7

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Undergraduate Program in Central European Studies

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WEEK: TOPICS: DATE: INSTRUCTOR
1 Introduction (history/outline) Feb 19 JK/AO
2 Market failures: externalities, tragedy of the commons, enforcement as public good, also, (rise and fall) of the environmental Kuznets Curve February 26 AO
3 Interventionalist solutions to the Externality problem – Pigouvian taxes and standards and charges, also environmental labeling and incomplete consumer information in laboratory markets March 5 JK
4 Interventionalist solutions to the Externality problem – Marketable pollution permits March 12 AO
5 Non-Interventionalist solutions to the Externality problem – The Coasian solution March 19 JK
6 Non-interventionalist solutions to the Externality problem – Self-regulation March 26 AO
7 *Mid-term exam April 2*
8 Environmental Policy in the Czech Republic – History and current issues April 9 JK
9 Environmental Policy in the EU – History and current problems April 23 (April 16 falls into Semester break and on Easter Holiday) AO
10 Environmental Policy in the world context – History and Current problems April 30 JK/AO
11 Contingent valuation and related issues May 7 AO
12 To be determined by the interests of the class
Final exam: to be determined (according to schedule May 18 – 21)

Non-Interventionalist solutions to the Externality problem – The Coasian solution

Readings for Lecture 5:

Schotter, Microeconomics, A Modern Approach (2nd edition), Chapter 17, Sections 17.5 & 17.6

Coase, R. (1960), The problem of social cost. Journal of Law and Economics 3, 1 – 44.

Hoffman, E., Spitzer, M. (1982), The Coase Theorem: Some Experimental Tests. Journal of Law and Economics 25, 93 – 98.

Harrison, G., McKee, M. (1985), Experimental Evaluation of the Coase Theorem. Journal of Law and Economics 28, 653 – 670.

COASE - THE PROBLEM OF SOCIAL COST

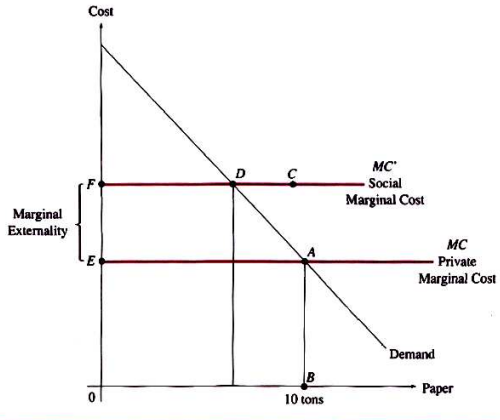
- a free market solution for the externality problem
- Coase – the agents are able to correct the effects of the externality by private agreement if they can costlessly negotiate among themselves to find a mutually beneficial way to split the gains and thereby achieving the Pareto efficient outcome

Recall the water-paper society example:

- Mill is producing 10 tons of paper at a (private) MC = \$0.005/pound = competitive price
- Water treatment plant MC = (\$.50 + extra \$.05 per each ton of paper produced) per 1,000 gallons of clean water
  - total MC is \$.50 +10(tons)*\$.05(externality)=\$1 per 1,000 gallons = competitive price
- assume at such price 1 mil. gallons of water is demanded.

FIGURE 17.2 Pigouvian taxes.

The imposition of a tax equal to the marginal externality (distance *EF*) equates the private marginal cost *MC* faced by the paper mill with the social marginal cost *MC'* and thereby induces the mill to produce at the optimal level for society (point *D*).



- **point A** – competitive market outcome -> Not Pareto Optimal. Why?

- ⇨ say the mill would reduce its production by 200 pounds. Given the market price that would mean a loss of 200x$.005=$1 in revenues
- ⇨ cost of producing clean water is now reduced by (200p/2000p)=1/10x$.05=$.005 per 1,000gal. => 1 mil. gallons would be produced at a cost of $995 instead of $1,000 -> $5 saved for the treatment = Pareto Improvement

Coase's argument

- negotiation => WTP can pay the mill something between $1 and $5 to reduce its production by 200 pounds which will make both parties better off
- if still room for improvement – further negotiation until they arrive to the P-O outcome
- what if mill owns the property rights for dumping wastes into the river? It is still profitable to forgo $1 in revenues and accept some >$1
- what if the WTP owns the property rights for the river? Mill will be willing to pay for being able to dump waste into the river as long as MR>MC. And the WTP will be willing to accept

COASE THEOREM In markets with externalities, if property rights are assigned unambiguously and if the parties involved can negotiate costlessly, then the parties will arrive at a Pareto-optimal outcome regardless of which one owns the property rights.

Coase, R. (1960), The problem of social cost. Journal of Law and Economics 3, 1 – 44.

1) Externality, liability, and property rights

- discussion of the externality problem, liability for damage, property rights assignment and optimal outcome from the point of view of an economist and of a court
- illustrated on number of court cases – it is not always straightforward to assign a property rights, liability for damage (who is to blame for the smoke, he who built a wall blocking the air flow or he who lights the fire? who is to blame for stained cocoa-nut fibre matting, the sulphate of ammonia manufacturer or the producer of the matting who uses a specific bleach which reacts with sulphate of ammonia?)
- *"The reasoning employed by the courts in determining legal rights will often seem strange to an economist because many of the factors on which the decision turns are, to an economist, irrelevant. Because of this, situations which are, from an economic point of view, identical will be treated quite differently by the courts. The economic problem in all cases of harmful effects is how to maximise the value of production."*
- *"the immediate question faced by the courts is not what shall be done by whom but who has the legal right to do what. It is always possible to modify by transactions on the market the initial legal delimitation of rights. And, of course,* ***if such market transactions are costless, such a rearrangement of rights will always take place if it would lead to an increase in the value of production.****"*

