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# **Firm Property Rights, Bargaining, and Internalization**

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## **Abstract**

Coase's seminal 1960 paper on externalities is associated with the so-called Coase Theorem which is stated in the literature in many forms. However, its main thrust was less to state a theorem than to challenge Pigou's earlier insistence on the need for government intervention through Pigouvian taxes to achieve internalisation of externalities. Coase argued instead that private party bargaining can be relied upon to internalise externalities, but equally insisted that establishing clear and firm property rights is a precondition to successful internalisation achieving bargaining. Similar thinking has led to clear definitions of property rights becoming a key part of World Bank conditionality in the environmental area.

This paper discusses the underpinnings of this position, arguing that it is little researched and subject to challenge. We first show how Coase only considered one type of property right, and where others such as compensation rights are allowed for the property right assignment will itself directly achieve internalisation with no need for further bargaining. We also show how ambiguous property rights can dominate a clear assignment of property rights for a case where recipients of damage can move to avoid damage, but must remain and actually receive damage in order to be recipients of compensation. Rights to either polluters to pollute, or to recipients of damage to compensation create a distortion; and either outcome is dominated by no assignment of property rights, but a tax on polluters (Pigouvian tax) with revenues redistributed equally to the whole population.

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<sup>+</sup> Part of this paper was written while Abrego was at the University of Warwick. Views expressed are not necessarily those of the International Monetary Fund.

## **I. Introduction**

Economists generally seem to think that establishing firm property rights is a precondition for efficient resource allocation in the presence of externalities. Property rights are seen as necessary for Coasian bargaining to occur, which, in turn, will achieve internalisation (Pareto efficiency). Myles (1995) in a recent graduate public finance text, for instance, (p. 323), argues that "... the clarification of property rights should constitute the first step in the construction of a policy towards externalities". The World Bank frequently argues a similar case for dealing with environmental externalities in developing countries (World Development Report 1992). The literature on international environmental externalities which produced the polluter pays principle (OECD (1977)) sees the absence of property rights as a fundamental impediment to achieving internalisation and hence Pareto-efficient outcomes.

At the time, the main point of Coase's (1960) paper was that government intervention through taxes and subsidies as argued for by Pigou (1924) was not necessary to internalise externalities.<sup>1</sup> Bargaining between the private parties to the externality could yield the same outcome with no government intervention. But for this to occur clear property rights needed to be established first. Coase saw the assignment of such rights as being arbitrary from an economic point of view because externalities are inevitably reciprocal in nature and founded mainly on appeals to natural justice. But once established they lead to efficient outcomes through bargaining.<sup>2</sup>

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<sup>1</sup>The problems created by non-convexities in the presence of externalities (see Starrett, 1972) also later cast doubt on whether market guided mechanisms (such as a Pigouvian tax) can satisfactorily achieve internalisation, adding further impetus to the search for clear property rights which allow bargaining to take place.

<sup>2</sup> He advanced other propositions, such as the claim that the outcome of such bargaining was independent of the assignment of property rights, which Dolbear (1967), Huwicz (1995) and others later showed to be false.

The purpose of this paper is to argue that existing literature discussion of property rights and internalisation needs to be more nuanced than simply repeating Coase's conditions. We first show that despite Coase's arguments in favour of clear property rights as a precondition for bargaining, bargaining may not be needed if a wider array of potential property rights beyond those considered by Coase are available. Coase only considered rights to be either free of or to inflict damage, in effect court rulings on injunctions; not compensation rights for damage actually inflicted. However, compensation rights as embodied in the OECD's polluter pays principle will automatically internalise externalities, without the need to resort to bargaining as in Coase. The argument that firm property rights are needed to generate efficient outcomes via bargaining is thus weakened if some types of property rights can achieve this directly without bargaining.

We argue that in the presence of behavioural responses to the damage accompanying external effects, the establishment of firm property rights need not always be a good thing. We appeal to cases where recipients of damage can move to avoid or abate damage, and property rights established in their favour can cause them to remain in a heavier damage location and receive more damage. Compared to the case where no bargaining occurs, granting such rights may make things worse.

