Experimental Economics as a Tool for Developing Market-Oriented Environmental Management Programs
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I thought I would talk this morning about electricity and the environment because the electric power industry creates huge, terrible problems for the environment--problems that I think are unnecessary and can be fixed, but it's going to be very, very hard. I was going to talk a little about airport congestion because that's similar. Also, emission trading--the California experience. These are all things that we've had input in from the laboratory. Of course in the case of emission trading the laboratory was very essential in doing the testing of a two-sided combinatorial auction to match up the complex packages of SOx and NOx, and two regions, across time monthly, between buyers and sellers. And then I was going to talk a little bit about water.

I think I will, at the end, still have a chance to say something about electricity because I think that's really a kind of a paradigm problem of huge environmental impact, and nothing's really being done about it. [correcting himself:] Something's being done at the emission level, but there's much more involved than that.

I want to begin by talking a little about common property resources and two kinds of solutions--or types of analysis, frameworks of thinking--that are applied to common-property-resource and public-good-type problems. The first fall under the heading of what I call constructive rational analysis (and, sometimes, solutions) based upon incentium mechanism. Good examples of those would be Scott Gordon's path-breaking paper in 1954 in the JPHE [Journal of Public Health Education] that anticipated Garrett Hardin's science work by 14 years. That paper, though, is really about property rights and the problems created in the fishery [sic]. Of course, Garrett Hardin also dealt with some of those issues.

Another example of constructive rational analysis is of course, Samuelson's original public goods paper. Out of that paper, since there was no decentralized solution to that problem, the presumption has always been that the private sector could never solve public good problems and common property resource problems--the government had to solve them. Anyone who believes that has got to believe that Al Capone was a Catholic Cardinal in Chicago in the 1920's. It's unbelievable, those early naïve views that the government would solve those problems. We now look back on that and it's not clear whether the government is a source of solutions or a source of problems having to do with externality and public goods.

The title of this conference tells us, I think, that that whole way of thinking is completely changed now. The question now is not necessarily Who?, but How? The devil is in the details, and where people are worrying about incentives and the mechanisms that give the right incentives, there's still a huge, huge country mile between that kind of thinking though and some kind of actual real-world application.

The other type of rationality I call "ecological"--ecological rationality--and there are a lot of good examples of that. It turns out that people worked on common property and public good resource problems long, long before there were any economists around to analyze the problem. Some of you are no doubt familiar with these. My colleague Bob Netting, who is in anthropology at the University of Arizona, did this great work on the Swiss alpine cheese makers. (Their solutions . . .and there isn't just one full-blown solution that burst out of air around 1200 AD, but you can identify solutions there to the commons problems that go back about 800 years.) It's more complex than just the simple statement I'm going to make, but an important part to the solution to their common property problem was the rule that the number of cows that you were allowed to graze in the commons meadows in the summer depended on the number that you carried through the winter. And theirs is a cold climate--the cows have to be indoors and there has to be heat. This is an expensive operation, so there is a limited capacity to carryover cows through the winter. Here the solution to the common property access problem was tied into a private property right. As I said, that's an over-simplification--there were a number of other aspects to the solution besides that. (The list, for example, that people like Lynn Ostrum have given you in summarizing Bob Netting's work, that's the first one. There are another three or four.)

Also, some of you may be familiar with Atchison's Maine lobstermen. About a hundred or so years ago they basically created property rights in the sea for setting lobster traps, and they enforced them. None of them were lawyers and none of them were legislators, and, in fact, they were no doubt breaking the law. If you worked as a Boston banker and decided to retire and move up to Maine and, just as a hobby, catch lobsters by putting a trap out there, you would right away find your trap floating, rather than being on the bottom, because it had been broken. And if you tried again, you could get yourself in serious trouble – these things were enforced.

Also, I think most of us know of Ronnie Cosa's work related to the theory of public goods, and the universal example that people use is the lighthouse. He asked a startling question: Let's see what people actually did with lighthouses. Well, it turns out they were private--most of them in the early years were private. How did they collect? Well, it turns out that ships have to stop in port somewhere, so the private lighthouse owner went to the port authority and collected there.

