Misinterpreting the Coase Theorem

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Abstract: The Coase theorem is often interpreted as demonstrating why private negotiations between polluters and victims can yield efficient levels of pollution without government interference. It is considered by many to provide the theoretical underpinnings for "free-market" solutions to environmental problems. This article explains why misinterpreting Coasian negotiations as a market driven process leads to erroneous conclusions. More importantly, this article demonstrates why negotiations between polluters and victims would fail to yield efficient outcomes *even if* property rights were well-defined, *even if* there were only a single victim, *even if* negotiations entailed no transaction costs, and *even if* negotiators behaved rationally and reached a successful agreement. Unlike other critiques of the Coase theorem that focus on irrational behavior and transaction costs, our critique identifies perverse incentives that arise even under conditions most favorable to the theorem. By accepting, rather than challenging, the premises of the theorem, our analysis provides an "internal" critique that strengthens well-known "external" criticisms.

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The discourse on environmental policy has shifted noticeably over the last two decades. The old, mainstream view that environmental problems result from market failures and require government intervention has been losing ground to an ideologically more conservative view that insists that markets "fail" only when property rights are ill-defined, and that the "solution" lies in clarifying property rights and leaving affected parties to negotiate with one another in "free markets."[1] The Coase "theorem," as it is commonly known and interpreted, plays a crucial role in buttressing the free market, property rights approach to analyzing and solving environmental problems. Most who remain skeptical that clarifying property rights will suffice to solve environmental problems challenge the premises of the Coase theorem. While demonstrating that the Coase theorem relies on highly implausible assumptions is important, unfortunately it leaves the central thrust of the theorem intact. This article challenges the core of the Coase theorem by demonstrating that voluntary agreements are likely to be *inefficient* even when there is only a single pollution victim, even when property rights are clear, even when transaction costs are zero, and even when negotiators behave rationally. Voluntary agreements will be inefficient, because of perverse incentives to dissimulate that neither Coase, nor his supporters and his critics have never acknowledged.

The perverse incentive others have ignored derives from a crucial difference between the traditional assumption of "perfect knowledge" and a far more restrictive and less plausible assumption game theorists call "complete information." Careful analysis reveals there is no reason to believe that negotiations will yield efficient outcomes *unless* both parties have "complete information." Under the traditional and more plausible assumption of "perfect information" we demonstrate that perverse incentives give rise to inefficient outcomes even in the case of a single victim. By accepting the traditional premises of the Coase theorem that are well-known among economists, our analysis provides an "internal" critique that strengthens previous "external" criticisms. We show that felicitous conclusions about efficient outcomes reached through voluntary negotiations are unwarranted – even when negotiations reach a successful conclusion, and even under assumptions others have pointed out are necessary but highly implausible.

We begin by presenting the Coase theorem as it is taught in both microeconomic and environmental economic textbooks, followed by a review of important caveats others have noted. We then digress slightly to explain why the Coase theorem has nothing whatsoever to do with markets or market forces, and why misinterpreting Coasian negotiations as a market driven process generates erroneous conclusions. Next we explain why the traditional analysis of Coasian negotiations should be seen as an example of a game called "divide-the-pie," and we review what the theoretical and experimental literature has to teach us about this game. After probing the difference between the assumption of perfect knowledge and the assumption of complete information, we demonstrate why perverse incentives would be likely to lead a polluter and even a single victim to agree to an inefficient level of pollution. We close by explaining why additional perverse incentives that arise among multiple victims are far more damaging to the prospects of reaching efficient outcomes than however much they might increase the "transaction costs" of negotiations.

The Traditional Presentation of the Coase "Theorem"

The confused history of misinterpretations of what is called the Coase "theorem" demonstrates why formal modeling, where assumptions are stated rigorously and conclusions are derived as theorems, can sometimes be useful. Ronald Coase – who did not use the word "theorem" in his seminal article (Coase 1960) – complained decades later that his views had been misrepresented in many standard formulations (Coase 1988 and 1994). Others have also argued that Coase's argument has been misconstrued (Friedman 1991; McCloskey 1998; Medema 1994 and 1995; Medema and Samuels 1997; Posner 1993; and Klaes 2000). After surveying 45 microeconomics textbooks, Butler and Garnett reported that in their view "80 percent misrepresent Coase's arguments" (2003, 133).

Standard Presentation: Microeconomics and environmental economics textbooks invariably present the Coase "theorem" using the diagram and accompanying explanation below. First, it is assumed that there is only one polluter and one pollution victim. Second, it is assumed that the "right to pollute" or the "right to

be free from pollution" is clearly defined. Under these assumptions, the potential efficiency gain from negotiation is demonstrated using Figure 1 below.

(Insert Figure 1)

The horizontal axis measures the number of units of pollution. The vertical axis measures the polluter's marginal profits from polluting and the victim's marginal damages from pollution in dollars. Line BCD is the polluter's marginal profits from the pollution curve and it is assumed to be downward sloping. Line OCA is the pollution victim's marginal damage from the pollution curve and it is assumed to be upward sloping.

According to the diagram, if the polluter has the legal right to pollute, the polluter will emit OD units. In this case the victim has an incentive to pay the polluter to reduce emissions. When the polluter emits OD units, the last unit of pollution emitted causes the victim DA in damages but profits the polluter practically nothing at all. The polluter would be better off reducing emissions by one unit in exchange for any positive payment, and the victim would be better off making any payment less than DA in exchange for a one unit reduction in emissions. There are mutually beneficial deals to be struck as long as the polluter's marginal profit curve, BCD, lies below the victim's marginal damage curve, OCA. Only when emissions have been reduced to OE are mutually beneficial deals exhausted. In the case where the victim has the legal right to live free from pollution, she will not allow the polluter to emit any units at all and the polluter will have an incentive to pay the victim for permission to increase emissions from zero. Again, there are mutually beneficial deals to be struck as long as the polluter's marginal profit curve, BCD, lies above the victim's marginal damage curve, OCA. Only when emissions have been increased to OE are mutually beneficial deals exhausted.

OE represents the socially efficient level of emissions. In this simple, hypothetical situation the only social benefits from pollution are profits received by the polluter, and the only costs to society are damages suffered by a single victim. Because OE is the level of emissions that equalizes marginal social benefits, BCD, and marginal social costs, OCA, OE is the level of emissions that maximizes net social benefits. Regardless of whether polluter or pollution victim is assigned the property right, voluntary negotiation will yield the efficient outcome. This is the typical presentation of the Coase "theorem" in textbooks.

