

# Internalizing Environmental Externalities and the Coase Theorem

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*This article offers a brief review of the Coase Theorem in the context of policy planning. This concept first revolutionized the regulatory approach to the environmental problem because it advocated how bargaining mechanisms correct externalities without any pre-condition on entitlement assignment. However, given a set of non-negligible constraints imposed by the empirics i.e., non-null transaction costs and asymmetric income effects, questions remain on how decentralized decision-making processes, i.e., private market mechanisms, can ensure Pareto-efficiency in practice without undermining the local validation of the theorem. Starting from major theoretical underpinnings, this brief highlights that active regulation of externalities by governments is relevant under reasonable conditions. Far from being empirically inadequate, Coase's transaction-cost-free model must be seen as a demonstration of how transaction costs cause substantial distortions and inefficiencies when excluded from environmental policy frameworks. Thus, Coasian bargaining and Pigouvian taxation may be complements rather than substitutes. Active public environmental intervention could act as a backup system capable of correcting inefficiencies when market mechanisms and private negotiations fail to do so.*

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## 1 Introduction

Economic goods fall into excludable/rivalrous, excludable/non-rivalrous, non-excludable/rivalrous, non-excludable/non-rivalrous categories. While the market provision of excludable goods leads to consumption and supply levels deemed suitable to match optimality criteria, market failure occurs in the case of non-excludable goods, regardless of their rivalrous or non-rivalrous nature (Graves, 2020). Fundamental to resource economics, allocating natural and environmental goods efficiently cannot be disconnected from policy instruments (Schneider, 2022).

Pigou (1920) first defended that setting a tax equal deemed suitable to capture the marginal environmental damage induced by industrial activity would compensate for inefficiency losses and allow the market provision to reach optimal levels. Later, Samuelson (1954) offered an extension distinguishing between continuous and non-continuous public

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goods. For the former, optimality would be achieved if the marginal benefits of provision remain higher or equal to the marginal costs. In the latter, however, the public good is optimally supplied if the vertically summed marginal benefits of those benefitting from it exceed the marginal provision costs. Thus, government regulations gradually shifted towards internalizing those environmental externalities using active optimal provisions of public goods. Coase (1960) challenged this view and advocated that bargaining mechanisms may correct the externalities without any pre-condition on entitlement assignment when some conditions are fulfilled. In doing so, he did not only disregard the “*environmental*” role of public institutions but suggested that active government interventions are neither necessary nor efficient.

This brief aims to evaluate the relevance of the Coase Theorem in the context of environmental planning. The main objective is to offer a critical but synthetic evaluation of this theory linked to empirical conditions susceptible to invalidating the local power of the theorem. Associated arguments are thought to provide a broad picture to the reader as well as inclusive knowledge on this topic.

The rest of the paper is organized as follows. Section 2 introduces the conceptual foundations of this theorem and underlines how it changed the historical pattern of public interventions. In a nutshell, we describe how private bargaining mechanisms without any pre-condition on entitlement assignment may prevail over public intervention in correcting externalities. Having reported theoretical underpinnings and conflicting outcomes, Section 3 provides the intuition behind a public regulation of externality is nonetheless relevant under reasonable conditions, especially when transaction costs prevent decentralized decision-making processes, i.e., private market mechanisms, from reaching Pareto-efficiency. In Section 4, concluding remarks are formulated.

## 2 The Coase Theorem: Background

Pigou (1920) first defined the principle of externalities as a situation in which the marginal private cost differs from the marginal social cost. Without public interventions, an inefficient allocation of resources would be caused by the discrepancy between private and social costs (Schweizer, 1988). Therefore, Pigou (1920) supplied a program incorporating taxes and subsidies (“*bounties*”) deemed suitable to internalize these externalities. In doing so, he deliberately argued in favour of a state-led public intervention.

Coase (1960) offered a controversial paper challenging Pigou’s approach to environmental issues (or referred to as an attempt to “*expos[e] the weaknesses of Pigou’s analysis*”) and highlighted that the allocation of property rights by legal rules is neutral among two parties because all externalities are internalized through decentralized decision-making processes (Coase, 1991; Canterbury & Marvasti, 1992). This novelty, located around the nature of the transfer payment internalizing the externality, operated a break with the conventional regulatory approach to environmental damages. At the time, existing legal practices to address those externalities were limited to two formal statements: (*i*) only governments could internalize externalities through taxes and subsidies; (*ii*) entitlements had to be assigned to the agent affected by the externality only (Cassidy & Chae, 2006). Instead, Coase claimed that assigning entitlements to non-governmental entities corrects the externalities efficiently without any pre-condition on which party should receive such entitlement (Cassidy & Chae, 2006). Due to the symmetry of the environmental issue, taxing the producers generating

the externalities is finally an asymmetric intervention which hides the second side of the problem for Coase (1960, p. 2): “The traditional approach has tended to obscure the nature of the choice that has to be made. The question is commonly thought of as one in which A inflicts harm on B, and what has to be decided is: how should we restrain A? But this is wrong. We are dealing with a problem of a reciprocal nature. To avoid harm to B would inflict harm on A. The real question that has to be decided is: should A be allowed to harm B or should B be allowed to harm A?”.