The structure of the paper is to first discuss Coasian bargaining and property rights. We note that nowhere in Coase, or the literature that follows, is there any discussion of the efficiency implications of property right assignments and whether the way these are assigned can themselves generate inefficiencies through induced behavioural responses; i.e. whether firm property rights are necessarily a good thing. The next section discusses compensation rights, the polluter or victim pays principles, bargaining and efficiency. We then discuss the establishment

of property rights in a case where there is locational mobility, and present an example where establishing firm property rights is Pareto worsening. These two main sections of the paper serve to emphasize the themes that bargaining may not be needed to achieve efficiency under some property rights schemes, and that firm property right allocation are not always desirable on efficiency grounds.

## **II. Coase, Property Rights, Bargaining and Externalities**

In his 1960 paper Coase argued that in the presence of externalities and assuming away transactions costs, the establishment of clear property rights would allow for bargaining between private parties to take place which would lead to the full correction of externalities and the restoration of Pareto optimality. Since then, the idea that well-defined property rights are a precondition for achieving economic efficiency in the presence of externalities seems to have been accepted without any serious challenge by both academic and policy-oriented economists.

Coase's paper was written as a critique of Pigou (1924) which argued that government intervention through taxes on the economic activities responsible for externalities was the way to restore Pareto efficiency. Coase's argument was that with clearly defined property rights and bargaining Pigouvian taxes, and hence government intervention, were unnecessary. Coase argued that since externalities were reciprocal, the assignment of property rights was to a large degree arbitrary; but their assignment was a necessary precondition to bargaining achieving Pareto optimality. If victims of damage had the property rights to be free of damage, they would accept some amount of compensation for allowing damage generating economic activity to proceed. If inflictors of damage had the property rights, victims of damage would bribe them to restrain their damage generating activities. In either case, all the relevant marginal conditions for efficiency and optimality would be satisfied and Pareto optimality would be restored. As Buchanan and Stubblebine (1962) later argued, Pigouvian taxes under this view of the world could be even harmful on efficiency grounds if they were introduced after bargaining had successfully internalised the externality at issue.

The verbal style of Coase's paper has, over the years, given rise to more than one version of the theorem (e.g. Cooter, 1989; Stigler, 1989; Coase, 1992; Hurwicz, 1995). Coase's central

proposition that the allocation of resources is independent of the legal assignment of rights has been shown to be false (Dolbear, 1967; Hurwicz, 1995; Hurwicz, 1999; Shapiro, 1974; Editors, 1977).<sup>3</sup> Coase's various propositions on property rights and bargaining for externality correction are often referred to as "the Coase Theorem", although Coase's original statement was not in the form of a theorem as such. Instead, he put forward a set of ideas and illustrations as to how, in the presence of an externality, a clear definition of property rights will allow private bargaining to take place, and lead to an efficient outcome without the need for government intervention. Over the years details of Coase's analysis have been criticized on various points of detail, but the idea that firm property rights are needed for internalisation of externalities has not to our knowledge been questioned. The same is true of Coase's critique of Pigouvian taxation that if it is at best unnecessary and at worst efficiency worsening. In the policy community, for instance, institutions such as the World Bank have actively campaigned in favour of clear property rights as the necessary first step towards efficient externality treatment in developing countries (REF.)

As presented in Cooter (1989), the central element of the Coase theorem is the assertion that, in the absence of transaction costs, the legal assignment of property rights is irrelevant for the allocation of resources, since this will be modified by individuals through market transactions. With zero transaction costs, "all that matters (questions of equity apart) is that the rights of the various parties should be well-defined..." (Coase, 1960, p.119). Market transactions will guarantee efficient resource allocation regardless of the legal assignment of property rights, and with firm property rights in place there is no need for Pigouvian taxes.

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<sup>3</sup> Also see Starrett (1972) and Hurwicz (1999).

