Externalities, Markets, and Government Policy

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While public production or Pigovian taxes might correct for market failures, theory cannot solve the problem without a detailed analysis of the institutional structure of the problem at hand.

In 1991, Ronald H. Coase received the Nobel prize for his work on the role of transaction costs in economics. His paper on "The Nature of the Firm" (Coase 1937) introduced transaction costs as the primary reason for the existence of firms. Coase pointed out that firms substitute an internal management structure for market transactions to eliminate the costs of negotiating, writing, and enforcing contracts. More than two decades later, his classic paper, "On the Problem of Social Costs," (Coase 1960) revolutionized the way in which economists perceived market and nonmarket solutions to the problem of externalities. In this paper, Coase argued that the problem of externalities cannot be examined without looking at the institutional setting of the problem and the size of transaction costs. According to the Nobel committee, the latter paper is the most cited paper in economics in the years since its publication. His work has stimulated research in the areas of law and economics, antitrust economics, regulation, public choice, and the role of government in economic society. The purpose of this article is to offer an explanation of Coase's contribution to the analysis of the role of government.

Externalities

Until the work of Coase (1960), economists had a highly simplified view of the role of markets. From Adam Smith, they believed that the basic role of government is to establish the rules of the game (defend property rights); from A. C. Pigou (1932), they learned that it is worthwhile for the government to subsidize or tax private activities whenever the market produces too little of a good thing (such as education) or too much of a bad thing (such as pollution). Such externalities (unpriced benefits or costs) constituted the main exception to the rule that Adam Smith's invisible hand will efficiently allocate resources. Coase basically showed that externalities may or may not require a governmental solution; the need for a government solution depends on the circumstances of each case. In shifting the terms of the debate, Coase single-handedly moved economics from presuming specific roles for government action to a more neutral position requiring detailed analysis.

Let us reconsider a simple situation examined by Pigou and Coase: one agent's profit-maximizing decisions affect the profits of another party through a technological external diseconomy. For concreteness, imagine a railroad engine is the source of fire-starting sparks to a farmer's crops. Pigou had argued that the rail-

road should be held liable for the damage done to the farmer's crops because, otherwise, too many resources would be allocated to the railroad. Pigou suggested that efficiency could be brought about by imposing a tax on the railroad.

Coase began his analysis with a simple point: if the railroad is made liable to the farmer, in a world of zero transaction costs, the railroad and farmer would reach an agreement themselves. Moreover, even if the railroad were not liable, an agreement would be reached with substantially the same allocation of resources. As an example, suppose a railroad could make $100 running one train per day and $150 running two trains per day. The farmer can make $150 planting one field or $160 planting two fields. If the fields are planted next to the tracks, the railroad destroys $60 worth of crops per train per field. It is assumed that there is no problem of assessing damages.[1]

Tables 1, 2, and 3 describe three situations. Each row describes the consequences of the railroad running no trains, one train, or two trains per day. Each column shows the consequences of the farmer's planting no fields, one field, or two fields. The lower-left-hand corner of each cell shows the profits to the railroad; the upper-right-hand corner of each cell shows the profits to the farmer; if positive, the lower-right-hand corner shows payments to third parties (Table 3 only). In Table 1, the railroad must directly compensate the farmer for damages to his crops. In Table 2, the railroad has the right to start fires on the farmer's fields. Table 3 shows an ideal Pigovian tax: the railroad is taxed by the amount of the damage and a third party receives the lump-sum amount of the tax revenues.

In any table, the total benefit to society is the sum of the payoffs shown (ignoring consumer surplus). In all three tables, the maximum attainable total benefit is $190 and is reached when one train is run and one field is planted.

In Table 1, the railroad is liable for damages inflicted and must pay $60 per train per field to the farmer. When one train is run and one field is planted, the railroad receives a payoff of $40 (= $100 – $60) and the farmer receives a total payoff of $150 (the same as if there were no railroad). While this is the social optimum, if the railroad is running one train per day, the farmer has an incentive to plant two fields because, with the payment of damages, the farmer can make $160, more than can be made by planting only one field. This would lower the railroad's profit to –$20. Clearly, in a world of zero transaction costs, it would pay the railroad
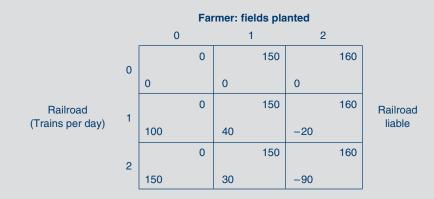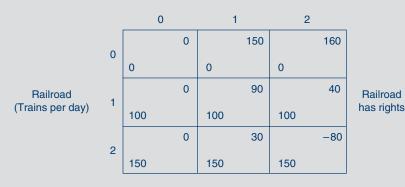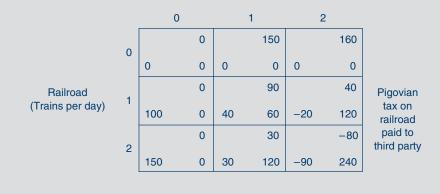
to make an agreement with the farmer not to plant the second field. The railroad could offer the farmer, say, $11 not to plant the field, increasing the railroad's net profit to $29 and increasing the farmer's payoff to $161 (for a total of $190 still).[2]