2) **Costly negotiation**

- *once negotiation is costly (often so in reality), the rearrangement of rights will only take place if the benefit exceeds the cost. In that case the initial assignment of property rights matters!*

- *"Once the costs of carrying out market transactions are taken into account it is clear that such a rearrangement of rights will only be undertaken when the increase in the value of production consequent upon the rearrangement is greater than the costs which would be involved in bringing it about. When it is less, the granting of an injunction (or the knowledge that it would be granted) or the liability to pay damages may result in an activity being discontinued (or may prevent its being started) which would be undertaken if market transactions were costless. In these conditions the initial delimitation of legal rights does have an effect on the efficiency with which the economic system operates. One arrangement of rights may bring about a greater value of production than any other."*

3) Pigou's Treatment

- critique of Pigou's conclusions and the policy implications he draws
- if a railway is hold responsible for fires caused by sparks from the engine, under some parameterizations, taxing the railway may cause it to cease its operation completely (no liability => 2 trains per day, liability=> 0 trains), society might be better off WITH two trains per day and some crops lost to fire (alternative production of crops).
- *"It is enough for my purpose to show that, from an economic point of view, a situation in which there is "uncompensated damage done to surrounding woods by sparks from railway engines" is not necessarily undesirable. Whether it is desirable or not depends on the particular circumstances."*
- *Another simple example:*
  "Imagine a town in which there are traffic lights. A motorist approaches an intersection and stops because the light is red. There are no cars approaching the intersection on the other street. If the motorist ignored the red signal, no accident would occur and the total product would increase because the motorist would arrive earlier at his destination. Why does he not do this? The reason is that if he ignored the light he would be fined. The private product from crossing the street is less than the social product. Should we conclude from this that the total product would be greater if there were no fines for failing to obey traffic signals? The Pigovian analysis shows us that it is possible to conceive of better worlds than the one in which we live. But the problem is to devise practical arrangements which will correct defects in one part of the system without causing more serious harm in other parts."
- *"Pigou is, of course, quite right to describe such actions* (externalities) *as "uncharged disservices." But he is wrong when he describes these actions as "anti-social." They may or may not be. It is necessary to weigh the harm against the good that will result. Nothing could be more "anti-social" than to oppose any action which causes any harm to anyone."*
- *"The social product equals the private product minus the fall in the value of production elsewhere for which no compensation is paid by the business. … The belief that it is desirable that the business which causes harmful effects should be forced to compensate those who suffer damage (which was exhaustively discussed in connection with Pigou's railway sparks example) is undoubtedly the result of not comparing the total product obtainable with alternative social arrangements."*
  EXAMPLE:
  Assume that a factory which emits smoke is set up in a district previously free from smoke pollution, causing damage valued at $100 per annum. Assume that the taxation solution is adopted and that the factory owner is taxed $100 per annum as long as the factory emits the smoke. Assume further that a smoke-preventing device costing $90 per

annum to run is available. In these circumstances, the smoke-preventing device would be installed. Damage of $100 would have been avoided at an expenditure of $90 and the factory-owner would be better off by $10 per annum. Yet the position achieved may not be optimal. Suppose that those who suffer the damage could avoid it by moving to other locations or by taking various precautions which would cost them, or be equivalent to a loss in income of, $40 per annum. Then there would be a gain in the value of production of $50 if the factory continued to emit its smoke and those now in the district moved elesewhere or made other adjustments to avoid the damage.

…

Without the tax, there may be too much smoke and too few people in the vicinity of the factory; but with the tax there may be too little smoke and too many people in the vicinity of the factory. There is no reason to suppose that one of these results is necessarily preferable.

…

The aim of such regulation should not be to eliminate smoke pollution but rather to secure the optimum amount of smoke pollution, this being the amount which will maximise the value of production

SUMMING-UP

- it is not always desirable to make the producer of the externality automatically liable for the damage caused, one has to take into account all circumstances, cost and benefits of ALL involved, costs of alternative arrangements
- *"…if the parties involved can negotiate costlessly, then the parties will arrive at a Pareto-optimal outcome regardless of which one owns the property rights."*

- work through the numerical examples of section III. and VI. (the cattle-raiser vs. farmer) and of section VIII. p. 32-33 (railways); we've done similar exercises

EXPERIMANTAL EVALUATION

I. Hoffman, E., Spitzer, M. - The Coase Theorem: Some Experimental Tests. JLE 25 1982

Experimental testing of Coase's main idea that rational individuals, if allowed to negotiate costlessly, will find a way to rectify the damage done by the externality

Their results provide a overwhelming support the Coasian solution. Moreover, subjects do not seem to behave selfishly (or, rationally in economic sense)

FORMALIZATION OF COASE:

- *"Ronald Coase investigated the economic effects of liability rules for externalities when the affected parties can bargain with each other. Coase posited that a change in a liability rule will leave the agents' production and consumption decisions both unchanged and economically efficient within the following (implicit) framework:*
  (a) two agents to each externality (and bargain),
  (b) perfect knowledge of one another's (convex) production and profit or utility functions,
  (c) competitive markets,
  (d) zero transactions costs;

(e) costless court system,
(f) profit-maximizing producers and expected utility-maximizing consumers,
(g) no wealth effects,
(h) agents will strike mutually advantageous bargains in the absence of transactions costs."