Traditional Caveats: Almost all textbooks acknowledge, as did Coase (1960), that negotiations are likely to fail in the presence of high transaction costs.[2] Many texts also point out inherent difficulties in assigning property rights, and some question the appropriateness of doing so for resources like air and water. More careful treatments of the Coase theorem also acknowledge that the initial assignment of property rights not only affects who pays who, and therefore how the efficiency gain from negotiation is distributed, but it may also affect what the efficient level of pollution turns out to be.[3] A less widely known problem arises if the affected parties lack the financial means necessary to negotiate a successful agreement (Harris 2002). Lastly,

careful presentations acknowledge free rider and hold out problems that emerge when there are multiple pollution victims.

Standard Interpretation: Despite these well-known caveats, the Coase theorem still occupies a prominent position in all environmental and microeconomics textbooks. It is still widely interpreted as demonstrating why private negotiations between polluters and pollution victims can be relied on to yield efficient levels of pollution without government interference, as long as property rights are clear and independent of who has them. The following summaries of the Coase theorem by the authors of five leading environmental economics textbooks are typical.

> Ronald Coase held that as long as negotiation costs are negligible . . . the court could allocate the entitlement to either party, and the efficient allocation would result. The only effect of the court's decision would be to change the distribution of costs and benefits among the affected parties. This remarkable conclusion has come to be known as the Coase theorem. (Tietenberg 2003, 81)

> The Coase theorem states that if property rights are well defined, and no significant transaction costs exist, an efficient allocation of resources will result even with externalities. (Harris 2002, 49)

> Ronald Coase made a profound impact on the world of externalities and policy by pointing out that in many cases these could be solved by negotiation between the parties. His "theorem" amounts to the result that the physical results of such negotiations can be expected to approximate the efficient resolution of the externality. . . . This result will be arrived at whatever the initial assignment of property rights. (Russell 2001, 46)

> The Coase theorem states that in the absence of transaction costs affected parties to an externality will agree on an allocation of resources that is both Pareto optimal and independent of any prior assignment of property rights. (Hanley, Shogren and White 2001, 157)

> So what the Coase theorem actually says is that given this kind of externality situation due to incomplete private property rights, one solution involves creating property rights for either the victim or the generator, and that either assignment will lead to an efficient outcome. (Perman et al. 2003, 138)

Coasian Negotiations: Not a Market Process

Coasian negotiations are often described as a "free market" alternative to government regulation. To the extent that the Coase theorem serves as the theoretical underpinning or intellectual predecessor of the modern, "free market environmentalism movement," misrepresentation of Coasian negotiations as "market transactions" is important.[4] In the 2001 edition of the book that launched the free market environmentalism movement, Terry Anderson and Donald Leal acknowledge their intellectual debt to Ronald Coase:

> The free market environmental approach to pollution is to establish property rights to the pollution disposal medium and allow owners of those rights to bargain over how the resource will be used. Following the lesson from Ronald Coase (1960), the central questions are: who has the right to use the air, water, or land? For what uses? And what are the transaction costs for the owners of these rights to bargain over the uses of the resources? If the property rights are well defined and enforced and the bargaining costs are low, regulation . . . is unnecessary; a market of waste disposal will determine which of the competing uses dominates. (Anderson and Leal 2001, 132)

Free market environmentalists, however, are not the only ones to represent Coasian negotiations as market processes. John Asafu-Adjaye is one example of a textbook author who mistreats Coasian negotiations as a market transaction and analyzes the movement from inefficient, initial levels of pollution to efficient levels of pollution as if it were a market driven process:

> From the foregoing, it can be seen that, irrespective of who has the property right, *equilibrium* is achieved at the quantity of q* [OE in figure 1 above] and a price of p* [OF in figure 1 above]. The outcome of this market solution is an efficient allocation of resources and the removal of the Pareto-relevant externality. (Asafu-Adjaye 2000, 82)

Asafu-Adjaye leaves no doubt that he believes market forces are at work when he tells us "the Coasian solution assumes a *perfectly competitive market*" (Asafu-Adjaye 2000, 83).

It may be reasonable to describe Coasian negotiations as the *laissez-faire* solution to the problem of externalities, and therefore, as an alternative to government intervention. However, it is inaccurate and misleading to describe Coasian negotiation as a market process. Establishing property rights over externalities is not the same as creating a market for externalities. Establishing property rights is a necessary, but not sufficient condition, for enabling market forces to emerge.

Recalling that Coase (wisely) confined his discussion to the case of a single polluter and a single victim, Coasian negotiations can only be seen as one-on-one negotiations between two parties. There is no market in Coase's scenario, much less a competitive market. Competitive markets are situations where there are many sellers and many buyers of a good. In competitive markets, individual actors do not negotiate price with one another at all, but instead take the market price as given and decide how much they are willing to buy or sell at that price. Even when markets are less than competitive there are more than two parties involved. In a monopolistic (monopsonistic) market there are still many buyers (sellers) and it is assumed that the law of uniform price will determine a single selling price for all units of the good in the market.[5] The process by which a polluter and a victim might negotiate a change from OD (or from zero, depending on the assignment of the property right) to OE is not a market process at all, but a one-on-one negotiation.[6] Before discussing what the literature tells us about bilateral negotiations of this kind, it is important to point out two erroneous conclusions that derive from treating Coasian negotiations as if they were a market process.

Misleading Conclusions about Payments: The first mistake relates to the size payment we expect would be necessary for both polluter and victim to agree to the efficient level of emissions. Authors who misinterpret the Coasian situation as a market process searching for an "equilibrium" price per unit of emissions are tempted to predict a definitive payment equal to the price where the marginal profits for the polluter are equal to the marginal damages of the victim, OF, times either the number of units abated if the polluter has the property right, (OD-OE), or the number of units emitted if the victim has the property right, OE. It is easy to make this mistake. Assume the polluter has the property right. If we think of the victim as negotiating abatement with the polluter unit by unit, starting from OD and proceeding to OE where all mutually beneficial deals have been exhausted, then the payment for the last unit of abatement would have to be OF. The victim would pay no more and the polluter would take no less than OF for the last unit of abatement to arrive at OE. If this were a market situation where the law of uniform price should apply, all units of abatement would have to sell for OF, and the victim would therefore have to pay the polluter an amount equal to OF times (OD-OE), or the area of the rectangle DECG, to induce the polluter to cut emissions from OD to OE. But there is no market, and therefore there are no market forces to secure the law of uniform price.

