Difficulties with Negotiation

Does the assignment of property rights matter? Not for the efficiency of the negotiated outcome, according to Coase. But this result holds only if the firms are able to negotiate with each other.

What should prevent firms from negotiation?

One problem may be the negotiation process itself. Just because parties can gain from a deal, does not mean that they will reach an agreement. There is a substantial economic literature on the process of bargaining.* If there are well–defined rules for the actual process of bargaining, and if both parties know the gains and losses at stake, then the theory predicts that they will indeed reach an agreement : how they split the gains from the deal depends on the rules, and also on how impatient each party is. But with ill–defined bargaining rules, and some secrecy about how big the gains are, bargaining may be more difficult.

So the first problem with what is often called the "Coase Theorem", is that negotiation may break down, even when there are only two firms involved.

Negotiation becomes much more difficult when there are more than two parties involved. And there often are more than two parties : one firm's pollution may affect several other firms (and people), not just one.

What is the problem if firm 1's coal use affects (negatively) not just firm 2, but firm 3 as well? The efficient level of coal use Z_1^* is now the level which maximizes $\pi_1 + \pi_2 + \pi_3$. Suppose that we start out with firm 1 having the right to pollute, and choosing some level of coal use Z_1 which exceeds the efficient level Z_1^*. Reducing its coal use to Z_1^* would reduce firm 1's profits by some amount $A_1 > 0$, but would increase the profits of firm 2 and firm 3 by A_2 and A_3 respectively. The fact that Z_1^* is efficient means that

$$A_2 + A_3 > A_1 \tag{1}$$

Equation 1 means that, there are some bribes B_2 and B_3 which firms 2 and 3 could make, with $B_2 < A_2$, $B_3 < A_3$ but large enough so that $B_2 + B_3 > A_1$. So a deal is possible which reaches the efficient outcome, and which makes all three firms better off : firms 2 and 3 gain more in profits than they have to pay in bribes, and the bribes received by firm 1 sum to more than the amount of profits it loses.

But negotiation of the bribes becomes more difficult with three parties. Firm 3, for example, would like to behave as a **free rider**, getting firm 2 to pay most of the bribe to get firm 1 to reduce its coal use. Reduced coal use (by firm 1) is a public good for firms 2 and 3 : neither can

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* The short textbook by "Bargaining and Markets" by Osborne and Rubinstein is a good introduction to this literature.

be excluded from the benefits. And the more parties there are, the stronger the incentive to act as a free rider. With many parties to an externality, getting to the efficient solution by negotiation is no easier (but no more difficult) than getting an efficient public good supply by negotiation.

Of course information is not always perfect. Firm 1 will want to exaggerate the benefits it gets from more coal use, in order to convince the other firms that a big bribe is necessary to get it to reduce Z_1. Other firms, damaged by Z_1, will want to understate the extent of the damage they suffer, if they think that will enable them to contribute less to the money collected to pay firm 1 to reduce its coal use. These are problems which occur in public good provision, for which there exist possible solutions, but which seem often to lead to a very inefficient solution.

<center>The Outcome with No Negotiation</center>

So there are several reasons why negotiation may not take place, or may not reach an efficient outcome : strategic behaviour by negotiators, information asymmetries, too many parties involved.

So it may be reasonable to expect that in some situations negotiations might be impossible. If negotiation is impossible, what does that imply for the assignment of property rights? With "costless" negotiation, the assignment of property rights would not affect the efficiency of the negotiated outcome. With infinitely costly negotiation, the assignment of property rights determines completely. In the two–firm example, suppose that negotiation were impossible, and that firm 2 sued to prevent firm 1 from using coal. If the court decided in favour of the defendant, and ruled that firm 1 had the right to use all the coal it wanted, without having to get permission from firm 2, then the outcome would be a level of coal use of Z_1^{eq}. Z_1^{eq} is what firm 1 would choose if it totally ignored the externality. If the court gives it the right to ignore firm 2, and if negotiation is impossible, it will ignore firm 2.

If the court decided in favour of the plaintiff, then firm 1 has no right to use coal. So $Z_1 = 0$. That is the end of the story, if the two firms cannot negotiate a transfer from firm 1 to firm 2 in exchange for the right to use some coal. Firm 1 is forced to set $Z_1 = 0$; each firm then chooses its labour input L_i to maximize its profit, given that $Z_1 = 0$.