Other versions of the Coase theorem cite its statement that with clear property rights, bargaining among interested parties (both recipients and inflictors of damage) will lead to Pareto optimal outcomes. The bargaining set defines these allocations at which both parties can be made better off; all that is needed is to define reservation utilities and supporting property rights to achieve this. Coase conceived of such rights in terms of rights to the recipients of damage to be guaranteed utility levels free of any disutility associated with damage, or to the inflictors of damage having rights to demand compensation in order to reduce the level of damage inflicted. He did not consider other forms of rights, such as the more common legal right to be compensated for actual damage, or to be subject to damages via litigation and suit. The Coasian property right concept was that either the presence or absence of an injunction from the courts to enforce restraint of damage at any level.



### **III. Internalisation through Compensation Rights (Polluter-pays Principle)**

As we note above, the discussion both in Coase and in the literature that has followed has been about property rights and their role in internalising externalities defining rights in terms of minimum utility levels; the utility level of recipients of damage associated with no damage, on the one hand, and the utility level of damage inflictors associated with unfettered rights to inflict damage, on the other. No attention has been given in the economics literature to other forms of property rights, such as the right to sue for damages, as against an injunction to desist as in Coase. This is even though rights to damages are what is typically at stake in actual court cases. The right to sue for damages actually inflicted we refer to as a compensation right, in contrast to a Coasian right.

A feature of this set of property rights is that in the case of compensation rights (as against an injunction), rights awarded in favour of those who actually receive damage associated with externalities will automatically internalise them. In contrast to the situation with Coasian rights, no additional bargaining will be needed to internalise the externality and achieve Pareto optimality.

That this is so can be seen as follows. We consider a case where damage is utility based and recipients of damage have a separable utility function of the form

$$U^R = U(G^R) - V(D^R) \quad (1)$$

where  $U^R$  is the utility level of recipients of damage,  $G^R$  is consumption of goods by recipients of damage, and  $D^R$  is damage received by damage recipients. We consider a single good, whose production is at constant marginal cost

$$C(G) = \lambda G \quad (2)$$

Damage associated with the production of goods is fixed coefficient

$$D = \beta G \quad (3)$$

and is all received by the damage recipients.

With no compensation rights, producers equate the market price of  $G$  to its marginal production cost

$$P_G = \lambda \quad (4)$$

and fail to internalise the utility based externality associated with  $V(D^R)$  in (1).

However, with compensation rights awarded to the recipients of damage, then costs to producers also include the marginal disutility of damage ( $V'(D^R)$ ) since this must be paid as compensation to damage recipients. This implies that

$$P_G = \lambda + V'(D^R) \quad (5)$$

and in this case Pareto optimality is fully restored by the assignment of property rights without any resort to Coasian bargaining.

This case also corresponds to the application of the polluter pays principle. This was originally suggested by the OECD (1973) as a mechanism for resolving international externality conflicts, but with no claims offered for its efficiency properties. However, if the victim pays principle is followed instead, no internalisation occurs; and without added bargaining no move towards Pareto optimality will occur.

The point, however, is that if a wider set of property rights are considered as instruments to achieve internalisation than those discussed by Coase, then the choice of property right form becomes an instrument which can be used to internalise externalities. And compensation rights paid to recipients of damage by those who inflict damage will automatically internalise

externalities without any recourse to bargaining, while Coasian rights require additional bargaining.

#### **IV. Internalisation and property rights in the presence of locational choice**

In nearly all the cases that Coase (1960) discusses it is implicitly assumed that there is no locational choice in that neither the party causing the damage nor the victim can move to a different location in response to the externality; although this case is touched on in a two paragraph discussion at the end of the paper. As a result, different property right assignments only have income distribution implications. An immobility assumption, of course, is extreme. For example, fishers on a river can move upstream in response to pollution that reduces downstream stocks; and individuals living close to a busy airport can move away to avoid noise.

Once the possibility of locational choice in response to damage is taken into consideration, achieving appropriate internalisation through Coasian deals becomes more complicated; to the point that it is unclear whether establishing firm property rights in a Coasian sense is always a good thing. If polluters are liable for damage and must pay compensation, victims have an incentive to remain in the polluted area to receive compensation. This distorts migration decisions, with too many people remaining in the damage-ridden area. Bargaining deals struck between polluters and victims will address the damage component of the externality, but will not be able to correct for the migration distortion. Thus, well-defined property rights which allow for bargaining to take place need not restore Pareto optimality. In contrast, a Pigouvian tax set equal to the difference between marginal and social cost will be able to achieve full internalization since—provided that the revenues are distributed across regions in an equal per capita lump-sum fashion—it will not distort migration decisions.

