

MARKET INTERNALIZATION OF EXTERNALITIES: WHAT IS FAILING?

BY

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The usual internalization of externality ‘by the market’ can be thought of through two different exchange modes: competitive markets, with Kenneth J. Arrow (1969); or bargaining, with Ronald H. Coase (1960). Although, in both cases, ‘externality’ refers to a non-exchanged effect that produces suboptimalities, these authors are working with two different, implicit conceptions of externality, rooted in different analytical worlds and calling for different institutions—parametric prices for the former but not for the latter. Moreover, while both start out with different theoretical frameworks, the authors share a concern for realism and unite when they introduce transaction costs, both advocating a policy design that calls for taking into account the costs of the different solutions. Nevertheless, this introduction of transaction costs does not itself escape consistency problems, since they do both maintain a reference to their respective ideal worlds.

I. INTRODUCTION

The economics literature abounds with definitions of externalities; yet, at the same time, it contains a similarly high number of complaints about the lack of any such definition.¹ In general terms, we may say that ‘externality’ refers to the unpriced effects

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¹The concept of externality has always seemed to evade rigorous and consensual definition. See, for example, Scitovsky (1954), Bator (1958), Buchanan and Stubblebine (1962), Mishan (1965), Arrow (1969), Heller and Starret (1976), and Baumol and Oates (1988). For a history of the concept, see Berta (2008), Laffont (1977), or Papandreou (1994).

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of economic activities.² Externality, in its usual meaning, is thus a “residual concept” (Lagueux 2010), defined by its exteriority to the market, and this has two consequences. First, the definition of externality depends on the specific definition of the market that has been adopted. Second, since externalities can also be internalized ‘by the market,’³ the specific nature of such a solution again depends on the definition of the market in question.

Economic theory traditionally distinguishes two different models of exchange: the perfect competition model where the agents involved are an auctioneer and price-takers (Walras 1874), and the bargaining model where the agents are price-makers (Edgeworth 1881). Not surprisingly, therefore, in the literature on externalities we find two modes of internalization by the market: that which takes place within a perfect competition framework (Arrow 1969), and that within a bargaining framework (Coase 1960). Kenneth J. Arrow’s (1969) conception of externality in terms of missing markets and its internalization by what is now called ‘Arrovian markets’ became seminal in general equilibrium theory: this is used, for example, by David Starrett (1972), Jean-Jacques Laffont (1977, 1988), Leonid Hurwicz (1995), and John Boyd and John Conley (1997). Ronald Coase’s “The Problem of Social Cost,” published in 1960, gave renewed vigor to the economic analysis of externalities: criticizing the Pigovian approach and leading to the “Coase theorem,” this paper became seminal within property-rights theory and new institutional economics.

Our paper compares Arrow’s (1969) and Coase’s (1960) analyses of externalities, with a twofold aim. First, we stress the differences between their theoretical solutions to externalities; that is, in their modes of internalization by the market (perfect competition and bilateral bargaining) in a world of zero transaction costs. Although Arrow and Coase both consider that externalities are the source of Pareto suboptimalities, which are solved by internalization—in this sense, we describe externalities as ‘absolute’⁴—these different modes of internalization through the means of exchange implicitly invoke different assumptions and institutions, and, therefore, entail different implicit definitions of externality. In view of this, we also emphasize that defining an externality as an effect that has either no market or no price is insufficiently determinate, given that ‘market’ may refer here to different institutions and theories of exchange.

Second, we bring to light an overlap between their respective ideas on economic policy that has thus far been overlooked. As we shall see, Arrow (1969), following Coase, introduces transaction costs and, therefore, breaks with the prevailing view in general equilibrium theory, according to which missing markets are inefficient. Both stress the likely causes of externalities: markets are costly to create. Whenever transaction costs exceed the potential gains of internalization, market solutions are no longer desirable. Since the inefficiency of externality *per se* is no longer straightforward,

²Since Viner (1931), there has been a consensus that these “technological externalities” should be excluded from the so-called pecuniary externalities, which refer to effects transmitted by prices.

³We set aside taxation and regulation (*à la* Pigou 1932). Since an externality is considered as an effect outside the market, we focus here on internalization by the market.

⁴The distinction “absolute” vs “relative” is borrowed from Andreas A. Papandreou (1994, p. 91), who applies it to Arrow’s “market failures.”

it is now relative. Both authors then indicate that other institutional solutions may be more efficient than the market: Arrow joins Coase (1960) regarding the necessity of comparing different solutions to externalities, and, hence, of taking into account the costs of these various institutions.

It is well known that the idea of the “Coase theorem,” although present in Coase’s 1960 paper, was not the main insight presented therein, but was just a first step in the development of the analysis, which then goes on to introduce transaction costs; but economists have focused their attention on the “Coase theorem,” “like augurs divining the future by the minute inspection of the entrails of a goose” (Coase 1981, p. 187). It is less well known that, in the same manner, Arrow’s solution by perfectly competitive markets can also be seen as only a first step in his analysis: he himself points out why his theoretical solution is impracticable, and he also introduces transaction costs. Therefore, he partly steps outside the general equilibrium theory framework in explaining the source of missing markets. Since Arrowian competitive markets remain a standard solution in general equilibrium theory, the solution via ‘Arrowian markets’ seems to have met with the same destiny as the “Coase theorem.”