Moreover, if the victim negotiates abatement unit by unit, for every unit of abatement prior to the very last unit before OE, there are a range of prices that would leave both the victim and polluter better off. For example, if the victim wanted to negotiate a further unit of abatement starting from OU, any price less than UW and greater than UR would leave both the polluter and victim better off. It is not clear what price in that range they would agree on, and no reason to believe they would settle on OF for any other unit of abatement prior to the last.

In truth, there is no reason the polluter and victim must settle on a single price to be paid per unit of abatement at all. Once we realize that the traditional treatment of Coasian negotiations only makes sense if we imagine the polluter and the victim staring at Figure 1 together and negotiating how to share an efficiency gain whose size they both know, it becomes apparent there is no reason for them to negotiate abatement unit by unit at all, and also no reason for them to agree on a single price to be paid for each unit of abatement.[7] In Coasian negotiations all the polluter and victim need to do is agree on how much the victim must pay the polluter – in grand sum total – to cut emissions from OD to OE. However, when seen in this light it is far from obvious what size payment would be required to secure the deal. If polluter and victim truly did have to agree on a single price per unit of abatement, the total payment would have to be equal to the area of the rectangle DECG to exhaust all mutually beneficial deals since no other price would secure the last unit of abatement. But since, in fact, they do *not* have to agree on a single price per unit, there are many different total payments the victim could make to the polluter to reduce emissions from OD to OE that would be mutually beneficial.

For example, if the victim paid the polluter an amount slightly less than the area of figure DECA, the polluter would capture almost the entire efficiency gain from negotiations and the victim would only be

slightly better off. On the other hand, if the victim paid an amount only slightly larger than the area of triangle DEC, the victim would capture almost the entire efficiency gain and the polluter would be only slightly better off. Deducing the upper and lower bounds of the size of the payment is not difficult, but as we see below, more definitive conclusions about how players would divide the efficiency gain depends very much on how bargaining is carried out.

The absurdity of the market interpretation is further illustrated by considering what this line of reasoning implies about what factors would determine how the efficiency gain would be divided. As the marginal profit and damage lines are constructed in Figure 1, a payment equal to the area of DECG divides the efficiency gain, the area of DCA, equally between the polluter and victim. The victim's welfare improves by an amount equal to the area of GCA, while the polluter gains by an amount equal to the area of DCG. As long as the absolute value of the slope of the marginal profit line is equal to the absolute value of the slope of the marginal damage line, as it is in Figure 1, the areas of triangles DCG and GCA will be equal. However, if Figure 1 were redrawn so that the absolute value of the slope of the marginal profit line were less than the absolute value of the slope of the marginal damage line the area of triangle DCG would be smaller than the area of triangle GCA and the victim would receive more of the efficiency gain than the polluter.[8] But there is no reason to believe that the division of the efficiency gain should depend on the relative slopes of the marginal profit and damage lines, much less that the efficiency gain would be divided equally if the absolute values of the slopes of the two lines happened to be the same. Instead the division of any efficiency gain will depend on the relative bargaining power of the polluter and victim, as Coase (1960) himself remarked, and as game theoretic modeling of different bargaining procedures that advantage one player over another demonstrate, as discussed below. Assuming that Coasian negotiations are a market driven process with a single price per unit of abatement that exhausts all efficiency gains, leads to the erroneous conclusion that how efficiency gains are split depends on the relative slopes of the marginal damage and profit curves.

Misleading Conclusions about Abatements: Independent of what size payment would be required to secure a deal, misinterpreting Coasian negotiations as a market process also leads to unwarranted conclusions about the likelihood that parties will negotiate their way to an efficient level of pollution. When Coasian negotiations are misinterpreted as a market process, analysts can easily deceive themselves that the kind of forces that drive markets to their equilibrium will drive negotiations to OE units of pollution and a price per unit of abatement equal to OF. But just as there are no market forces to drive the price per unit to OF, there are no market forces to drive the level of emissions to OE. If the polluter and victim agree to a level of emissions equal to OE it must be for some other reason, not because there are market forces which drive the bargain to that outcome. It is clear why omniscient polluters would never reduce pollution below OE. It is also tautologically true that if polluters pollute more than OE they will have failed to exhaust all mutually beneficial deals. But do protagonists always negotiate efficiently and leave no mutually beneficial deals unconsummated? It is time to consider what game theory has to tell us about these kinds of negotiations.

Traditional Analysis of Coasian Negotiations: A Game of Divide the Pie

If Coasian negotiations are not a market process, what are they? The only way to make sense of the traditional analysis of the Coase theorem is to imagine the polluter and the pollution victim both staring at Figure 1 together, and then negotiating with one another about how to divide the efficiency gain – the area of triangle DCA if the polluter has the property right, or the area of triangle OCB if the victim has the property right. In which case, the traditional analysis of Coasian negotiations is simply a two-person, non-cooperative game called "divide-the-pie." However, in this game the antagonists must both know the size of the pie they have to divide, i.e., the true size of the potential efficiency gain from negotiations. And the only way Coasian negotiators could both know the true size of the pie would be if they both had what game theorists call "complete information." In a game of complete information, not only does each player know her own payoffs in all possible outcomes, but she knows her opponent's payoffs in all possible outcomes as well. Moreover, each player knows that her opponent knows her payoffs, and each player knows her opponent knows she knows. In our context this amounts to assuming that the polluter not only knows what her marginal profit curve looks like, she also knows what the victim's marginal damage curve looks like; and the victim not only knows what her marginal damage curve looks like, she also knows what the polluter's marginal profit curve looks like. Moreover, both the polluter and the victim know that they both know all of this information.[9]

When we relax the assumption of complete information below we discover it is no longer likely Coasian negotiations would lead to efficient outcomes. Which means only under the assumption of complete information is there any possibility of arriving at the conclusion that Coasian negotiations *may* yield efficient outcomes. However, even in this case it turns out the divide-the-pie game is more complicated than it first appears. A rich and complex *theoretical* literature, complimented by a growing *experimental* literature reveal that even under the most favorable conditions we can imagine, the conclusion that Coasian negotiations will yield efficient outcomes is far from certain.