We can show this in a simple model which we can solve numerically to evaluate different tax and bargaining solutions.

We assume there are two region,  $A$  and  $B$ , and two goods,  $E$  and  $F$ . Good  $E$  is produced only in region  $A$ , and generates a negative externality which only affects consumers residing in that region. Production of  $F$  takes place in both regions, and is assumed not to generate any externality. Residents of region  $B$  are thus damage-free.

### *Production and Damage*

For simplicity, we assume that each good is produced using a single factor (labour) and under conditions of decreasing returns to scale. Denoting goods by  $i$  and regions by  $j$ , we write the production of goods as

$$Y_i^j = (L_i^j)^{\alpha_i^j}; \quad 0 < \alpha_i^j < 1; \quad i=E, F; \quad j = A, B \quad (6)$$

where  $Y_i^j$  denotes outputs and  $L_i^j$  represents labour inputs. The exponents  $\alpha_i^j$  are strictly less than one in the production of each good in each region, and define the elasticity of output with respect to the labour input  $L_i^j$ . The assumption that good  $E$  is only produced in region  $A$  implies that  $Y_E^B = L_E^B = 0$ .

We assume that damage from the production of good  $E$  in region  $A$  affects residents in region  $A$ , lowering their utility. We assume a fixed coefficient damage function, with damage given by

$$D^A = \beta Y_E^A \quad (7)$$

where  $D^A$  denotes damage in region  $A$ , and  $\beta$  is the damage per unit of production of good  $E$  in that region. By assumption,  $D^B = 0$ .

## Preferences

Preferences are defined over consumption of goods in each region and damage if residents in a region receive damage. We assume that there are three types of consumers in the economy, all having the same preferences. Polluters,  $p$ , or owners of firms producing good  $E$  in region  $A$  receive the return to the fixed factor used in production of  $E$  in  $A$ . Victims,  $v$ , are labourers who are resident in region  $A$ , while residents in region  $B$ ,  $n$ , receive no damage. As the owners of a fixed factor used in  $A$  polluters who reside there are assumed not to be affected by the damage they generate, and hence not to move across regions. Labourers have the option to move freely across the two regions but victims locate in region  $A$  only. Utility functions for agents types are given as

$$U^p = U^p(C_i^p) \quad (8)$$

$$U^v = U^v(C_i^v, D^A) \quad (9)$$

$$U^n = U^n(C_i^n) \quad (10)$$

where  $U^p$ ,  $U^v$  and  $U^n$  denote utility for each consumer type (producers, victims, unaffected).  $C_i^p$ ,  $C_i^v$  and  $C_i^n$  represent the corresponding agents goods consumption, and  $D^A$  is damage from production of good  $A$ . In the special case where (4) can be written in separable form we have

$$U^v = \hat{U}^v(C_i^v) - V(D^A) \quad (11)$$

where  $\hat{U}^v$  is utility from goods consumption in the absence of damage, and  $V(D^A)$  is damage in utility terms. We assume all labour locating in region  $A$  is equally affected by the same damage, i.e.  $V(D^A)$  is the damage per labourer locating in  $A$ .

## Equilibrium

In this model equilibrium involves goods and labour market clearing conditions, with goods prices and the wage rate by region endogenously determined. Consumers in each region maximize utility subject to their budget constraint, but because of interregional mobility possibilities, equilibrium also involves an equal utility condition across regions. Thus, with identical goods prices across regions, interregional differences in wage rates are offset by the marginal value of damage for those residing in region  $A$ . Assuming that the same damage accrues to all individuals who locate in  $A$ , migration equilibrium requires

$$W^A - \frac{V(D^v)}{\lambda} = W^B \quad (12)$$

where  $W^A$  and  $W^B$  are each region's wage rates, and  $\lambda$  is the marginal utility of income.