Coase then considered the alternative or reciprocal situation in which the railroad has the right to destroy whatever crops are planted near the tracks. In Table 2, if the farmer again plants one field and the railroad runs one train, the railroad earns $100 while the farmer earns only

Table 1
Railroad Directly Compensates Farmer

Each cell: upper-right corner = Farmer profit; lower-left corner = Railroad profit.

Railroad (Trains per day)	Farmer: fields planted — 0 (Farmer / Railroad)	1 (Farmer / Railroad)	2 (Farmer / Railroad)
0	0 / 0	150 / 0	160 / 0
1	0 / 100	150 / 40	160 / –20
2	0 / 150	150 / 30	160 / –90

Railroad liable

Table 2
Railroad May Start Fire in Farmer's Field

Each cell: upper-right corner = Farmer profit; lower-left corner = Railroad profit.

Railroad (Trains per day)	0 (Farmer / Railroad)	1 (Farmer / Railroad)	2 (Farmer / Railroad)
0	0 / 0	150 / 0	160 / 0
1	0 / 100	90 / 100	40 / 100
2	0 / 150	30 / 150	–80 / 150

Railroad has rights

Table 3
Railroad Pays Tax to Government

Each cell: upper-right corner = Farmer profit; lower-left corner = Railroad profit; lower-right corner = payment to third party.

Railroad (Trains per day)	0 (Farmer / Railroad / Third party)	1 (Farmer / Railroad / Third party)	2 (Farmer / Railroad / Third party)
0	0 / 0 / 0	150 / 0 / 0	160 / 0 / 0
1	0 / 100 / 0	90 / 40 / 60	40 / –20 / 120
2	0 / 150 / 0	30 / 30 / 120	–80 / –90 / 240

Pigovian tax on railroad paid to third party

$90 (= \$150 − \$60)$. However, now the railroad has an incentive to run another train, increasing its profits to $150 and lowering the farmer's profits to $30. But, again, in a world of zero transaction costs, it would now pay the farmer to offer, say, $51 to the railroad to not run the second train, raising the railroad's payoff to $151 and raising the farmer's from $30 to $39. This is again the social optimum, where the total gain to society is still $190.

In comparing Tables 1 and 2, when there is full and costless cooperation between the two parties, the resulting allocation of resources is the same: one field is planted and one train per day is run. The only difference is the distribution of the spoils. This is the celebrated Coase theorem: in a world of zero transaction costs, the allocation of resources does not depend on who has the property rights but rather on the existence of well-defined rights.

Why was this analysis so innovative in its impact on economics? To understand the Coasian contribution, it is useful to go back to the original Pigovian analysis of externalities. In Table 3, the railroad pays a tax to the government equal to the damages imposed on the farmer. The tax revenue is then redistributed to a third party, shown in the lower-right-hand corner of each cell. If the tax revenue is paid to the farmer, we are again back to Table 1, and it is necessary for the railroad to bribe the farmer into planting only one field.[3] If the tax is paid to a third party, a profit-maximizing railroad will run one train per day if the farmer plants one field; a profit-maximizing farmer will plant one field if the railroad runs one train per day. The total benefit to society is again $190 (= \$40 + \$90 + \$60)$. The optimum appears to be achieved without any necessity of negotiation between the parties. It is an equilibrium because if the farmer is planting one field, the railroad maximizes its income with one train per day; and if the railroad is running one train per day, the farmer maximizes his income with one field.