See, these are examples of emergent ecological solutions to problems where people, with at most, high school educations but with a lot of experience with the nitty gritty of the problem and an awareness of how costly it is, try out things and think of things and they come up with solutions. Of course I'm not trying to argue that every problem can be solved in this way--I'm just giving you that example.

Now, goats were first domesticated, I think, 10,500 years ago and I don't know when the first branding of domesticated cattle took place, but in the Egyptian tombs and hieroglyphics there are all kinds of references to branding. Also, in this country there was a national cattle industry before most of the west of the U.S. even had states--there were just territories. So, in a territory like Arizona there was open range--there was no

law; there was no local sheriff; there might have been a federal marshal, but he had a huge territory to cover. He didn't have much time and couldn't possibly handle your cattle rustling problems. So, people formed cattle clubs, and the cattle clubs financed hired gunmen, and the hired gunmen were to go around and check and make sure that the guy's cattle that he was talking to market didn't have somebody else's brand on it. So, they had a solution to that problem. It disappeared once you had a local sheriff. Think about it. We think of the government solving public good problems by solving the free righter [?] problem. No, it's often the reverse, as this example shows. Here was a solution that existed, and then the cattlemen, who had their own association and their clubs for solving the problem, said, "Wow, we're paying taxes--let's let the sheriff do this." So they wanted a free ride on the public budget and wanted the government to do something they had a solution to before.

I want to suggest that most of these emergent ecological solutions to problems could not have been invented by an economist because we [economists] have not traditionally thought about these problems in a way that would enable us to do that. I think now the great empirical work that has been done--and of course Lynn Ostrum's book on governing the commons is a magnificent source--now that so many of us are familiar with these ingenious mechanisms out there that people come up with, we are now sensitized more to those kinds of solutions, and I hope people have them in mind when they think about coming up with incentive mechanisms.

I sometimes use the example of a shopping mall. The shopping mall is a rather remarkable institution, and I don't think an economist could have invented the shopping mall because it's got too many shared-goods problems--public goods, common areas and then private--it's just a huge can of worms from that point of view. I don't think anyone has ever tried to do any kind of formal analysis of the shopping mall, but shopping malls have been around for a long time and they seem to work pretty well. People have worked out contracting arrangements for sharing public access stuff, for sharing utility bills on the commons part of it, the parking spaces, and yet also have a portion of the system that is under a private roof, and separating those things out.

I just want to bring to your attention that there are lots of these kinds of examples out there, and I think this points out a really important function of laboratory experiments. I think of laboratory experiments… Suppose you come up with a nice model, an incentive mechanism for solving a problem you see out there. If you are really daring and not very sensitive, you might actually go out there and try to put it into practice right away without testing it at all. You're asking for trouble when you do that, I think. If you're going to start in the field, you at least need to start on a small scale. To my way of thinking, it's better to test out the basic kind of incentive properties of that system in the laboratory. What you'll find is that by the time you've done the work that it takes to design the first experiment, your thinking will already have changed. The reason why it will already have changed is because we're not very good at forcing ourselves to express and define an institution in all of its details, if we're just sitting at our desk with a pencil and paper. But, if you ask yourself, 'How would I test this thing?' then you have to write instructions for subjects--you have to know what to do. When you design an experiment,

you're creating an institution in all of its detail. I think most experimentalists will tell you that maybe at least 40-50% of what they learn from any experimental program is in that before they even start running subjects. What you're doing is forcing a discipline on your thinking. In proving a theorem, you see, it's natural to consider both the assumptions and the results as variables, and you're trying to get a mapping from assumptions into results – that's how we make our living as theorists. And in theorems, the results are very much determined by finding something that's actually tractable. But for an experimentalist that's really just a bare beginning. When you start running experiments, you'll often find . . . Well, the first thing you find is that it's not what you expected or not completely what you expected, and you have to ask yourself why. That gets you back to thinking about the problem a little more from the point of view of the decision maker. It can force you to think about a lot of things that you have to come to terms with. You then go back and make some modifications and then go back to the lab again. Most studies involve this cycle, sometimes many times, especially if it's a very complex experiment. This is a form of ecological rationality. You see, you're finding out what real people can do, what real people tell you about what their problems are in trying to make decisions. Of course, it's some process like that that created the institution that we observe today with the Swiss Alpine cheese makers or with the Maine lobstermen.