- *"Coase's Theorem is much more a proposition than a typical economic theorem. Once the analyst fully accepts this point, the Coase Theorem's appeal depends on the reasonableness of assumption **h** in a typical Coase Theorem setting. In other words, one must know whether two people who are in a situation satisfying assumptions **a** through **g** will tend to act in accordance with assumption **h**."*

- …and that's what they were testing. And some more…

Existing (experimental) literature, issues, and new questions

- large and growing experimental literature exists on 2- and 3-person bargaining games, the main issue often is whether parties to a bargain will choose a Pareto optimal allocation
- 2 main questions
    - Pareto Optimality
    - Division of profits

Pareto Optimality

- (Existing) *"experimental evidence suggests that "Pareto optimal choices seem to be more frequent under the following conditions:*
    *(1) When subjects play for significant **amounts of real money**,*
    *(2) when all parties can engage in **free face-to-face communication***
    *(3) when parties can make **enforceable contracts** with one another*
    (4) when there is (="exists") *an **equal-split allocation** among the Pareto optimal allocations*
    *(5) when all parties have **full information** about one another's payoffs, and*
    *(6) when **prizes are paid in public**.*
  The first five conditions are all clearly contained in the Coase axioms. The last condition seems to be a natural extrapolation from Coase's perfect information and zero transaction costs assumptions."

Division of profits

- *"A second issue, which Coase himself does not raise but which has troubled some commentators, is how parties to a bargain typically divide the profits from a joint decision."*
- *" The experimental literature differs on this issue. On the one hand, many articles conclude that subjects divide profits either equally or in proportion to the effort each party extends. On the other hand, an almost equally large literature concludes that subjects try to maximize their own profits and refuse to settle for less than they could command by operating alone."*
- *In general, the following experimental conditions seem to be associated with more equal splitting of profits:*
    *(1) **repeated, face-to face negotiations***
    *(2) the ability to choose a Pareto optimal allocation which is also an **equal split;***

(3) ***public payoffs****; and*
(4) ***full information*** *about one another's profits*

New questions

- **Bargaining with side payments allowed** – *"There have been very few experiments which have both required subjects to bargain over a variety of different discrete choices and allowed them to make side payments to one another at the same time*
- **Extension to larger (>2) groups** – *"Another important question raised by Coase's critics is whether a proposition describing two-person bargaining can be extended to larger groups. Experiments with three- and four-person games suggest that Pareto optimal outcomes can be achieved, but experiments with larger groups have generally concluded that free-rider problems take over unless special allocation mechanisms are imposed. However,* ***these larger group experiments have not allowed open communication, side payments, and enforceable contracts****."*

=>

- set of controlled experiments designed to test the Coase proposition in 2- and 3-person bargains
- the results strongly favor the Coase proposition
- the results also strongly suggest that parties engaging in repeated negotiations with one another may split profits equally even though in single-shot negotiations they are more likely to choose individually rational ("selfish") divisions
- of the 114 experimental decisions, 89.5 percent were Pareto optimal, in 62 of those payoffs were divided nearly equally

EXPERIMENTAL DESIGN

- 2-person and 3-person setup,
- full and limited information
- sequential (repeated) and non-sequential (one-shot) interaction

A. 2-person setup

a) PERFECT INFORMATION

- subjects randomly assigned A or B
- each pair in a separate room, with monitor present (instructions)

Specific Instructions to Participants

You will be asked to make several choices. Each choice will involve choosing a number. The cash value to you of the number is given in the set of payoff sheets attached to your instructions (see pp.). For example, if $5 were next to number 2 on your payoff sheet and if number 2 were chosen, then you would be paid $5. In the example shown below, for instance, you might be person B. Your payoff sheets list not only the value of each number to you, but also the value of each number to the other participant.

Two of you will participate together on each decision. One of you will be designated the "controller." The controller may, if he or she wishes, choose the number by himself or herself and inform the monitor, who will stop the experiment and pay both participants. The other participant may attempt to influence the controller to reach a mutually acceptable joint decision; the other participant may offer to pay part or all of his or her earnings to the controller.

…

If a joint agreement is reached, both parties must sign the attached agreement form, stating both what the chosen number will be and how much money will be transferred from one participant's earnings to the other's. No physical threats are allowed. If a joint agreement is made and the form is signed, the monitor will terminate the experiment and pay each participant according to the terms set forth in the agreement.

TABLE 1
SAMPLE PAYOFFS SCHEDULES ($)

A. TWO-PERSON EXPERIMENTS

DECISION 1			DECISION 2		
Number	A	B	Number	A	B
0	0.00	12.00	0	0.00	11.00
1	4.00	10.00	10	1.00	10.00
2	6.00	6.00	20	2.00	8.00
3	8.00	4.00	30	4.00	6.00
4	9.00	2.00	40	5.50	5.50
5	10.00	1.00	50	9.00	4.00
6	11.00	0.00	60	10.50	1.00
			70	9.00	0.00

B. THREE-PERSON EXPERIMENTS

DECISION 1				DECISION 2			
Number	A	B	C	Number	A	B	C
1	1.00	7.00	7.00	1	0.00	8.50	8.50
2	5.00	5.50	5.50	2	3.00	7.00	7.00
3	10.00	4.00	4.00	3	5.50	5.50	5.50
4	12.00	0.00	0.00	4	11.00	4.00	4.00
				5	13.00	0.00	0.00