Review of Theoretical Literature: The theoretical literature on one-shot, bilateral, non-cooperative, divide-the-pie games reveals that how the pie will be divided depends very much on how negotiations are organized. If offers are simultaneous, literally any division of the pie is a possible equilibrium.[10] Many games of alternating offers have a unique equilibrium, but what that equilibrium will be depends on key parameters in the structure of the game. In finite horizon alternating offer games, changes in the number of offers permitted and changes in who makes the last offer can significantly change how the pie is divided. In infinite horizon games slight variations in discount rates, speeds of response, and penalties for rejecting offers can change how the pie is divided in surprising ways.[11]

Regarding the major issue at stake – will players agree to an efficient outcome, regardless of how they divide the efficiency gain – the theoretical literature on divide the pie-games can be read as cautiously optimistic. *Provided* (1) both parties care only about their own payoff, (2) both parties behave rationally, (3)

neither party suspects the other may not behave rationally, and (4) neither player believes the outcome of an early game will become known to players in future games in which the player expects to participate, game theory rarely predicts inefficient outcomes. Joseph Farrell explained the intuition for this result as follows: "If everyone knew all about everyone else, it is hard to envision how negotiation could drag on or break down" (Farrell 1987, 115). However, if any of these four assumptions fail to hold, the theoretical literature predicts it is quite possible for parties to fail to reach an agreement on how to divide the pie, leaving us with an inefficient outcome. Robert Pindyk and Daniel Rubenfeld are unusual examples of authors of a textbook who acknowledge in their presentation of the Coase theorem that rational concerns for one's reputation as a bargainer can lead to inefficiencies. They point out that "bargaining can also break down even when communication and monitoring are costless. . . . One party makes a demand for a large share and refuses to bargain, assuming incorrectly that the other party will eventually concede. . . . An agreement may never be reached especially if one or both parties want to earn a reputation for tough bargaining" (Pindyk and Rubenfeld 2001, 640).

Review of Experimental Literature: The experimental literature, on the other hand, suggests reason to be pessimistic about achieving efficient outcomes in one-shot, divide-the-pie games. Ochs and Roth (1989) report that outcomes in alternating offer finite horizon bargaining experiments they conducted were inconsistent with what theoretical models assuming mutually rational behavior predict. They report that notions of equity seem to intrude and often lead players to reject offers a player deemed unfair even though doing so left the player with less than had they accepted what they regarded as an unfair offer. Moreover, Ochs and Roth report that experiments where players were first conditioned to expect a certain split, and then matched with players who were conditioned to expect a different split, often resulted in failures to reach an agreement and inefficient outcomes.[12] Based on an evaluation of both literatures David Kreps hypothesized that theoretically relevant factors such as "who has which discount rate and what is the precise protocol of bargaining will be swamped by expectations as to what one can expect to get and what one expects must be given in order to come to agreement" (Kreps 1990, 568). In other words, Kreps cautions us not to always expect real people to reach an efficient outcome even if a Coasian negotiation were a one shot, alternating offer game with complete information.

Complete Information: More than Perfect Knowledge

We demonstrate below that one cannot conclude that Coasian negotiations will yield efficient outcomes if players do not have complete information. However, this does not mean the assumption of complete information is plausible. Economists are long accustomed to assuming "perfect knowledge" when analyzing the efficiency of market systems. This traditional perfect knowledge assumption is that each party knows "perfectly" what its own preferences or technologies are, i.e., that nobody is surprised to find that their choice affects them differently than they anticipated. In effect it is an assumption about perfect *self*-knowledge.

Traditionally the only other "knowledge" actors are assumed to know "perfectly" is the vector of market prices, which they are assumed to take as givens if markets are competitive. Many critics have challenged the assumption of perfect self-knowledge as unrealistic. But in our view critics have generally misconstrued the real purpose of this assumption.

Economists do not assume perfect self-knowledge because we really think people never mistake how they will actually be affected by an outcome. We assume it because otherwise it is impossible to use logic to *deduce* how people will behave in a given situation. Of course there may be other ways to predict how people will actually behave, and they may prove to be better predictors than deducing what behavior would be in someone's self-interest. But if we wish to use logic to deduce behavior we must assume actors know and act in their own best interest. More importantly, economists also assume perfect self-knowledge because if we want to know what kind of behavior particular institutional circumstances promote, the answer is found by deducing what individually rational behavior would be under those circumstances. Again, this is not to say that people always choose to act in their own self-interest. But it is true nonetheless that the kind of behavior any institution *promotes* is the behavior that would be in the self-interest of individuals who find themselves in that institutional situation.[13] In other words, in our view the traditional assumption of perfect self-knowledge is less an assumption of conviction and more an assumption dictated by methodological considerations. Of course one of the great accomplishments of economic theory was the discovery that even when actors in an economy know nothing at all about other actors in the economy, if each actor is what we might call fully "self-aware" and also aware of the prices of goods and services, when all markets clear the outcome will be a Pareto optimum – provided we make a number of important assumptions.[14] This grand discovery began as a vision in the mind of Adam Smith in the mid-eighteenth century who coined the phrase "invisible hand" to describe the miracle of the market system, was refined over two-hundred years by economists such as Alfred Marshall and Leon Walras, and was finally proved rigorously as the fundamental theorem of welfare economics by Kenneth Arrow and Gerard Debreu in the mid-twentieth century.

It is important to notice that it is *not* traditionally assumed that every actor has perfect knowledge about the preferences and technologies of all *other* actors in the economy. Not only is this more far reaching assumption about what actors know far less plausible, it would take the shine, so to speak, off the minor miracle contained in the fundamental theorem if it were required. How much more surprising and delightful that everything will work out for the best – at least as far as efficiency is concerned – when people are *not* assumed to know what others want, or are capable of! However, as we have seen, hidden in standard presentations of Coasian negotiations is an implicit assumption that both actors know not only exactly how they are affected by pollution, but also exactly how their opponent is affected as well. In the language of game theory, traditional treatments of the Coase theorem assume "complete information" – even if most analysts seem unaware that this assumption is necessary to conclude that successful Coasian negotiations between a polluter and a single victim will lead to efficient levels of pollution, or that this necessary assumption is far more restrictive and less plausible than the traditional assumption of perfect self-knowledge.