I would be the last to argue that you are done when that mechanism goes out the door. All you've done is shake out some of the more obvious problems. You may have fairly fine-tuned it for that particular world, but when it goes into the field it's going to have a life of its own. Problems will come up that you didn't address in the laboratory, and sometimes it's useful, when those problems arise, to go back to the laboratory and see if you can understand what that problem is. With a combination of the empirical work you're now doing and a back-to-the-laboratory kind of exercise, where you have more control, you're seeking to get a better understanding and a better evolutionary or ecological outcome for that particular world that you are trying to create a new institution for. This will continue to go on because the world will change, and so then the institution no longer fits the world that it may have fit originally or even in the laboratory. So, I see this as a continuous process of monitoring and modification. When it gets into the world, things become more difficult because now you have stakeholders. You have people who don't want to change because it's not in their interest to allow a change. Coming to terms with that is probably one of our most difficult problems, because you're dealing now with a political process, which is inevitably much harder, I think. The economics is often fairly easy, and even the experimental part of it, compared to the politics of it.

Let me just say a little bit about electric power because that's something we've done a lot of experimental work in. The experiments tell us a lot about what the problem is out there. Here's the problem: During the typical day in any region in the world that's being served by electrical energy, the customer load will vary from off-peak to peak by a factor of about 2 to 1--sometimes less, sometimes more. The peak use of power is much, much higher, say double, what the off-peak use of power is. The capacity of the system--the capacity of generators, the capacity of transmission lines, the capacity of substations, all the wires in the system, the transformers, everything--is determined by that peak, not the off-peak. That huge capital investment, that mind-boggling amount of capital

investment, is idle a good bit of the time. (The reason why that's the way it works is because there aren't any good prices, right down to the appliance level of the end-use consumer.) Now, if you dry your clothes at 3 PM in the afternoon, you're paying for all of that capacity that you wouldn't need if people didn't dry their clothes at 3PM in the afternoon, and I'm not even mentioning just the energy. I can show you data in which the marginal cost of peak energy is 6 and 7 times the marginal cost of off-peak…and that's just the energy--there's no capital in that. Now if you think about that, I think you'll realize how incredibly poorly managed and organized is one of the largest industries in the world. There's a huge environmental impact of that--all these unsightly transmission lines--and they are trying now… FERC [Federal Energy Regulatory Commission] wants to get better incentives for investment so people will build more of them when we don't even know whether we need more of them, because we don't have any way of prioritizing the consumption of power to the end-use consumer and asking whether it's cheaper simply to have the flow of electrons interrupted to particular low-priority uses of power. This would make the consumer happier because he wouldn't pay as much overall, but still wouldn't be interrupted in times of peak usage. The way it works now is, in the American-style regulation (and it's no better in foreign-style government ownership), what has been "put in the saddle" is this myth that all demand at all times will be served, and furthermore, it will be served at a constant fair price--everyone pays the same amount--and of course it's the world's most unfair system because it's a system that levies a tax on all the off-peak users in order to subsidize all the peak users. The peak users, the guys drying their clothes at 3PM in the afternoon, are not paying their full costs. It's the off-peak guys that are subsidizing that. That's what happens when you're just looking at an average price that will give you enough average revenue to cover your average costs--it's all that "average" thinking that has created this monstrosity.