Equilibrium prices for the two goods are given by  $P_E^*$  and  $P_F^*$ , such that

$$\sum_{k=1}^3 C_k^k = \sum_{j=1}^2 Y_i^j \quad i = A, B; j = E, F; k = p, v, n \quad (13)$$

Good  $F$  is assumed to be homogeneous and costlessly traded across regions, and hence we also allow for interregional trade in good  $E$ . Damage only occurs with the production of  $E$ , not consumption.

Market clearing for labour implies wage rates in the two regions,  $W^A, W^B$  such that

$$\sum_i \sum_j L_i^j = \bar{L} \quad i = A, B; j = E, F; \quad (14)$$

where  $\bar{L}$  is the fixed endowment of labour in the economy.

### *Compensation Rights, Internalisation and Pigouvian Taxes*

For this economy, we consider alternative property right arrangements as instruments to facilitate internalisation of externalities. We first consider the case where compensation rights are established rather than Coasian property rights, and no bargaining is considered in this case. We return later to Coasian property rights.

If we require compensation rights to be paid by those inflicting damage to those who suffer damage then the production externality is internalised, since producers respond to  $P_E - \frac{V(D^A)}{\lambda}$  as their effective output price. However in this case, the migration equilibrium condition (12) reflects the payment of compensation for damage, and becomes

$$W^A = W^B \quad (15)$$

and inefficiency results since too many individuals now reside in  $A$ .

In turn, if we allow for inflictor rights the efficiency condition for migration (equation (7)) is satisfied, but the externality is not internalised.

If however, a Pigouvian tax is used to correct the externality with a tax,  $\tau$ , on the output of the polluting industry,  $Y^A_E$ , this produces the required internalisation result. Here, in order not to distort migration decisions, tax revenue must be distributed in a lump-sum fashion across all individuals in an equal per capita manner, i.e. such that consumer receive the same amount of tax revenue regardless of where they reside. In this case, the income for each consumer is given by

$$I^p = P_E Y^A_E - W^A L^A_E + T \quad (16)$$

$$I^v = W^A L^A_E + P_D Y^A_D + T \quad (17)$$

$$I^n = P_D Y^B_D + T \quad (18)$$



where  $T$  per capita tax revenue in the whole economy, which is, in turn, given by

$$T = \tau P_E Y_E^A / \bar{L} \quad (19)$$

In this case, full internalisation occurs with a restoration of Pareto efficiency but without any formal assignment of property rights. Seemingly, an ambiguous or null assignment of property rights combined with an appropriate Pigouvian tax dominates equilibria with clearly allocated compensation or damage infliction rights.

### *Bargaining and Coasian Property Rights*

We can also evaluate outcomes in this structure under a Coasian assignment of property rights and bargaining using an explicit bargaining model. Here we model bargaining between polluters and victims using a Nash bargaining function (Nash, 1950). This approach to bargaining has been widely used in the literature, although other formulations such as those due to Kalai and Smorodinsky (1975) could be used. We assume that bargaining only involves polluters and victims, although with mobility those who actually receive damage will be endogenously determined. We can write the bargaining problem as the maximization of a Nash bargaining criterion function

$$\max \Omega = (U^p - \bar{U}^p)^\delta (U^v - \bar{U}^v)^{(1-\delta)}, \quad 0 < \delta < 1 \quad (20)$$

subject to the set of feasible allocations lying above some threat point or set of reservation utilities. In this formulation  $U^p$  and  $U^v$  are reservation utilities for polluters and victims, and  $\delta$  is a parameter reflecting polluters' bargaining strength.

In this set up, the interests of polluters coincide with those of the owners of the fixed factor in region  $A$ 's polluting industry,  $E$ , and the reservation utility for each party depends upon the liability rule prevailing. We assume that polluters must bribe victims in order for damage to

occur. Coase's formulation implies that the disagreement point for the parties under this property right arrangement is one where polluters are not allowed to inflict any damage without the agreement of victims (an injunction being in place against them requiring agreement from victims for any damage inflicted). In the present model, this corresponds to a scenario where victims are guaranteed their utility level from goods consumption alone (ignoring the disutility of damage) in any bargained outcome.