Coasian Negotiations with Incomplete Information

What happens when we relax the highly implausible assumption of "complete information" – or mutual omniscience? How would Coasian negotiations proceed if one party has only perfect self-knowledge leaving the other party with what game theorists call "private information"?[15] Let the polluter have the property right and assume that while the polluter knows the victim's marginal damage curve as well as her own marginal profit curve, the victim knows only what her marginal damage curve looks like and does *not* know what the polluter's true marginal profit curve looks like. For convenience of analysis also assume that bargaining continues until the victim believes all efficiency gains have been exhausted and pays the polluter an amount equal to the marginal damage of the last unit abated times the number of units abated. We call this level of abatement and size payment a "successful Coasian negotiation."

(Insert Figure 2)

If the polluter reveals her true marginal profit curve, BCD, to the victim, as we have seen a successful Coasian negotiation would have the polluter cutback on emissions from OD to OE in exchange for a payment from the victim equal to the area of rectangle DECG, and the polluter would gain the area of triangle DCG and the victim would gain the area of triangle GCA.

However, the polluter is in a position to pursue a more profitable negotiating strategy. Knowing that the victim does not know what her true marginal profit curve looks like, what if the polluter can convince the victim that her marginal profit curve looks like bAd? In this case the victim will negotiate based on a Figure 2 where the true marginal profit curve, BCD has been erased, and only the false marginal profit curve, bAd appears. In this situation, successful Coasian negotiations would lead the victim to pay the polluter an amount equal to the area of rectangle dDAg in exchange for a promise from the polluter to cut back emissions from Od to OD. From these negotiations the victim would *think* she had gained an amount equal to the area of the triangle gAa, and the victim would *think* the polluter had gained an amount equal to the area of triangle dAg. Of course this is not the case. In truth the victim has gained nothing in exchange for her large payment, and the polluter has been paid a great deal to do exactly what she would have done for no payment at all.

Clearly the polluter has much to gain if she can deceive the victim into thinking her marginal profit curve is higher than it truly is. If the polluter can substitute the "false" bargaining game above for the "true" bargaining game envisioned by Coase, she stands to gain considerably more than she could have hoped to gain from playing the "true" game. Moreover, only if the victim had complete information regarding the polluter's marginal profit curve as well as her own marginal damage curve would she be immune from this kind of deception. The consequences of dropping the implausible assumption of complete knowledge, or

omniscience, are profound. If the victim had the property right and the opportunity to deceive, she would stand to gain from over exaggerating her damages which would lead to less pollution than is socially efficient. In general, if the party with the property right also has private information, or a "knowledge advantage," in other words if her opponent does not know what her curve looks like, her rational strategy is to try to deceive her opponent into believing that her curve is higher than it truly is. The more successful her deception the more she stands to gain, and what is important for our purposes, the more inefficient the outcome will be. In light of the fact that complete information about the true situation of the other party is seldom the case in negotiations between polluters and pollution victims, it seems highly unlikely that Coasian negotiations will lead us to efficient outcomes very often in the real world – even if negotiators behave rationally, even if they believe their negotiations will remain secret forever, even if there are no transaction costs, and even if there is only a single pollution victim.

Joseph Farrell explained how critical the assumption of complete information is long ago:

> We cannot assume that all mutually beneficial contracts are signed, unless we assume that everyone knows everything about everyone else, which they do not. The strong form of the Coase theorem – the claim that voluntary negotiation will lead to fully efficient outcomes – is implausible unless people know one another exceptionally well. . . . When people don't know one another's tastes or opportunities, then experience, theory and experimental evidence all confirm that negotiations may be protracted . . . and unsuccessful. (Farrell 1987, 115)

And:

> I began by noting that the popular simple view of the Coase theorem is a tautology: that if bargaining and negotiation are perfect (that is, produce perfect outcomes) then the outcomes are perfect. Actually, negotiation is far from perfect, even in the simplest situations. . . . And it is especially imperfect in the hardest problems – those with private information. (Farrell 1987, 125)

Since Farrell first warned of the critical importance of "private information" in Coasian negotiations, game theory research on bilateral bargaining with incomplete information has confirmed his view. While theory predicts that parties will seldom fail to reach an agreement in one-shot, bilateral bargaining games of *complete* information provided to both parties assume the other will behave rationally, recent research in the theory of one-shot, bilateral bargaining with *incomplete* information yields a very different conclusion.[16] When Ariel Rubinstein re-examined his classic, infinite horizon, alternating offer, divide-the-pie game under the assumption that the discount rate of one player was private information he discovered that truthful revelation was never a first best strategy (Rubinstein 1985). Martin Osborne warns that *in general* we should not expect

the party with private information to reveal it truthfully: "When a receiver takes an action based on an unverifiable report about the state supplied by a sender, and the sender's and receiver's preferences differ, no equilibrium exists in which the sender accurately reports the state" (Osborne 2004, 349). Colin Cramerer explains the intuition for why private information can lead players to fail to reach an agreement this way: "In theory, asymmetries in information fundamentally change the nature of how people bargain. Introducing asymmetries undermines efficiency because bargaining strategies then serve two different purposes: Players bargain both to get the most they can and to convey information. The two purposes usually conflict" (Cramerer 2003, 182).

Of course, in the traditional divide-the-pie game deception and fear of deception only cause inefficiency if it prevents players from coming to an agreement on how to divide the pie.[17] But as Figure 2 makes clear, in bargaining between a polluter and victim deception can lead to inefficiency in a different, more troubling way. In Coasian negotiations deception can lead to an inefficient outcome even when players *do* reach an agreement because it can lead them to play a "false" divide-the-pie game instead of playing the "true" divide-the-pie. As we demonstrated above, a polluter with the opportunity to deceive would find it in her interest to substitute a false bargaining game based on curves bAd and OCAa for the true bargaining game based on curves BCD and OCA envisioned by Coase. But while the true bargaining game contains an efficiency gain equal to the area of triangle DCA for the polluter and victim to divide, the false bargaining game contains no actual efficiency gain whatsoever.[18] By assuming that Coasian negotiations would be "successful" in our analysis we effectively assumed away the kind of inefficiency that results when incomplete information prevents players from reaching an agreement — the subject of most theoretical research in the theory of bilateral bargaining with incomplete information. However, this enabled us to focus on a more troubling inefficiency that results when the opportunity to deceive leads a rational player to trick her opponent into playing a different bargaining game with a smaller efficiency gain — or perhaps no efficiency gain at all — and thereby prevents them from playing the bargaining game with a larger efficiency gain envisioned by Coase.