Mas-Colell et al. (1995), among others, formalized this theorem algebraically. For an exhaustive and accurate review of the environmental applications of the Coase Theorem, we recommend the excellent contribution offered in Deryugina et al. (2021). Consider two agents presenting an indirect utility function defined  $v_i(p, w_i, h) = \max_{x_i \geq 0} u_i(x_i, h)$  with  $px_i \leq w_i$  for  $i = 1, 2$ ; where  $p$  refers to the price vector for consumption bundle  $x_i$  of agent  $i$ ;  $w_i$  corresponds to the budget constraint set higher than  $px_i$ ;  $u_i$  indicates the level of utility (welfare),  $v_i$  is the indirect utility and  $h$  refers to the externality introduced within the model. If a quasi-linear utility function is considered according to the numeraire,  $v_i(p, w_i, h)$  becomes  $\Psi_i(p, h) + w_i$  and finally  $\Psi_i(h) + w_i$ . If both agents are considered “price-takers”, suppose agent  $I$  set  $h$  to maximize  $\Psi_1$ , such that  $\Psi'_1(h^*) = 0$ . Then, the social optimum should maximize  $\Psi_1 + \Psi_2$  such that  $\Psi'_1(h^o) = -\Psi'_2(h^o)$ . One may observe that the equilibrium level of  $h^*$  remains sub-optimal (strictly lower than the optimal level) unless  $h^* = h^o = 0$ . One clearly identifies that, if  $\Psi'_2(\cdot) < 0$ , the externality is negative and  $h^* > h^o$  (agent 1 set  $h$  too high). Conversely, if  $\Psi'_2(\cdot) > 0$ , the externality is positive and  $h^* < h^o$  (agent 1 set  $h$  too low). Now, let's assume that agent 2 has been offered the right to be free of externality  $h$ , but is willing to waive that right in exchange of financial compensation with  $T > 0$ . The maximization problem of agent  $II$  becomes  $\max_h \Psi_2(h) + T$  subject to  $\Psi_1(h) - T \geq \Psi_1(0)$ ; where the constraint is binding because agent 1 is required to agree to the bargaining process, such that we end up with:  $\max_h \Psi_2(h) + \Psi_1(h) - \Psi_1(0)$ . The quantity which is to be maximized takes the form of the social welfare function shifted by a constant, and the equilibrium externality is the optimal one:  $h^o$ . Conversely, if there are no restrictions on agent  $I$ , agent  $II$  would need to provide compensation corresponding to an amount  $T < 0$ . Agent  $I$  is thought to engage in this agreement if and only if  $\Psi_1(h) - T \geq \Psi_1(h^*)$ . The maximization problem for agent  $II$  thus becomes  $\max_h \Psi_2(h) + \Psi_1(h) - \Psi_1(h^*)$ . Once again, the quantity to be maximized takes the form of the social welfare function shifted by a constant, and the equilibrium externality is the optimal one:  $h^o$ . A more generalized form supplied in Ellingsen & Paltseva (2016) underlined that the Coase Theorem holds for two economic parties (agents) only (1 x 1 bargain). If there is more than one party involved on one of the two sides, coordination mechanisms operate between polluters and victims, leading to the failure to achieve efficiency .

Coase (1960) showed that Pigou's approach is outdated: the party at the origin of the distortion should not be the only rewarded or penalized in the case of positive and negative externalities, respectively. However, several perfect competition conditions must hold. Consumers and producers must be price-takers and maximize their respective profits and utilities; there should be no wealth effect which implies a quasi-linearity in the numeraire, rendering externalities  $h$  disconnected from direct budgets  $w_i$  and side-financial transfers  $T$ . Also, complete asymmetric information among parties is assumed; no endowment effect should persist. This includes homogeneous behaviours of agents, regardless of their respective entitlement to property rights. Also, no transaction cost should exist, whereas

the bargaining process is efficient such that negotiation can reach Pareto-efficiency and address externalities because any private party generating or being affected by externalities will end up to the same resource allocation (Farrell, 1987). Thus, internalizing externalities does not require public intervention because private bargaining can supersede an active (and *invasive*) government regulation of externalities, which corroborates Deryugina et al. (2021), who stressed that Coase-like bargaining represents an alternative to standard regulatory public instruments (taxes and subsidies). That is, weak government interventions should not be completely excluded.