Denoting by  $R$  the amount of compensation that polluters must pay for damage inflicted,  $R$  is determined through bargaining. Since only wage earners in  $A$  are affected by damage and hence take part in bargaining, residents in  $B$  receive no compensation. Consumers' incomes in this case then become

$$I^p = P_E Y_E^A - W^A L_E^A - R \quad (21)$$

$$I^v = W^A L_E^A + P_D Y_D^A + R \quad (22)$$

$$I^n = P_D Y_D^B \quad (23)$$

Analytical results on the outcome under bargaining are not possible in this structure, and numerical simulation must be used; to which we turn next. However, since only one variable, the level of output  $E$  in  $A$  (and hence damage) is the subject of bargaining, and two distortions are present, the production externality and the migration condition, bargaining over one object seems unlikely to be able to achieve full internalisation.

Table 1 presents the parameters for a simple economy with CES preferences for polluters and damage receivers which we use to provide an example of how bargaining is dominated by a Pigouvian tax in this case. We also specify output elasticities with respect to labour in each region, a damage coefficient,  $B$ , and have arbitrarily set the relative strength in bargaining to 0.5 for each of the two groups of polluters and damage receivers.

**Table 1**

**Parameter Values Used for an Artificial Economy  
In Which Ambiguous Property Right Assignments Dominate  
Firm Property Rights**

<b>Output elasticity with respect to labour</b>	
• Good E, region A	0.67
• Good F, region A	0.73
• Good F, region B	0.83
<b>Shares in preferences</b>	
• Polluters	
○ Good E	0.40
○ Good F	0.60
• Damage receivers	
○ Good E	0.40
○ Good F	0.60
<b>Elasticity of substitution in preferences</b>	
• Polluters	1.25
• Damage receivers	1.25
<b>Damage coefficient (<math>\beta</math>)</b>	0.03
<b>Relative strength in bargaining</b>	
• Polluters	0.50
• Damage receivers	0.50

**Table 2**

**Outcome in Artificial Economy under Coasian Bargaining and Pigouvian Tax Scheme Achieving Full Internalization**

	<b>Competitive Case*</b>	<b>Bargaining Outcome with rights to damage receivers</b>	<b>Pigouvian Tax Scheme with Transfers to Provide Constant Utility for Polluters</b>
<b>Utility</b>			
• Polluters	38.42	34.13	34.13
• Damage receivers	342.82	350.45	350.60
<b>Social welfare change*</b>	0.00	0.89	.93
<b>Labour demand</b>			
• Dirty good			
○ Region A	20.00	17.42	17.35
• Clean good			
○ Region A	25.00	34.84	34.84
○ Region B	25.00	17.74	17.82
<b>Output</b>			
• Dirty good			
○ Region A	30.00	27.36	27.28
• Clean industry			
○ Region A	40.00	50.88	50.88
○ Region B	30.00	22.54	22.62
<b>Tax Rate</b>			0.11
<b>Subsidy Rate</b>			0.09

\* Sum of Hicksian EVs (polluters' + damage receivers')

Results from the model in Table 2 show that under Coasian bargaining both polluters and damage receivers benefit relative to the disagreement point. Output of the good generating damage falls, output of the dirty good in region A where damage is inflicted increases, and output in the damage free region falls as internalisation occurs. The utility of polluters falls and

that of damage receivers rises. Under a full internalisation Pigouvian tax scheme with no assignment of property rights polluters lose and damage receivers gain, but the social welfare gain exceeds that under bargaining. In this case, assigning property rights and allowing bargaining to proceed does not yield first best policy response.

## **V. Conclusion**

This paper raises the seemingly neglected issue of efficiency impacts of alternative property rights assignments. It first discusses whether or not property rights mechanisms can be used directly as an instrument to achieve internalisation; despite the thrust of the literature since Coase that property rights are largely a precondition to bargaining, which in turn achieves Pareto Optimality. It draws a distinction between rights of victims to be free of damage, and rights of damage inflictors to inflict damage; the rights considered by Coase; and rights to sue for damages actually inflicted. Under the latter, compensation rights to victims will automatically internalise the externalities with no need for bargaining. It also argues that there are cases, such as where behavioural response to damage occurs, where defining property rights and allowing for bargaining does not yield first best outcomes and presents an example supporting this position.

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