Multiple Victims: More than Additional Transaction Costs

While incomplete information undermines the Coase theorem even when there is only a single polluter and a single victim, multiple victims make successful Coasian negotiations much more problematic. However, this point has been acknowledged by everyone — with the important exception of free market environmentalist ideologues — so what is novel about the argument presented here?[19] Beginning with Coase (1960), most economists interpret the problem of multiple victims as one of high transaction costs. Though some critics have analyzed free rider and hold out problems that arise in the case of multiple victims as problems of perverse incentives, the tendency within the profession has been to treat multiple victims as simply raising the costs of negotiation. This section argues that the standard practice of treating incentive problems as

transaction costs in the case of multiple victims is misleading because it trivializes problems created by perverse incentives and underplays their importance.[20]

It is perfectly reasonable to categorize not only lawyer fees but the opportunity cost of time spent in negotiations between a polluter and her victims as "transaction costs." Moreover, if the cost of time spent negotiating and lawyer fees exceeds the size of the efficiency gain from negotiations, it is clear we should not expect negotiations to yield efficient outcomes because there is no incentive to negotiate. Coase recognized this, and virtually everyone interpreting Coase has acknowledged it as well. It is universally referred to as the "zero transaction cost" assumption of the Coase theorem. But this is not the main reason that voluntary negotiations will not lead to efficient outcomes. In our opinion free market environmentalists are not unreasonable when they consider this objection inconsequential. If the only reason we fail to get an efficient outcome is that the costs of negotiation are larger than the efficiency gain they would yield, the inefficiency cannot be very great in the first place. To a great extent only "Pareto relevant" inefficiencies, i.e., inefficiencies that are larger than the transaction costs of overcoming them, are worrisome.

Most analysts treat the additional problems introduced by the existence of multiple victims of pollution as an addition to the transaction costs associated with negotiation. The rationale for doing so is that when there are multiple victims there will be additional costs of negotiation either because there are many more negotiations if the polluter must negotiate separately with each victim, or because there will be costs associated with identifying and inviting victims to join a coalition to negotiate with the polluter on behalf of all victims. But labeling these problems transaction costs prevents us from seeing that they are fundamentally different than lawyer fees and opportunity costs of time spent in negotiations. The real problem with multiple victims is that because of the free rider and hold out incentives separate negotiations with individual victims will not occur, even if the potential efficiency gain is large, and because of the incentive for victims to misrepresent damages, negotiations with a victim's coalition will yield inefficient outcomes. When multiple victims are improperly treated as merely increasing transaction costs one is led to expect efficient outcomes as long as the potential efficiency gains from negotiations with multiple victims are large compared to the additional costs of those negotiations. However, when properly understood as a problem of perverse incentives it becomes apparent why relying on voluntary negotiations will not yield efficient outcomes when there are multiple victims even when potential efficiency gains are quite large. Why do multiple victims change the situation qualitatively and dramatically?

Separate Negotiations: When there are multiple victims we should not expect separate negotiations between the polluter and each individual victim to lead to an efficient outcome. If the polluter has the property right each victim has an incentive to deny any harm in hopes that other victims will step forward and pay the polluter to abate — the free rider problem. If the victims have the property right each victim has an incentive to exaggerate harm and threaten to veto any deal unless she receives the entire payment the polluter is willing to offer all victims collectively — the hold out problem. In both cases separate negotiations will end in failure and lead to too little abatement and too much pollution. But this is not because the

transaction costs of multiple negotiations are prohibitive. It is because the existence of multiple victims creates perverse incentives for victims that will lead separate negotiations to quickly break down.

A Coalition Representing All Victims: Therefore, when there are multiple victims the only hope for successful negotiations lies in organizing a coalition of victims to negotiate with the polluter as a group. But there are two reasons multiple victims of pollution are predictably unable to organize a coalition to negotiate effectively with a polluter — neither of which has anything to do with the transaction costs of identifying victims and issuing them invitations to join an organization. The first problem arises whenever there is no objective way to verify who is truly a victim and who is not, even when each true victim is damaged to the same extent. If the polluter has the property right every victim has an incentive to deny their true status as a victim and hope other victims will join the coalition and contribute money to bribe the polluter to cut back on emissions. On the other hand, if the victims have the property right everyone has an incentive to claim they are a victim even if they are not, in order to receive part of the payment the polluter will offer. In either case there is an incentive for people to lie about whether they truly are victims. In one case the victim's coalition will predictably contain many fewer victims than it should and negotiations will therefore result in too little abatement because the coalition will lack funds to bribe the polluter. In the other case the victim's coalition will include many who are not truly victims and negotiations will result in too little pollution as the polluter is compelled to pay more than is warranted.

Even if we could solve the problem of distinguishing between who are victims and who are not, there is a second problem. If victims are not affected to the same degree, but there is no objective way to determine who among them is more or less damaged, how can the coalition decide how much to collect from or pay to different victims? If victims are asked the extent of their damage they have every reason to lie. If polluters have the property right and victims who are more damaged are expected to contribute more to bribe the polluter to abate, people will under report their damage, which leads to too little abatement. If victims have the property right and victims who are damaged more expect to receive higher payments, people will over report their damages, which leads to little pollution. So even if we could accurately identify who are victims and who are not, when there is no way to know how much different victims are damaged there is no reason to believe negotiations between a coalition representing all victims and the polluter will lead to the efficient amount of abatement. In most real world situations victims are damaged to different degrees and it is often difficult to distinguish those who are truly victims from those who are not. Therefore, when there are multiple victims either separate negotiations between the polluter and individual victims will break down due to perverse free rider or hold out incentives, or negotiations between a polluter and a coalition representing all victims will yield inefficient outcomes because of perverse incentives for victims to misrepresent their damages. Moreover, this problem is qualitatively different from inefficiencies that arise because the transaction cost of negotiations is greater than the benefit from correcting them. Incentives to free ride, hold out, and misrepresent are not transaction costs, and it is misleading to treat them as such.