What should the court do? As Coase argued in the second half of his 1960 article, if efficiency is the goal of the legal system, sometimes it might be better to rule in favour of firm 1 and sometimes it might be better to rule in favour of firm 2. Of course Z_1^* is the best level of coal use, from the standpoint of economic efficiency. But the court may have to choose between assigning the property right to firm 1, resulting in $Z_1 = Z_1^{eq}$, or assigning it to firm 2, resulting in $Z_1 = 0$. Neither outcome is the best, but one outcome may be better than the other. Which is better depends on the **total benefits** to firm 1 of allowing it to use coal (at its preferred level of Z_1^{eq}), and on the **total costs** of allowing this usage.

That is, if judges have to decide between "all or nothing" : allowing the "ignore the externality" level Z_1^{eq} of coal use, or allow no coal use at all, then they must compare total benefits and total costs. The fact that the **marginal** benefit of coal use equals the **marginal** social cost at $Z_1 = Z_1^*$

<center>25</center>

does not really help in making this all or nothing choice.

The total benefit to firm 1 of coal use at a level Z_1 is just the area under its marginal benefit curve, between 0 and Z_1. The total social cost of coal use of Z_1 is just the area under the marginal cost curve, between 0 and Z_1. In figure 2, the total benefit of increasing coal use from 0 to the "equilibrium" level Z_1^{eq} is the area under the (red) "marginal private benefit to firm 1" curve, between 0 and the equilibrium quantity, 15. The total social cost is the area under the (blue) "marginal social cost" curve, between 0 and 15. In the figure, the two areas just happen to be equal. That means that, in the case depicted in figure 2, assigning the property right to either firm is equally good — or equally bad. But that does not have to be the case : the total benefit of coal use of Z_1^{eq} could be higher than the total social cost, as in figure 4, or lower, as in figure 5. In the case depicted in figure 4, it would be better to assign the property right to firm 1, and in the case depicted in figure 5, it would be better to assign it to firm 2.

So, Coase's main points concerning the assignment of property rights, when negotiation is impossible : (i) it may sometimes be more efficient to give a firm the right to pollute, than to prevent it from polluting ; (ii) it is **total** costs and benefits, not marginal costs and benefits, which determine to whom the property right should be assigned to maximize firms' joint profits.

Coase was concerned only with the legal system, and its role in attaining efficiency in the presence of externalities. The analysis really rests on assuming that the goal of the legal system is economic efficiency. It is not clear that lawyers and judges agree with (some) economists there. Further, if we did want judges to determine the most efficient allocation of property rights, why wouldn't we let judges propose the most efficient solution? Rather than choosing between allowing firm 1 to do what it wants, and preventing it from doing any polluting, why not tell firm 1 that it can pollute, but only up to a certain maximum level? And why not make that maximum level the efficient level, Z_1^*?

Whose Fault is it?

Another point raised by Coase is that it is the activities of **both** firms which lead to the externality. He concentrated on the case in which it might be more efficient to have firm 2 move, or shut down. If joint profits were maximized by shutting down firm 2, or having it move, so that firm 1 could use coal without having any externality problems, then negotiation would lead to this outcome, if the firms could negotiate costlessly. If the firms cannot negotiate, then the efficient choice will not result automatically.

But the activities of firm 2, at the margin, may also affect the magnitude of the social cost. Suppose that firm 2 runs a hotel, and the noise, or smell, or pollution, from firm 1 affects its profits. For a given level of the externality–causing activity Z_1 chosen by firm 1, the more that firm 2 invests in the hotel, the bigger will be the cost of the pollution. In this situation, efficiency requires that firm 1 choose an efficient level of coal usage Z_1, but that firm 2 also choose an efficient level of investment in the hotel, one for which the marginal benefit equals the marginal cost.