- each number corresponds to a production decision
- payoffs according to a simple payoff schedule, each schedule has a clear joint-profit maximizing number which pays at least $1 more than the next highest
- one subject has the power to choose a number unilaterally => property right (Coase)
- instructions also allow subjects to make transfers to one another by contract
- after the instructions, understanding was tested
- flip of coin to assign the property rights (controller)
- the bargaining was face-to-face and public contracts were in writing and strictly enforced
- all payments were made in public
- subjects were not told what their objectives should be in choosing a number or in forming contracts
- environment as close as possible to one satisfying all the sufficient conditions for the Coase Theorem to hold: two parties who are fully informed about one another's payoffs and who have no transactions costs.
- authors suspected that parties to a bargain might divide the profits differently if their relationship were to continue than if they were to make only one decision => 2 versions of this first set of experiments:
    - **Sequential:** 6 pairs of subjects made 2 decisions each, in sequence. The coin was flipped to decide who was the controller before deliberation began on each decision. The subjects thus knew they would make two decisions together, but during the first decision, they did not know who would be controller for the second. The object was to simulate a legal environment in which the assignment of rights was uncertain but the parties knew they would have to maintain a continuing relationship. (a nuisance case in which the parties will interact over a period of time but in which the legal assignment of liability is not clear).
    - **Non-sequential**: 2 groups of 4 subjects who did not know one another made 6 single, pair-wise decisions each (a legal environment in which one bargain would be struck between two parties who would never have to communicate again)

ii) LIMITED INFORMATION

- an environment less favorable to Coase theorem
- subjects only know their own payoffs
- they were allowed to reveal their payoffs in bargain (didn't have to)
- otherwise same instructions
- sequential and non-sequential version

B. 3-person setup

b) PERFECT INFORMATION

- subjects randomly assigned A, B, or C
- each triad in a separate room, with monitor present (instructions)
- first part of the instructions same as before, but "three persons"
- "Either one of you will be chosen as the "controller" or two of you will be chosen as "joint controllers"

…

*a) **If one** of you is chosen, then the controller may, if he or she wishes, choose the number by himself or herself and inform the monitor, who will stop the experiment and pay all three participants. The other two participants may attempt to influence the controller to reach a mutually acceptable group decision; either or both of the other participants may offer to pay part or all of his or her earnings to the controller.*
*b) **If two** of you are chosen as joint controllers, then either joint controller may, if he or she wishes, attempt to choose the number. (This is done by filling out one of the attached forms and handing it to the monitor.) The joint controller who chooses the lower number will determine the number. If, for example, one joint controller chooses number 2 and the other joint controller chooses number 1, then the monitor will set the number at 1 and pay the participants accordingly. The remaining participant (the one who is not a joint controller) may attempt to influence either or both of the remaining parties to reach an acceptable group decision; any party may offer to pay all or part of his or her earnings to one or both of the remaining parties.*

In order to reach a group agreement, the following procedures must be followed:

*a) **If one** person has been designated the controller, then either one or both of the other participants can join the controller in a group decision by filling out and signing one of the attached agreement forms. All of the parties to an agreement must sign, and if any portion of any participant's earnings is to be paid to someone else, then the participant agreeing to pay must sign the agreement form before the agreement will be enforced by the monitor. Otherwise, the controller can choose the number alone.*
*b) **If two** participants have been chosen joint controllers, then both joint controllers must join in a group decision before it will become effective. Otherwise, the number will be chosen in accord with the procedure described in the preceding paragraph (that is, the joint controller choosing the lower number sets the number). The remaining participant may also be a party to a group agreement. Again, all of the parties to a group agreement must sign, and if any portion of any participant's earnings is to be paid to someone else, then the participant agreeing to pay must sign the agreement form before the agreement will be enforced by the monitor. No physical threats are allowed. If either party makes a physical threat, the threatened party will be paid his or her maximum payoff, and the threatening party will get nothing. When a group agreement is reached and the forms are signed, the monitor will end the experiment and pay the participant*

TABLE 1
SAMPLE PAYOFFS SCHEDULES ($)

A. TWO-PERSON EXPERIMENTS

DECISION 1			DECISION 2		
Number	A	B	Number	A	B
0	0.00	12.00	0	0.00	11.00
1	4.00	10.00	10	1.00	10.00
2	6.00	6.00	20	2.00	8.00
3	8.00	4.00	30	4.00	6.00
4	9.00	2.00	40	5.50	5.50
5	10.00	1.00	50	9.00	4.00
6	11.00	0.00	60	10.50	1.00
			70	9.00	0.00

B. THREE-PERSON EXPERIMENTS

DECISION 1				DECISION 2			
Number	A	B	C	Number	A	B	C
1	1.00	7.00	7.00	1	0.00	8.50	8.50
2	5.00	5.50	5.50	2	3.00	7.00	7.00
3	10.00	4.00	4.00	3	5.50	5.50	5.50
4	12.00	0.00	0.00	4	11.00	4.00	4.00
				5	13.00	0.00	0.00

- the instructions are meant to model a pollution externality; A might correspond to a factory which wished to dump the by-products of its production process into a stream, and B and C might be downstream riparian owners who dislike increased levels of pollution. The choice of a number would correspond to the choice of a level of pollution. If A were the controller, his power to choose the number unilaterally would represent the factory's right to pollute as much as it wished, without having to pay anyone anything. If B and C were joint controllers, their shared power might represent each riparian owner's independent right to obtain an injunction preventing the factory from dumping any pollutants. Under such circumstances, B and C's right to attempt to set the number independently would correspond to each riparian owner independently telling the factory the maximum level of pollution the riparian owner will tolerate. The factory obviously may not pollute to any greater extent than the lowest level allowed from among the independent riparian owners. In just this way, if B and C attempt to set the number independently, the lower of their choices controls. For this very reason, all riparian owners would have to join in an agreement not to seek an injunction before the factory could rely on the agreement. Similarly, in the experiment, both B and C must join in a group agreement in order for A to be able to rely on it.