Hopefully this conference is going to get away from that, and is already getting well away from that. I puzzle how to deal with this problem. The first thing we did--that FERC did--when we moved toward deregulations of the wholesale markets was they separated the wires from energy. That's what they did with the high-voltage wires. The high-voltage wires were separated from generation because they saw those tie-in sales as a problem, but the low-voltage wires are just the same. So, your friendly local distributor has for 95 years been tying in the sale of energy to you with the rental of the wires, but there's no requirement that they have to be tied together. Where do you buy your gasoline when you rent a car? All you do is rent the vehicle--the guy doesn't care whether you drive it at all--he's just got a per-day charge, and you get your energy somewhere else. The wires business does not have to be combined with the energy business. To create free entry in just the energy part of it (and that is 55% or more of your bill) and to get some ecological experimentations going to find out what blend of consumer preference and interruption technology is going to yield a return on your investment. [sic] In order to allow the experiment--the long-standing experiment in free entry and exit (that's what all that's about--trial and error--the right to lose money and the right to keep it when you make some)--in order to get that to work, if you want to come in and get a customer from your local distributor and sell him energy, you can't do it without getting access to the wires. Because you're going to give him a rate--the

cheapest technology for giving him a rate that's going to depend upon use is just to go into his house and put a switch on a space heater, or a hot water heater if it's electric, or something like that. And you don't have to come into the house to turn it on or off--you would just have to send a signal to the switch, so there would be a contract to do that. Now, it really doesn't cost much to do that, but you have to get in the house. There's somebody else who's in the wires business who already owns those wires, and he's not well motivated to let you get in the house. Even if you pass a law and say that he can't block entry, he can still say, 'Well I can't let you in on Monday because we're doing some work and you'll have to wait two weeks.' If this sort of thing happens very much these guys [power providers] are out of business because there goes their margin.

In New Zealand there's actually a complaint procedure for alternative energy suppliers. If they're getting harassed by the local wires guy, they can file a complaint. Well, of course that's costly, and it will require an investigation, and they're trying to keep that from happening. All you have to do is remember… how many of you remember when no one was allowed in your house to work on the telephone wires unless that person came in Ma Bell's truck or AT&T's truck? How many remember that? And you remember that you couldn't buy a telephone to put in your house unless it was made by Ma Bell. Even some distinguished economists worried about network externalities--so that was a nice intellectual cover for all that baloney.

We're talking about a red, yellow, and green wire and any licensed technician can come in and do it. I know a lot of people that just did it themselves--they knew enough about that sort of thing--they always did their own. But the thing is, until we got a settlement that kept Ma Bell out of your house, we didn't have any means of allowing some competition for the provision of telephones and wires service.

I will leave those thoughts with you. This is a big environmental monstrosity, this electric power industry. We're being asked to provide more generation--that's one solution people are talking about. Also there is a lot of worry that we don't have enough transmission capacity, and yet there is no mechanism now whereby somebody can locate interruptability on the demand side below the substation and also generation below the substation. You see, in that industry there's a no-man's-land between the substation and the end-use consumer. And when you find that you can't satisfy all demand (in other words, the myth that you can has never been true--you can't because there are storms and that sort of thing that make it impossible), how do we shed load? We shed load by taking out substations, and when you take out a substation you take out all the customers below that. If you're riding on an elevator…you're out. If you're doing high-end computation…you're out, and all the other low-value uses are out. We found that out in California, except it wasn't just an unusual event--it came in and stayed. That can happen here. It can happen anywhere in the world. It even happened in Texas. All of a sudden the wholesale market skyrocketed in Texas and started to spike, and I know of at least one bankruptcy of a company in the energy business who was vulnerable to that--had contracts to sell it for a whole lot less money than they had to pay. You lose money real fast when you're paying $10 a kilowatt for something and reselling it for 12 cents. That's what happened in California, and it just sucks money out of your pocket so fast

you can’t even believe it--$15 billion was sucked out of the local distributors' pockets, and they just sat there and let it fly in the breeze. No preparation was made for that. Here’s a case in which a friendly environment and greater security, including protection from terrorist attacks, is a free lunch if you just get the prices right. See, which would you rather have if terrorists take out half of the generation capacity going into Chicago: Would you rather see half the substations shut down or just the lowest-half priority uses of power in Chicago? That’s sort of the alternative

Thank you.