The problem with the Pigovian analysis is threefold.[4] The first is that the optimum solution need not be the only equilibrium. In this example, there are two equilibria. Imagine the railroad just happens to come along after the farmer has planted two fields (the optimum with no railroad). Then if there is a Pigovian tax, the railroad would not find it optimal to run any trains. This, too, is an equilibrium because there is no incentive for either the railroad or the farmer to deviate from zero trains and two fields.[5] But this solution is not Pareto-optimal. The total social surplus is only 160 instead of 190 as in the previous equilibrium. If we take the reverse, where the farmer comes along after the railroad is established, the railroad initially would run two trains per day and the farmer would have the incentive to plant one field, causing the railroad to run only one train per day. In other words, historical accident can determine the equilibrium and whether or not the solution is optimal in the case of a Pigovian tax scheme.

The second problem is that if the farmer receives the payments to the government (the $60) and is aware of the link between his actions and government payments, he again will have an incentive to plant two fields. Therefore, there is still no solution to the externalities problem. To solve the externalities problem by a Pigovian tax requires that the tax receipts be paid to a third party who will not alter his or her behavior as a consequence of the payment. But as our first point illustrates, this is a necessary but not a sufficient condition due to the possibility of multiple equilibria.

The Pigovian solution seems rather strange because who in society would push for a tax on the railroad other than the farmer who is having to suffer the damages created by the sparks? Why pay the tax revenue to a third party? But if the tax revenue is paid to the farmer, we again have the original problem of having to make an agreement between the railroad and the farmer to reach the optimal solution. Thus, the Pigovian "solution" is no solution at all.

A third problem with the Pigovian solution can be seen if we broaden the example. Suppose that we are discussing the damages imposed by smokers on nonsmokers. There are many smokers and many nonsmokers. It is clear that in the real world, smokers and nonsmokers cannot negotiate to reach the optimum because the transaction costs are prohibitive. It seems to make sense, therefore, for the government to step in and, say, impose a Pigovian tax on smokers. But this has one problem: who is going to get the revenue from the tax? Tullock (1967), in a path-breaking article, pointed out that people in a democratic society will compete for tax revenues. This competition for revenues can dissipate all or part of the gains because lobbying has opportunity costs (hiring lawyers, public relations experts, word processors, and so forth). Thus, in Table 3, if the $60 revenue is dissipated by such actions, the total gain to society from a Pigovian tax would be only $130 if the farmer planted one field and the railroad ran only one train per day.

A precursor of Coase was the great institutional economist and legal scholar, John R. Com-

mons. According to Commons (1923, 326), judges have often ruled that "taxes may not be used for private purposes." But Commons pointed out that taxes are always used for some type of private purpose. The question is whether that private purpose is tinged with enough public interest to make the taxes worthwhile. For example, property taxes in many localities are used to support "public education." Teachers' unions consistently lobby to increase their share of the public purse, and the educational bureaucracies expand at the cost of sacrificing the very goal of teaching students. This example can be multiplied many times. Taxes imposed on the working population are used to support large segments of the nonworking population. Government employees become a central clientele to the political party that hires them.

Coase's basic insight is really that we cannot separate the analysis of externalities from the real-world situation we are describing. What we have just said simply shows that there is no a priori role for government policy in controlling externalities. It does not say that there is no role. But instead of concocting abstract theories about externalities and what to do about them, the Coasian research agenda requires the economist to actually study the detailed setting in which the alleged externality is taking place. We must examine the institutions, the property rights, and the costs of contracting in each and every instance. As Coase (1993, 97) once put it, "What I object to is mindless abstraction or the kind of abstraction which does not help us to understand the working of the economic system."

Positive transaction costs and property rights

A transaction cost is a cost of using a market. "There are negotiations to be undertaken, contracts have to be drawn up, inspections have to be made, arrangements have to be made to settle disputes" (Coase 1992, 715). It is important to distinguish between what has been called the Coase theorem and what I will call the Coasian hypothesis. This is the hypothesis that the legal system under a system of positive transaction costs "will have a profound effect on the working of the economic system and may in certain respects be said to control it" (Coase 1992, 718).

To illustrate this at the simplest level, in the parable of the railroad and the adjacent farmer, suppose it costs the railroad $10 or the farmer $20 for each planted field to build a protective firewall. This is a transaction cost

because, from the point of view of the railroad, it is a cost of preventing damages. When a lawyer is hired to write a contract, it is done to protect the firm in a legal dispute. Whether the railroad is liable or not, a firewall will be built by profit-minded agents. But now we get a different allocation of resources. If railroad is liable, it will run two trains a day and the farmer will plant two fields. But if the farmer must build the firewall, the farmer will only plant one field because of the exorbitant cost of protecting two fields and diminishing returns. The major implication, then, of the existence of transaction costs is that changing the rules of liability has an impact on resource allocation.