In response, researchers challenged the robustness of this theory (Shapiro, 1974; Zerbe, 1980; Allen, 1999; Grebennikov & Rivera, 2007), albeit at times, providing conflicting conclusions.<sup>1</sup> Regardless, if efficient outcomes seem reached for both parties, the distribution effect differ among them (Posner & Parisi, 2013).

### 3 Theoretical Underpinnings and Conflicting Outcomes

Historically, the Coase Theorem received contrasted support, ranging from absolute admirations to serious criticisms. Medema (2014)'s survey showed how this concept has been differently approached and heterogeneously interpreted by economists. First developed through a series of examples, this theory let the domain in active search of general principles (Cooter, 1989). Thus, it is initial form; this paper was not and did not seek to become a "theorem", unlike what has been commonly defended in the literature. Coase neither formalized nor supplied a general proof but rooted its argument around a discussion of common law on liability and nuisance (Deryugina et al., 2021). Here, failures and underpinnings are outlined, along with implications for environmental policy.

Deryugina et al. (2021) outlined the features of the Coase Theorem as embedded within a triple structure. First, the efficiency thesis follows the First Fundamental Welfare Theorem and enlarges it with cases comprising environmental externalities: when property rights are clearly assigned to private entities, bargaining leads to a Pareto optimum. Second, the invariance thesis relates to the Second Fundamental Welfare Theorem: bargaining mechanisms lead to the same Pareto optimum without any pre-condition on entitlement assignment. Third, the first two outcomes hold only when transaction costs are null and income elasticities are equal (income effects). If the income elasticity derived from the demand for property rights differs among parties, the equilibrium prices and output should be substantially modified (Canterbery & Marvasti, 1992). Also, if transactions involving the exchange of property rights are costly, e.g., identifying potential trading partners, negotiating contracts, monitoring for compliance, the predictions of the theorem become undermined. However, if the parties involved in the negotiation process need ex-ante transaction costs to reach the agreement phase, as showed by Anderlini & Felli (2006), the theorem fails because of an "*hold-up problem*", in which two parties could reach an efficient outcome by cooperating but fail to do so because one party refuses to give the other one an increased bargaining power that would reduce its own profits, and reciprocally. In the Coasian context, solving the "*hold-up problem*" might produce a new set of ex-ante transaction costs for both parties, which lead to the generation of a new "*hold-up problem*". When transaction costs do exist,

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<sup>1</sup> For a discussion on the preferences of the two agents in the set-up, see Hurwicz (1995) and Chipman & Tian (2012).

the initial allocation of property rights and the set of parties outside options do influence the outcome (Grossman & Hart, 1986; Anderlini & Felli, 2006).

Several papers applied the Coase lens to a single case. For instance, Hanley & Sumner (1995) connected the Coase framework to common property resources (red deer) in the Scottish highlands. Ruml (2005) examined the relevance of the Coase model on the Western US appropriative water rights allocations. Folefack (2014) applied the Coase Theorem to assess the welfare implications of conflicts induced by herders' damage in croppers' land in the Adamawa region of Cameroon. Byun (2015) offered an analysis of the Alaska Native Claims Settlement Act within a Coasian context. Pirard (2012) studied Payments for Environmental Services (PES) to users of "mandatory" spices in the Indonesian recipe, under the condition that PES sustain a pre-defined environmental service, which are defended as market-based mechanisms aimed at filling the regulatory gap caused by the lack of prescriptive regulations funding resources for environmental conservation. Deryugina et al. (2021) surveyed the experimental literature assessing how do Coase Theorem's implications vary across the validation/invalidation of its assumptions and offered the first review evidence for the Coase Theorem applied to various environmental problems, distinguishing between situations in which the polluter pays and those in which it does not. Results reported that a range of examples of Coase-like bargaining involve more than two parties, which nonetheless does not prevent the Coase-related bargaining mechanisms from remaining a viable alternative for externalities for which conventional public policy leverages (taxes and subsidies) fail. Furthermore, their review of laboratory experiments show that the Pareto optimum is less likely to be reached if information is asymmetric or transaction costs are large, i.e., relatively to symmetric information, bargaining involving multiple parties and high payoffs. The authors claimed that most replications of Coase-like bargaining involve an entity acting on behalf of the aggregated interests of a larger population (governments acting as agents of their people, and environmental groups acting on behalf of their members), which substantially reduces transaction costs and help solving the coordination problem among agents. Accordingly, Deryugina et al. (2021) concluded to multi-faced implications of the theorem: on the one hand, Section 2 did underline how the Coase Theorem contradicts with the Pigouvian approach supporting active government interventions because assigning property rights to private entities should ensure Pareto-efficient outcomes through Coasian bargaining processes; on the other hand, one sees in Section 3 that the Coase argument can be used to support Pigouvian taxation strategies when transaction costs persist and thus undermine the main outcome of the theorem. Thus, Coasian bargaining and Pigouvian taxation are complement rather than absolutely substitute. Said differently, the existence of positive transaction costs, which do play out in practice, opens questions about the well-established market mechanisms-government regulation opposition arising after the publication of the theorem. If Coase (1960)'s framework remains sensitive to a range of assumptions determining its policy outcome, Coase (1992) himself acknowledged that omitting transaction costs in a model that seeks to represent the mechanisms operating in the real economy was unrealistic. One simple counterexample is worth mentioning here: when a factory is polluting a sub-urban area, convincing millions of households to transfer funds to the plant owner in compensation for the shut-down the plant is hardly feasible, simply because political, beliefs, and socioeconomic elements may nurture inferences in this decision-making process. Recent political events showed that convincing factory owners to cover the marginal social cost of carbon borne by households living nearby is not straightforward.