Conclusion

What is called the Coase theorem is commonly interpreted as "proving" that if property rights are made clear private negotiations between polluters and pollution victims will eliminate all "Pareto relevant" inefficiencies without need for government interference. Careful examination reveals that this conclusion is false under any realistic conditions. Others before us have argued that the interpretation espoused by "property rights" or "free market" environmentalists is wildly over optimistic. But most critics have emphasized inefficiencies that arise from practical and ethical complications of assigning property rights, irrational behavior, transaction costs of negotiation, and lack of financial means to secure agreements. In other words, previous critics have focused on why polluters and their victims may fail to reach efficiency enhancing agreements when acknowledged premises of the Coase theorem prove to be unrealistic. However, by failing to highlight the importance of perverse incentives others have left the main thrust of the Coase theorem unchallenged. In the case of multiple victims tying objections to positive transaction costs underplays fatal free rider and hold out incentive problems that have nothing to do with the opportunity costs of negotiations. And in the case of a single victim, the few critics who recognized that standard treatments hinge on an implicit assumption of complete information failed to see that the real danger from private information lies not in obstructing agreement but in creating a perverse incentive to substitute a "false" bargaining game with a smaller efficiency gain for the "true" bargaining game with the maximum efficiency gain envisioned by Coase.

Ronald Coase deserves credit for challenging some misconceptions that plagued the profession before him. He pointed out that parties whose behaviors affect one another negatively may have an incentive to negotiate a more efficient modification of their behavior. He pointed out that if property rights are ambiguous parties will be tempted to concentrate their energies on winning the ambiguous property right through litigation rather than on negotiating efficiency gains. He also pointed out — to everyone's surprise at the time — that *regarding efficiency* it may not be important which party has the property right. However, an accurate summary of the issues raised by the Coase theorem should read as follows:

(1) *Even if* there is only a single polluter and a single victim, *even if* it is clear who has the property right, *even if* there are zero transaction costs to negotiations, *even if* both parties have "complete information," i.e., they know not only their own marginal profit or damage curve but the marginal profit or damage curve of the other party as well, *even if* both parties know that the other knows all this as well, *even if* both parties play rationally and know the other party will do likewise, *even if* players care only about the absolute size of their own payoffs, and *even if* the bargaining procedure is carefully structured; it is still possible a polluter and victim might fail to reach an efficient outcome if either has reason to be concerned for their bargaining "reputation."

(2) However, it is highly unlikely that Coasian negotiators would have "complete information." In which case the party with the property right can exaggerate her profits or damages because her opponent has no way to know what they truly are, and when this occurs it is predictable that "successful" Coasian

negotiations will lead to grossly inefficient outcomes. If the polluter has the property right and the victim does not know what the polluter's marginal profit curve looks like, the polluter has an incentive to exaggerate her profits from pollution, and "successful" Coasian negotiations will lead to more pollution than is efficient. If the victim has the property right and the polluter does not know what the victim's damage curve looks like, the victim can gain by exaggerating her damages, and "successful" Coasian negotiations will lead to less pollution than is efficient. While true that this conclusion derives from an absence of complete information, the kind of omniscience that is necessary to conclude that negotiations will tend toward efficient levels of pollution is highly unrealistic for polluters and their victims, and goes considerably beyond the kind of perfect *self*-knowledge necessary to assume that competitive markets will lead to efficient outcomes. Moreover, the most important way that incomplete, or private information causes inefficiencies is not by preventing polluters and victims from coming to agreements, but by permitting the party with private information to substitute a "false" bargaining game with less, or no efficiency gain, for the "true" bargaining game with a larger efficiency gain envisioned by Coase. In which case, inefficiency arises not from failure to reach agreements but from inefficient agreements that are reached.

(3) If there are multiple victims of pollution perverse free rider and hold out incentive problems will doom separate negotiations between the polluter and each victim to failure. But if victims attempt to negotiate collectively, perverse incentives to misrepresent damages will lead to inefficient outcomes. In either case it is highly unlikely that voluntary negotiations when there are multiple victims will achieve efficient levels of pollution. To his credit Professor Coase was aware of this limitation to his "theorem," although he initiated the unfortunate practice of trivializing problems introduced by multiple victims as transaction cost problems, when, in truth, they are far more fundamental problems of incentive incompatibility. A reasonable assessment of how the logic of free rider and hold out behavior is likely to impact voluntary negotiations between polluters and multiple victims should lead us to expect failure, not success, even if the costs of identifying potential victims and issuing them invitations to join a victim's coalition are low.

(4) Finally, a common conclusion regarding the size of the payment required to secure a successful agreement to Coasian negotiations is completely inaccurate. It is common to interpret Coasian negotiations as if they were a market process, which they are not. When the Coasian situation is properly understood as a two person game of divide-the-pie with complete information it becomes clear that bargaining protocol and asymmetries in players' situations determine how the pie will be divided. In which case it also becomes clear that the size payment we would expect from successful Coasian negotiations has nothing to do with a per-unit price that equates marginal benefits and marginal damages. Instead it simply depends on the relative bargaining power of the two parties, modified by any notions of equity the parties may bring to their negotiations.

In conclusion, the main reasons voluntary negotiations between polluters and their victims will not lead to efficient outcomes are not because of positive transaction costs or irrational behavior, but because negotiators seldom know their opponent's true situation, which leads to perverse incentives to dissimulate,

and because the existence of multiple victims creates perverse incentives for victims to free ride, hold out, and misrepresent the extent of damages. To treat the first problem as a lack of perfect knowledge is disingenuous because it is not the traditional assumption of perfect *self*-knowledge that is required, but instead a far more implausible assumption of "complete information" that is tantamount to social omniscience. Moreover, to treat the problem of incomplete information merely as an obstacle to reaching agreements misses a far more significant problem: If information about the situation of the party with the property right is private, that party will have both the motive and opportunity to replace the positive sum game of negotiations envisioned by Coase with a smaller, or zero sum game whose "successful" outcome is inefficient. To treat problems that arise when there are multiple victims as just more transaction costs trivializes serious incentive problems which go far beyond the time and expense of identifying and contacting multiple victims. Perverse incentives to free ride, hold out, and misrepresent are fatal to any hopes of achieving efficient outcomes through voluntary negotiations between polluters and multiple victims even when potential efficiency gains are quite large compared to the true transaction costs of achieving them.

How careless interpretations of the so-called Coase theorem can be easily manipulated to undermine the case for government regulation is not hard to see. Even if the Coase theorem does not always apply because some premise is unmet, leaving the impression that it *may* apply, and implying that only inefficiencies in excess of the transaction costs of negotiating their elimination will occur, means that one can always argue that "voluntary" solutions to environmental problems should be explored first before "second best," "command and control" policies be considered. Given the enthusiasm for "market-based solutions" and the antipathy for regulation in the neoliberal era, it is no surprise that free market environmentalism wields more influence on policy than is justified by its theoretical underpinnings. What is surprising is that after Coase drew attention to the all important subject of incentives in the case of externalities, discussion of important *perverse* incentives that externalities generate has played only a limited role in the ensuing discussion among professional economists. Lack of precision regarding "transaction costs" has served to hide perverse free rider and hold out incentives from view in the case of multiple victims. A similar lack of precision regarding what information Coasian negotiators are presumed to have has disguised perverse incentives that arise even in the case of a single pollution victim. Hopefully, this article helps demonstrate why the realm of real world situations where voluntary negotiations could be reasonably expected to provide efficient solutions to environmental problems is so small that free market environmentalism no more deserves a seat at the policy table than miracles deserve a role in the operating room.