The Coasian hypothesis suggests that it makes a real difference what the law stipulates about what is legal and not legal. If the law imposes the rule that companies are responsible for whatever illnesses are caused by their products and the standard of proof is relatively ambiguous, there will be a strong tendency for the product to disappear from the marketplace. Indeed, there are many examples of products that have disappeared in the United States that can be obtained elsewhere.[6]

Whether or not the change in the allocation of resources is beneficial requires a detailed study of costs and benefits. For example, a recent study by Richard Manning (1994) of the effect of changes in the tort law on the prices of childhood vaccines shows that the price of the DPT vaccine has increased by 2,000 percent over the past decade, with 96 percent of the price increase due to litigation costs.

Public goods

In the classic treatment of public goods (Samuelson 1955), it is supposed that public goods exhibit two characteristics: nonrivalry in consumption and the inability of providers to exclude users. A lighthouse has been used by economists of the stature of John Stuart Mill, A. C. Pigou, and Paul Samuelson as an example of a pure public good (Coase 1974). Apparently, the light from any lighthouse could be used by any number of ships and no ship could be excluded from using the light. Thus, the problem of free riding would make it difficult to privately finance a lighthouse. Coase (1974) used the lighthouse as a real-world illustration of his method of examining the argument for government interference into the economy. Coase surveyed the history of lighthouses and discovered that lighthouses were built by private parties even though everyone within sight of the lighthouse can use its services without any conges-

tion costs. Coase simply pointed out that ships usually arrive one at a time, they can be easily identified, and if a captain never pays, the light can simply be turned off, as it had throughout the early history of the lighthouse. The lighthouse operators also charged ships according to their tonnage, so that the price paid roughly corresponded to the benefits received by the owner of the ship. This is a market: a price is charged, and if the price is not paid, the next time the service will be denied. The institutional structure of production is important. If the lighthouse is made liable for any accidents caused by turning off the light, suddenly a service that could be provided privately is turned into one that will not be provided at all unless by some governmental agency.

This point and our analysis of externalities illustrate how even the greatest economists cannot, through deductive reasoning, decide whether government action is required to correct some perceived market failure. Some type of institutional examination of the facts is necessary before any policy prescription can be reached.

Conclusion

In this article, I have tried to clarify the debate that has raged over the Coase theorem since its inception. Basically, Coase pointed to a flaw in the argument for correcting market failures. While public production or Pigovian taxes might correct for market failures, theory cannot solve the problem without a detailed analysis of the institutional structure of the problem at hand. We pointed out that even if Pigovian taxes can be calculated, the solution requires (1) third-party payments, and (2) relatively small costs due to the competition for government revenues. As Coase (1990, 185) colorfully put it, presumably recalling Humphrey Bogart in the *Maltese Falcon*, "Such tax proposals are the stuff that dreams are made of." Similarly, whether a good is public or private depends on technology, transaction costs, and the institutions of the economy. At the same time, while there is no a priori argument for government intervention, there is also no a priori argument for *laissez faire*. Each case must be decided on the pragmatic principle of what works best in the real world.

Notes

I wish to thank Stephen Brown for his valuable comments on an earlier version of this article. The article was stimulated by the author's communications with Paul Samuelson over the penetrating analysis of Coase in Samuelson (1995). The current essay does not answer Samuelson's questions but simply tries to clarify the nature of the Coasian debate.

[1] Some might raise the issue that a farmer might locate next to the tracks just to sue the railroad. This is really just a transaction cost in disguise. We are assuming here that the example represents the technological opportunities available to the society as well as all the possibilities. The conclusions would not be changed by assuming N farmers, each with some clear-cut damage. If a farmer has the option to locate elsewhere with the same fecundity, there is no externality to worry about. I am indebted to Steve Brown for this point.

[2] Paul Samuelson (1995) has raised the issue of bargaining and negotiation failures. But this is, once again, a situation in which there are costs of contracting. The zero-transaction-cost world in economics is like the law of inertia when no forces are operating on an object: nothing stops perfection.

[3] See Coase (1990, 151) and Baumol (1972).

[4] The following analysis does not try to replicate the views of Coase (see, for example, Coase 1990, 179–85).

[5] It is an established point in economic theory that in the presence of externalities, competitive behavior can result in multiple equilibria (see Ruffin 1972).

[6] Diving boards are disappearing from neighborhood pools in the United States (*Investor's Business Daily*, May 13, 1996, A2). See also Peter W. Huber (1988, 155–61), for other examples, such as contraceptive devices and leprosy drugs.

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