- instructions also allow subjects to make transfers to one another by contract
- after the instructions, understanding was tested
- flip of coin to assign the property rights (controller; either A alone, or B+C)
- the bargaining was face-to-face, public contracts were in writing and strictly enforced.
- all payments were made in public
- subjects were not told what their objectives should be in choosing a number or in forming contracts.
- environment as close as possible to one satisfying all the sufficient conditions for the Coase Theorem to hold: two parties who are fully informed about one another's payoffs and who have no transactions costs.
- ONLY sequential version

ii) LIMITED INFORMATION

- subjects only know their own payoffs
- they were allowed to reveal their payoffs in bargain (didn't have to)
- otherwise same instructions
- ONLY sequential version

EXPERIMENTAL RESULTS

TABLE 2
EXPERIMENTAL RESULTS

			Payoff Division				
Experiment	N	N_1: Joint Profit Maximum	N_2: Equal Splits	N_3: Within $1 Different from Equal Split	N_4: Controller Received Exactly the Individual Maximum	N_5: Controller Received More than the Individual Maximum	Other
Two person:							
Full information:							
Sequential	12	12	12	0	0	0	0
Nonsequential	12	11	5	0	4	3	0
Limited information:							
Sequential	8	8	6	0	2	0	0
Nonsequential	12	11	3	3	3	1	2
Three person, sequential:							
Limited information:							
Single controller	21	19	3	4	2	5	7
Joint controller	15	9	2	3	5	4	1
Full information:							
Single controller	13	12	3	2	1	2	5
Joint controller	16	15	9	2	1	3	1
Coin flip barred by subjects on second decision	5	5	4	1	0	0	0
Total	114	102	47	15	18	18	16

- 114 observations
- 89.5% of all decisions are Pareto optimal
- the only deviation from nearly 100 joint-profit maximization is in the case with
    - 3 persons
    - joint controllers
    - limited information
- negotiation and coordination more complicated

- confirmation that the Coase Theorem is supported under the following conditions:
  (1) two parties to a bargain, with and without full information;
  (2) three parties to a bargain and a single controller, with and without full information;
  (3) three parties to a bargain, joint controllers, and full information
- except of 15 cases, the controllers either agreed to split payoffs nearly evenly (in line with social psychological experiments) or demanded at least their individual maxima (game-theoretic solution to a bargaining problem, an individually rational allocation) -> in line with Coase as the Pareto efficient outcome is achieved
- sharing more frequent in a 2-person sequential scenarios (full or partial info seems to make little difference)
- sharing also frequent in a 3-person sequential setup with full info; moreover, number of subjects sign agreement for both decisions when making the 1st decision
- it is possible that less sharing will be observed with a subject pool other than college students (may not be as rationally self-interested as older people)

- *"Indeed, to the extent that the sharing behavior indicates that either the subjects were failing to profit maximize or were maximizing interdependent utility functions which might violate one of the axioms of the Coase Theorem, our results cannot be taken to verify the theorem. Since the initial conditions were not all satisfied, assumption h might not have received a good test. However, if our assumption regarding individual motivations were incorrect, then these results may take on even more significance, for they seem to indicate that the Coase Theorem's prediction about production still has great power; the Pareto optimum was chosen almost 90 percent of the time. "*

- *"These experiments would seem to say that in two- and three-person situations a scholar might be able to assert with some confidence that groups will behave as if all of the Coase Theorem's assumptions were satisfied. Nevertheless, the pattern of sharing vis-a-vis individual maximizing behavior may not be inconsistent with rational behavior in the fact of uncertainty. Sharing buys "good will" in a continuing relationship, especially one in which the other person might be controller the next time. While the expected value of demanding at least the individual maximum may be higher, the expected utility may be lower."*

- pattern in the three-person, sequential, full-information experiments is consistent with a downward-sloping demand curve for risk avoidance
- As Table 3 shows, in three-person, sequential, full-information experiments joint controllers were more likely to share than single controllers on both decisions. Moreover, all second-decision sharing was linked to a binding or implicit contract among the participants. Thus, either the participants had actually signed such a contract, or they had shared on the first decision, creating an implicit contract to share all proceeds

TABLE 3
THREE-PERSON, SEQUENTIAL, FULL-INFORMATION RESULTS

	Number	Number Which Shared
First decision:		
Single controller	8	4
Joint controllers	9	7
Second decision:		
Binding contract:	5	5
Single controller on first decision	2	2
Joint controllers on first decision	3	3
Single controller:	5	1
Single controller shared on first decision	1	1
Joint controllers shared on first decision	1	0
Joint controller:	7	4
Single controller shared on first decision	1	1
Joint controllers shared on first decision	3	3

CONCLUSION

- the results provide strong support for Coase's proposition that agents will bargain to a joint-profit- maximizing outcome when it exists in 2- and 3-party bargaining situations under full information and when one party has the right to make the decision unilaterally under limited information.
- it is too early to tell whether the experimental departures from Pareto optimality in jointly controlled, three-person, partial-information games are significant (4 of the 6 departures occurred in the first of two decisions and were followed by a Pareto optimal decision; thus, it may be that the game is more difficult to learn with joint controllers -- possible experience effect
- if these indications of failure to achieve Pareto optimal results in jointly controlled, three-person, partial-information games are confirmed by future testing, we may be able to derive substantial policy implications for the law

POLICY IMPLICATIONS EXAMPLE

- assume a particular new land use, e.g., a cement factory, interfering with other land uses, e.g., home-owning (a "nuisance")
- Regardless of whether the court finds the new factory to be a nuisance, the court must confront the issue of whether to grant the winning side the right to an injunction or to limit that side to a damages remedy.
- two injunctive remedies, which were modeled in the experiment, from which the court must choose:

  (1) Factory's right => the factory may pollute at any level it chooses.