Notes

1. While Alfred Pigou (1920) is the best known exponent of this view, K. William Kapp (1950) provided an insightful treatment of social costs from an institutionalist perspective, which Ronald Coase (1960) chose to ignore and the profession has long forgotten. Kapp gathered empirical evidence from sources

available in his day to demonstrate that the negative effects of air pollution (chapter 5), water pollution (chapter 6), and the depletion and destruction of fauna, flora, and energy resources (chapters 7, 8, and 9) were far from insignificant. He thereby established a strong *prima facie* case that "the treatment of social costs as a minor and exceptional disturbance rather than as a characteristic phenomenon of the market economy" (Kapp 1950, 9) is unjustified. It is regrettable that few pursued Kapp's research agenda to refine empirical estimates of the magnitude of external effects in different industries. One can only wonder if it was perhaps because Kapp argued forcefully for government intervention to correct major economic inefficiencies resulting from external effects, and because his empirical work led him to conclude that "generally speaking, capitalism must be regarded as an economy of unpaid costs, 'unpaid' in so far as a substantial proportion of the actual costs of production remain unaccounted for in entrepreneurial outlays; instead they are shifted to, and ultimately borne by, third persons or by the community as a whole" (231) that his work was marginalized and largely forgotten.

2. This well-known caveat has given rise to the concept "Pareto-relevant" inefficiency – defined as a welfare loss in excess of the transaction costs of the negotiations that would be required to eliminate it.
3. In the exposition above, if the victim's demand for a cleaner environment increases with wealth, as proponents of the "Kuznets curve" would have us believe, then the victim would have a higher marginal damage curve if she were assigned the property right and was paid to relinquish that right to the polluter. In which case, the efficient level of pollution changes. This is often referred to as the difference between the "weak" and "strong" version of the Coase theorem. In the weak version no matter who has the property right the level of pollution that results from Coasian negotiations is efficient but not necessarily the same. In the strong version the outcome is not only efficient but the same.
4. The term "free market environmentalism" is associated with Terry Anderson and Donald Leal's 1991 seminal book of the same name. FME recommends privatization and the removal of natural resources and environmental amenities from the public domain. When privatization is unfeasible for either technical or political reasons, free market environmentalists cater their policy prescriptions in the "free market direction" — away from Pigovian taxes and toward tradable permits.
5. Only a discriminating monopolist (monopsonist) negotiates different prices separately with each buyer (seller), and this is only possible if buyers (sellers) cannot trade the good among themselves. Conceivably we could interpret the Coasian situation as a "market" that is both a perfect monopoly — only one seller — and a perfect monopsony — only one buyer. But this is no help since outcomes in this situation — where, in truth, there is no market — can only be analyzed using game-theoretic tools — our point below.
6. Below we argue that the traditional analysis of Coasian negotiations only makes sense when understood as a two-person, non-cooperative game called "divide-the-pie," which we argue can *only* be the case if the polluter and the victim are both assumed to have what game theorists call "complete information."
7. This scenario assumes that the polluter and victim have "complete information," a point we return to below.

8. If the absolute value of the slope of the marginal profit line were greater than the absolute value of the slope of the marginal damage line the area of triangle DCG would be larger than the area of triangle GCA and the victim would receive less of the efficiency gain than the polluter.
9. Games of complete information can be thought of as situations where actors are presumed to be "omniscient" and not merely "self-aware."
10. The word "equilibrium" in game theory should not be confused with the concept of a market "equilibrium." The concept of an "equilibrium solution" to a game does not mean there is a market, or that market forces are at work.
11. For the initial analyses see Stahl (1972) for finite horizon alternating models, and Rubinstein (1982) for infinite horizon alternating models. However, in no case is there reason to believe the victim would necessarily pay the polluter an amount equal to the area of rectangle DECG to cut emissions from OD to OE, which is what interpreting Coasian negotiations as a market driven process misleads one to expect.
12. See Roth (1995) and Camerer (2003) chapter 4 for two excellent evaluations of what the experimental literature on bilateral bargaining reveals. Of particular interest is that both authors conclude that failure to reach agreement — and therefore inefficient outcomes — occurs more often in experiments than theory predicts.
13. For a more extensive discussion of different kinds of perfect information, and situations in which one or another kind is more useful see Hahnel (2001).
14. Why the necessary assumptions of the fundamental theorem of welfare economics for private enterprise market economies are more numerous and less plausible than usually admitted, and how this leads to misleading conclusions is explored in depth in Hahnel and Albert (1990).
15. Another way of putting this is: What happens in a game of divide-the-pie when one party knows the true size of the pie to be divided but the other party does not?
16. What varies greatly depending on how complete information games are structured is who will capture more of the efficiency gain from bargaining. See Osborne and Rubinstein (1994) and Ishiguro (2003).
17. In which case the inefficiency is, of course, that neither player gets any pie when they fail to agree on how to divide it. The theoretical literature on games with incomplete information focuses on this problem and concludes that because players are less likely to reach an agreement than when they have complete information efficient outcomes can no longer be expected when there is private information.
18. Since there is no efficiency gain in the false game analyzed above, the false game is a zero sum game. So when the victim pays the polluter an amount equal to the area of rectangle dDAg this is simply a redistribution of a constant pie — the inefficient pie that results when the polluter emits OD units of pollution. If the polluter can only convince the victim that her marginal profit curve is higher than BCD but not as high as bAd, then "successful" Coasian negotiations will lead to an inefficient level of

emissions somewhere between OE and OD, and the "false" game would be a positive sum game, but a smaller positive sum than the "true" game Coase envisioned.

19. See Wellisz (1964) for an early treatment of problems raised by multiple victims, particularly when they are affected to different degrees.

20. Since government intervention is seldom discussed except when there are multiple victims one would think this should be definitive regarding policy implications.

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