In some circumstances, firm 2 may not have the right incentives in its choice of inputs. Suppose that the courts decide that firm 1 must pay **compensation** to firm 2 for the damage done by its activities. For what level of compensation would firm 1 be liable? Suppose that firm 1 chose a level Z_1 of coal usage, so that firm 2's profits were

$$p_2 F^2(L_2, Z_1) - w_L L \tag{1}$$

If firm1 did not use coal, then firm 2's profits would be

$$p_2 (F^2(L_2, 0) - w_L L \tag{2}$$

Since $\partial F^2/\partial Z_1 < 0$, expression (2) is bigger than expression (1). The dollar amount of the damage done by firm 1 is the difference between these two expressions, the profit firm 2 would have earned if firm 1 did not use coal, and the profits it actually does earn. So define the damages due as the difference between these two expressions, or

$$D(L_2, Z_1) = p_2 [F^2(L_2, 0) - F^2(L_2, Z_1)] \tag{3}$$

Note that, as in the hotel example above, the level of the damages due will depend not only on firm 1's coal use Z_1, but on firm 2's input use L_2.

In keeping with that example, assume that the marginal damage of a given amount of the externality will increase in absolute value when firm 2 uses more of its input :

$$\frac{\partial^2 F^2(L_2, Z_1)}{\partial L_2 \partial Z_1} < 0 \tag{4}$$

Assumption (4) ensures that the total damages from a given amount of coal usage, $D(L_2, Z_1)$, increases with the amount of labour hired by firm 2, since

$$D(L_2, Z)1) = -p_2 \int_0^{Z_1} \frac{\partial F^2}{\partial Z} dZ \tag{5}$$

Now suppose that the courts have decided that firm 1 must compensate firm 2 for any damages done by coal use. That means that firm 1's overall profit is

$$p_1 F^1(L_1, Z_1) - w_L L_1 - w_Z Z_1 - D(L_2, Z_1) \tag{6}$$

Firm 1 chooses its inputs so as to maximize its profit. Differentiating expression (6) with respect to L_1 and Z_1, and setting the derivatives equal to 0, firm 1 will choose input levels so that

$$p_1 \frac{\partial F^1}{\partial L_1} = w_L \tag{7}$$

$$p_1 \frac{\partial F^1}{\partial Z_1} = w_Z + \frac{\partial D}{\partial Z_1} = w_Z - \frac{\partial F^2}{\partial Z_1} \tag{8}$$

Having to pay compensation induces firm 1 to internalize the externality. Equations (7) and (8) are the conditions for maximization of joint profits. In particular, equation (8) says that firm 1 sets $MB^1 = MPC^1 + MD^2 \equiv MSC$, a s it should.

But what about firm 2? Firm 2's profit is

$$p_2 F^2(L_2, Z_1) - w_L L_2 + D(L_2, Z_1) \tag{9}$$

From the definition (3) of the amount of damages paid, this profit equals

$$p_2 F^2(L_2, Z_2) - w_L L_2 + p_2[F^2(L_2, 0) - F^2(L_2, Z_1)] = p_2 F^2(L_2, 0) - w_L L_2 \tag{10}$$

Firm 2 then chooses its own input level L_2 to maximize its profits, choosing L_2 so that

$$p_2 \frac{\partial F^2(L_2, 0)}{\partial L_2} = w_L \tag{11}$$

Equation (11) may look like the correct expression for efficiency : the marginal benefit of a little more of the input should equal the marginal cost. But the marginal benefit in expression (11) is evaluated, not at the **actual** coal use level Z_1, but at the coal use level of 0. Firm 2 acts as if there is no coal being used by firm 1, since it is being compensated for any harm done by the coal.

That means that firm 2 hires too much of its input. Every increase it makes in L_2 will raise the social cost of pollution, since MD^2 is increasing with L_2. But firm 2 is not paying those costs : firm 1 is. From assumption (4), the marginal benefit of L_2 is higher at $Z_1 = 0$ than at $Z_1 > 0$. By ignoring the externality, firm 2 is using a marginal benefit curve which is too high. It expands too much, by hiring too much L_2, compared to the efficient solution.

Now this problem arises only when firm 1 must pay compensation to firm 2. It is that compensation which makes firm 2 immune to the consequences of pollution, and so distorts its incentives to hire an efficient quantity of its input. If it knew that it would be compensated for any damage done by pollution, a hotel firm would build a huge luxury hotel near a toxic waste dump. That's inefficient. No customers will come. But the hotel owner won't care if he is compensated for the lost revenue from the absence of customers.

So, in some sense, **both** parties are responsible for the externality. And if the "victim" is fully compensated for any damage, then he no longer has any incentive to internalize the effects of his decisions.