(2) Homeowners' right => any homeowner is entitled to an order of the court directing the factory to emit no pollutants.

- The court may also choose from alternative two damages remedies:
  (Ia) Factory's right => the homeowners may obtain an order of the court directing the factory to emit no pollutants if and only if the home- owners pay the factory all damages from reducing the pollution.
  (2a) Homeowner's right => the factory may pollute at any level, but must pay homeowners for any damage caused by the pollution.
- problems:
  - injunctive relief may be inefficient because bargaining may fail to achieve Pareto optimality.
  - damages remedies are plagued by the difficulty of accurately appraising damages and the increased administrative costs associated with such a valuation.
- The almost complete dominance of Pareto optimal outcomes in the 2-person experiment suggests that, if there is only one homeowner, a court may choose from rules 1 and 2 (depending on whether the factory is or is not a nuisance) with confidence that the parties will bargain to an efficient outcome.
  Hence, injunctive entitlements have appeal in 2-party situations.
- with "many" homeowners, it has commonly been feared that strategic behaviors (often termed "free-rider problems") and problems of coordination may preclude the parties' rearrangement of judicial decisions into Pareto optimal patterns.
- The dominance of Pareto optimal outcomes in single controller, 3-person games suggests that, if there are two homeowners, a court may choose rule 1 with good confidence that the parties will bargain efficiently. However, with exactly the same parties, the results to date imply that a court may not choose rule 2 with the same high level of confidence about optimal bargaining.

II. Harrison, G., McKee, M., Experimental Evaluation of the Coase Theorem, JLE 28, 1985

- replication, and modification of H&S experimental design
- to get further insights on that part of H&S results that suggests non-selfishness

- **WHY?**

⇨ *"The Coase Theorem….. irrespective of which party has the unilateral property right (UPR) to impose the externality on the other party, we should find the Pareto-optimal level of externality generation. The compelling feature of this Coasian result is that it is brought about by the self-interest of each party and does not rely on their altruism with respect to one another or the visible hand of the state."*

⇨ H&S focus on the behavioral implications of assumption h, which implies two distinct behavioral outcomes:

(i) that the two parties will agree on a Pareto- optimal level for the externality; and

(ii) that any such agreement will be attained by means of a mutually advantageous bargain between the two parties.

⇨ H&S present experimental results that overwhelmingly support the first outcome but reject the second outcome. Pooling over all their experiments, 89.5 percent of all

bargains resulted in a Pareto optimal solution. However, in 60.8 percent of those solutions the two parties essentially agreed to split the total payoff equally, even though this represented a disadvantageous bargain for one of the parties (the "controller," or holder of the UPR) relative to the payoff attainable without any bargaining.

⇨ H&S explicitly recognize the problem with their results:

A core allocation is individually rational, Pareto optimal, and rational for every possible winning coalition of players. Some might argue that our results do not support Coase's hypothesis because so many subjects split equally instead of bargaining to a core allocation. It seems to us, however, that Coase's efficiency prediction has been the crucial part of his hypothesis in shaping legal and economic policy. It is on that basis that we claim our results support the Coase Theorem. We recognize that Coase expected the income distribution would favor the controller. That expectation is, of course, not confirmed in general by our results.

⇨ Ignoring the exegetical issue of what Coase "really meant," we can argue that the policy significance of the Coase Theorem derives primarily from the view that **the delimitation of UPR serves to facilitate the internalization of externalities through individually rational bargaining…**

⇨ … **The critical behavioral presumption, then, is that the affected parties act in a self-interested fashion in the bargaining** context defined by the initial property rights assignment. This presumption is **not supported by the results of H&S**. An alternative line of defense of their results is offered by Hoffman and Spitzer, based on the interpretation of their results as reflecting the altruism of their subjects:

Indeed, to the extent that the sharing behavior indicates that either the subjects were failing to profit maximize or were maximizing interdependent utility functions which might violate one of the axioms of the Coase Theorem, our results cannot be taken to verify the theorem. Since the initial conditions were not all satisfied, assumption h might not have received a good test. However, if our assumption regarding individual motivations were incorrect, then these results may take on even more significance, for they seem to indicate that the Coase Theorem's prediction about production still has great power; the Pareto optimum was chosen almost 90 percent of the time. These experiments would seem to say that in two- and three-person situations a scholar might be able to assert with some confidence that groups will behave as if all of the Coase Theorem's assumptions were satisfied.

⇨ In short, the Coase Theorem is behaviorally "right for the wrong reasons." Moreover, if we can rely on economic agents to be altruistic with respect to the generation of externalities, why do we need UPR (or Pigouvian taxes, for that matter) to internalize the problem? In this light, the Coase Theorem is rendered behaviorally vacuous for policy purposes

So, what do H&M do?

- they develop an experimental design that allows further careful evaluation of the Coase Theorem in the simplest possible context:
    - two parties
    - full information concerning each other's payoffs
    - non-sequential bargaining (no continuing experimental relationships)
- they find that the comparable H&S results that are inconsistent with individual rationality are attributable to a lack of understanding by certain subjects of the meaning of UPR.

- Moreover, they demonstrate that the Coase Theorem is not behaviorally vacuous for policy purposes, by illustrating the necessity of an initial assignment of property rights for mutually advantageous bargaining to produce an efficient outcome.