However, one should not neglect the relevance of the transaction-cost-free model from Coase (1960) due to constraining assumptions. Instead, it is plausible to see a relevant demonstration of why dramatic inferences and inefficiencies occur when transaction costs are not incorporated within the design of environmental policies. Being at the source of market inefficiency and social cost-enabler<sup>2</sup>, transaction costs should indeed be targeted, located, and minimized by government measures. As agreement costs rise with the number of parties involved in the bargaining process, an administration displaying legal rights and enforcement powers should thus commit to lower them (Canterbery & Marvasti, 1992; Baron, 2000; Kuzmin & Semyonovych, 2015). Although no clear analysis was conducted in this direction, Coase (1960) questioned the government’s ability to reduce such failures because of the large public cost it produces: “Given that the costs involved in solving the problem by regulations issued by the governmental administrative machine will often be heavy (...), it will no doubt be commonly the case that the gain which would come from regulating the actions which give rise to the harmful effects will be less than the costs involved in Government regulation” (Coase, 1960, p. 18). Beyond this debate, a consensus gathering a long line of economist can emerge. As perfect economic conditions do not exist, the Coase Theorem may better explain why inefficiencies occur rather than providing a set of pre-conditions ensuring that bargaining mechanisms would systematically correct environmental externalities without any pre-condition on entitlement assignment among private entities. Thus, the title opted by Ronald Coase, i.e., “the Problem of Social Cost” for his pioneer article remains insightful.

Additional market failures should not be overlooked by government interventions in search of identifying all existing impediments to efficiency: internalizing free riding behaviours when managing public goods, lowering the asymmetric information between polluters and victims, and anticipating opportunist strategies when seeking compensation from damages (Schweizer, 1988). While private negotiation is often seen as a substitute to government regulation, it may operate as a complement to public interventions (Farrell, 1987). Thus, public environmental regulation may act as a back-up system capable of correcting inefficiencies when markets fail to do so. Although Coase initially highlighted the random feature characterizing the initial allocation of entitlements, he supported that the theorem is finally a *reductio ad absurdum* aiming at shedding light on how and why transaction costs do matter for economic modeling and environmental policy (Deryugina et al., 2021).

#### 4 Conclusion: Regulating Environmental Externalities - The Green Line or the Green Light for Public Entities?

Far from setting a market-government opposition, Coase (1960) demonstrated that imperfect market mechanisms are sensitive to *ex-ante* assignment of property rights and the nature of the information shared by parties, i.e., symmetric, or not (Dasgupta, 1996). Said differently, ignoring the existence of non-null transactions costs and heterogenous income effects in future environmental planning is likely to undermine the effectiveness of the policy itself and lead to an inefficient regulation of the targeted externalities. To ensure a feasible transition towards sustainable path, no potential impediments to efficiency should be

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<sup>2</sup> “But equally there is no reason why, on occasion, such governmental administrative regulation should not lead to an improvement in economic efficiency” (Coase, 1960, p. 18).



excluded by government's regulators. Located at the heart of the policy issues but at the core of solutions, ignoring the above-mentioned disturbances would undermine the effectiveness of future regulations of environmental externalities, regardless their public or private impulses. *One more step but a mile to go* (Barrett, 2016).

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