EXPERIMENTAL DESIGN

- instructions follow Hoffman & Spitzer as closely as possible.
- neutral instructions
- each subject participated in 3 bargaining sessions (or, periods), each time different co-player
- in addition, they run a **"No Property Rights" session** (NPR), with no side-payments possible
- possible outcomes "agreement" vs. "disagreement" (on number chosen and corresponding payoffs);
- **3 alternative "disagreement" outcomes**: random (number is drawn and implemented), zero (zero payoff to both), controller (1 player is randomly designated controller, he decides, side-payments possible except of NPR session), learned at the beginning of each session
- SERIES OF EXPERIMENTS:
  1) replication of H&S, with unilateral property rights (UPR)
  2) no property rights (NPR)
  3) joint property rights (JPR)
  4) unilateral property rights, modified

1) Replication of H&S with UPR
   - UPR in all 3 sessions
   - slight modification of instructions (time limit of 10 mins for each session, subjects paid with a time lag), social surplus $1 or $2
   - *"We regard the introduction of a time constraint as a potentially important modification of the HS design for two reasons: (i) it avoids the problem of extraneous pressures on the time allowed for bargaining (for example, one subject may have a pressing appointment at a certain time), which may lead to different subjective costs of continuing to bargain; and (ii) it allows us to ensure that our financial incentives are salient for any particular subject pool (we can ensure that the potential payoffs are commensurate with the opportunity cost of the time involved in the experiment)."*
   - *"Although we have a strong prior expectation that these are behaviorally innocuous modifications for present purposes, it is important to confirm this before studying less trivial modifications. If this prior is not accepted, then our experiments do not constitute a literal replication of HS, but they do stand as an independent series of experiments. Moreover we may then examine the effect of the important modifications in an orthogonal fashion, irrespective of the extent to which we "replicate" HS."*
   - *HYPOTHESES:*
     H1. *The altruistic divisions of the joint payoff are due to learning behavior (that is, they occur primarily in sessions 1 or 2, and not in session 3).*

     - comes up from comparing the results of sequential and non-sequential 2-person, full info setups in H&S;
       - sequential => altruistic divisions;

- non-sequential => “only 45.5% of Pareto-optimal decisions altruistically divided

H2. *The altruistic divisions of the joint payoff are an artifact of a small social surplus (that is, increasing the surplus from $1.00 to $2.00 will reduce the number of observed altruistic divisions).*

- issue of opportunity costs of altruism in terms of forgone monetary payoff; or, alternatively, the opportunity cost of understanding the property rights of a controller

2) No Property Rights
   - bargaining environment with alternative disagreement outcomes
   - subjects can agree on number, but cannot contractually transfer to one another
   - implemented payoff schedule yields 2 P-O outcomes:
     i. P-O outcome that maximizes joint payoff
     ii. P-O outcome that divided the joint payoff (less than maximal) equally to both parties
   - HYPOTHESIS:
     H3*. In the absence of <u>transferable</u> property rights the parties will not choose the joint payoff maximum.*
   - rejection of H3 would mean there is no externality problem to be solved

3) Joint Property Rights
   - no party has the right unilaterally to choose any number but the two parties have the right to jointly choose any number and divide the total payoff as they wish
   - disagreement alternatives: zero or random (no party can be certain of positive payoff if they don’t agree)
   - *HYPOTHESES:*
     H4. *The establishment of joint property rights increases the number of joint maximum payoff outcomes.*
     - consistent with a weak behavioral form of the Coase theorem (JPR as a necessary condition for efficiency)

     H5. *The total payoff received under joint property rights will be equally split between the two parties.*
     - Nash solution for bargaining games of this form

4) Unilateral property rights , modified
   - first, training session of JPR (with zero or random disagreement outcomes)
   - HYPOTHESES:
     H6. *The establishment of unilateral property rights increases the number of joint maximum payoff outcomes.*
     - one can view the process with assigned property rights as a final stage of a bargaining series in which the initial periods involve incompletely specified property rights
     - pre-property-rights negotiation will impress the value of the property right on the person ultimately designated as the controller

     H7. *The establishment of unilateral property rights increases the number of individually rational bargains by the property right holder.*

- impact of pre-trial bargaining process on the post-trial allocation of resources
- if not rejected => strong support for behavioral form of Coase theorem

TABLE 2
EXPERIMENTAL DESIGN

Institution	Experiment	Session	Disagreement Outcome	Training Session	Social Surplus ($)	Payoff Schedule (See Table 1)
Unilateral property rights	UPR(1)	1	Controller	...	1	I
		2	Controller	UPR(1)	1	I
		3	Controller	UPR(1)	1	I
	UPR(2)	1	Controller	...	2	II
		2	Controller	UPR(2)	2	II
		3	Controller	UPR(2)	2	II
No property rights	NPR(Z)	1	Zero	...	1	III
		2	Zero	NPR(Z)	1	III
		3	Zero	NPR(Z)	1	III
	NPR(R)	1	Random	...	1	III
		2	Random	NPR(R)	1	III
		3	Random	NPR(R)	1	III
Joint property rights	JPR(Z)	1	Zero	...	1	I
		2	Zero	JPR(Z)	1	I
	JPR(R)	1	Random	...	1	I
		2	Random	JPR(R)	1	I
Unilateral property rights	UPR(Z)	3	Controller	JPR(Z)	1	I
	UPR(R)	3	Controller	JPR(R)	1	I

TABLE 1
ALTERNATIVE PAYOFF SCHEDULES

Schedule	Number	Payoff to A	Payoff to B	Joint Payoff
I	1	.00	4.00	4.00
	2	.50	3.50	4.00
	3	2.00	3.00	5.00
	4	2.50	1.00	3.50
	5	3.00	.50	3.50
	6	4.00	.00	4.00
II	1	.00	4.00	4.00
	2	.50	3.50	4.00
	3	2.50	3.50	6.00
	4	2.50	1.00	3.50
	5	3.00	.50	3.50
	6	4.00	.00	4.00
III	1	.00	4.75	4.75
	2	.50	4.50	5.00
	3	1.75	4.25	6.00
	4	2.50	2.50	5.00
	5	4.50	.50	5.00
	6	4.75	.00	4.75

NOTE.—The joint payoff values were not provided to subjects.

EXPERIMENTAL RESULTS:

- **H1 REJECTED**
  H1: *The altruistic divisions of the joint payoff are due to learning behavior (that is, they occur primarily in sessions 1 or 2, and not in session 3).*
  - ⇨ no apparent learning behavior across the three sessions -> probability of altruistic behavior not (statistically) significantly different in session 3;
  - ⇨ 45.5% of P-O with equal split in H&S vs. 60% in H&M -> the difference is not statistically significant though => **small modifications are behaviorally unimportant**

- **H2 CONFIRMED**
  H2: *The altruistic divisions of the joint payoff are an artifact of a small social surplus (that is, increasing the surplus from $1.00 to $2.00 will reduce the number of observed altruistic divisions).*
  - ⇨ increasing the social surplus significantly reduced altruistic divisions from 60% to 11.1%;
  - ⇨ might indicate that the individual irrationality in H&S may be due in part to small social surplus

- **H3 strongly SUPPORTED**
  H3*: In the absence of <u>transferable</u> property rights the parties will not choose the joint payoff maximum*
  - ⇨ zero decisions in NPR involved joint-profit maximization;
  - ⇨ in NPR(Z), all agreed, 100% involved equal split,
  - ⇨ in NPR(R) 83.3% ended with disagreement outcome
  - ⇨ **there is indeed an externality problem**

- **H4 SUPPORTED**
  H4: *The establishment of joint property rights increases the number of joint maximum payoff outcomes.*
  - ⇨ 97.1% of decisions with JPR lead to maximum joint profit

- **H5 SUPPORTED**
  H5: *The total payoff received under joint property rights will be equally split between the two parties.*
  - ⇨ 97% of the P-O outcomes equally split

- **H6 firmly SUPPORTED**
  H6: *The establishment of unilateral property rights increases the number of joint maximum payoff outcomes.*
  - ⇨ 88.2% of decisions that establish UPR in session 3 are P-O; difference in efficiency of JPR and UPR not significant (follows from strong acceptance of H4)

- **H7 cannot be rejected**
  H7: *The establishment of unilateral property rights increases the number of individually rational bargains by the property right holder.*
  - ⇨ UPR with trained subjects (trained under JPR) 76.5% outcomes individually rational, while in the initial UPR (replication) generated only 40% individually rational outcomes for the controller; dramatic support for the Coase Theorem

TABLE 3
EXPERIMENTAL RESULTS

EXPERIMENT	SESSION	NUMBER OF DECISIONS (N)	NUMBER OF JOINT PROFIT MAXIMUM DECISIONS (N_1)	PAYOFF DIVISION: Equal Splits (N_2)	Within $1.00 of Equal Splits ($N_3$)	Controller Receives Exactly the Individual Maximum (N_4)	Controller Receives More than Individual Maximum (N_5)	Other (N_6)	Disagreement Outcome (N_7)
HS	All	12	11	5	0	4	3	0	n.a.
UPR(1)	1	5	5	3	1	0	1	0	0
	2	5	5	2	0	1	2	0	0
	3	5	5	3	0	2	0	0	0
	All	15	15	8	1	3	3	0	0
UPR(2)	1	3	3	1	0	0	2	0	0
	2	3	3	0	0	1	2	0	0
	3	3	3	0	0	0	3	0	0
	All	9	9	1	0	1	7	0	0
NPR(Z)	1	2	0	2	0	n.a.	n.a.	0	0
	2	2	0	2	0	n.a.	n.a.	0	0
	3	2	0	2	0	n.a.	n.a.	0	0
	All	6	0	6	0	n.a.	n.a.	0	0
NPR(R)	1	2	0	1	0	n.a.	n.a.	0	1
	2	2	0	0	0	n.a.	n.a.	0	2
	3	2	0	0	0	n.a.	n.a.	0	2
	All	6	0	1	0	n.a.	n.a.	0	5
NPR (Z and R)	All	12	0	7	0	n.a.	n.a.	0	5
JPR(Z)	1	7	7	6	1	n.a.	n.a.	0	0
	2	7	7	7	0	n.a.	n.a.	0	0
	All	14	14	13	1	n.a.	n.a.	0	0
JPR(R)	1	10	10	9	1	n.a.	n.a.	0	0
	2	10	9	8	0	n.a.	n.a.	0	2
	All	20	19	17	1	n.a.	n.a.	0	2
JPR (Z and R)	All	34	33	30	2	n.a.	n.a.	0	2
UPR(Z)	3	7	6	2	0	2	3	0	0
UPR(R)	3	10	9	0	1	5	3	1*	0
UPR (Z and R)	3	17	15	2	1	7	6	1	0

NOTE.—Refer to Table 2 for a description of the experimental design; n.a. means outcome not applicable.
* Controller chose his individual maximum and transferred $1.00 to the other player. This outcome was implemented by the agreement form, with both subjects signing.

CONCLUSION

- strong support for the Coase Theorem
- in contrast to H&S results, which violate the individual rationality requirement of the Coase Theorem (as well as game theory).
- It would be interesting to undertake the boundary experiments identified by H&S (limited information concerning opponent payoffs and/or larger bargaining groups) with H&M experimental design, given that the Coase Theorem has now been established for the bargaining environment in which it was originally presented (full-information, two-person bargaining, individual rationallity)