Our aim, therefore, is to compare the accounts provided by Arrow (1969) and Coase (1960), which paved the way to the two main market solutions for externalities.⁵ This leads us to show that, even though they derive from significantly different analytic frameworks, they finally coincide in their policy propositions once Arrow introduces transaction costs in his analysis. In what follows, we dissociate them in areas where they are often associated (Arrowian markets versus bilateral bargaining, with zero transaction costs), and thus stress how their specific implicit definitions of externalities depend on their respective theoretical frameworks. Conversely, however, we also bring to light their convergence in areas where they are usually presented as conflicting (i.e., when transaction costs are positive).

This convergence, which has not previously been analyzed, may be explained by the fact that each author is not entirely aligned with the tradition to which he is associated. This is why comparing the two authors’ approaches on externalities is not equivalent to comparing general equilibrium theory and new institutional economics. The main differences between these traditions on externalities are well understood (see Dahlman 1979 and Papandreou 1994), but the comparison of Arrow (1969) and Coase (1960) on this issue has not been the subject of enough attention. In the literature related to the meaning and validity of the “Coase theorem,” some authors associate Arrow (1969) with Coase (1960) (with zero transaction costs) and assert that Arrowian markets formalize Coasian negotiation (e.g., Zerbe 1980, Starrett 1972, Boyd and Conley 1997, Fox 2007); others set them in opposition, as we do (e.g., Cooter 1982, Schweizer 1988). However, this literature is not concerned with Arrow’s paper in and

⁵The 1969 paper is the only one in which Arrow examines the definition of externality as a missing market and its solution by competitive markets. He returns to this standard solution in Arrow and Hahn (1971), but no longer mentions the role of transaction costs; he returns to the latter in Arrow (1979), but only in passing, since it is actually not the focus of the paper. Other founders of the general equilibrium theory (such as Paul A. Samuelson, Gérard Debreu, or Lionel W. McKenzie) did not devote any studies to this issue of definition of externality. Regarding Coase (1960), when he returns to the issue of nuisances (externalities) in his later career, he will always restate the 1960 argument (Coase 1981, 1988a, 1988b). This is why we focus on these two seminal papers: Arrow (1969) and Coase (1960).

by itself, and even less so with his introduction of transaction costs. Above all, it does not discuss the implicit definitions of externalities that thereby arise.⁶

Section II will show that Arrow's and Coase's different conceptions of exchange imply different implicit definitions of externalities and different institutions required for market internalization, when transaction costs are nil. Section III studies how the necessity of internalization is called into question by Coase's and Arrow's introduction of transaction costs. Our comparison brings to light that taking transaction costs into account does not avoid consistency problems: it breaks the straightforward link between externality and efficiency that previously prevailed in the world of zero transaction costs, and, therefore, it calls into question the relevance of the concept of externality. Since both authors try to retain the reference to their own ideal world, as we will see, they manage these difficulties in different manners.

II. ABSOLUTE EXTERNALITIES IN A WORLD WITHOUT TRANSACTION COSTS

In a world of zero transaction costs, externalities are 'outside the market' and must be internalized: absolute externalities are absolutely inefficient. Beyond this broad statement, however, there is little specific agreement. In particular, the two main theoretical frameworks typically associated with the study of externalities rely upon different conceptions of the market institution, and thus entail different definitions of externalities: these frameworks are Arrow's (1969) competitive equilibrium account and Coase's (1960) bilateral bargaining account.⁷

Externality as a Missing Market in a Perfectly Competitive Framework (Arrow 1969)

The pioneering work of James E. Meade and his concept of "unpaid factors" (1952, p. 57) was seminal in promoting the definition of externality as direct interaction—i.e., unpriced interaction—within a perfect competition framework. Following Meade (1952), there were several attempts in the 1950s and 1960s to define and specify the notion of externality and its relationship with the broader notion of market failure—see Tibor Scitovsky (1954), Francis Bator (1958), James Buchanan and Craig Stubblebine (1962) and, later, Walter Heller and David Starrett (1976).⁸ Arrow pursues

⁶As far as we know, only Papandreou (1994) analyzes Arrow's 1969 article and its introduction of transaction costs, in his history of the concept of externality. However, by providing a comparison of Arrow and Coase, our purpose is to stress their divergences and convergences, with a specific focus on their theoretical backgrounds and their definitions of externality.

⁷We begin this section with Arrow (1969) because, even though published after Coase (1960), it fits into the tradition criticized by Coase.

⁸Meade's analysis was confined to the sphere of production. It is only later, with Scitovsky (1954), that the concept of externality frees itself from the Marshallian concept of external economies to refer more widely to all kinds of unpriced interdependencies. Scitovsky clearly links externality to what he calls the "equilibrium theory" and to the world of perfect competition. Externality is identified with a failure of the market: any competitive equilibrium is Pareto-optimal, "except when there is interdependence among the members of the economy that is direct" (*ibid.*, p. 144). This idea was broadened a few years later by Bator: externality here refers to what he calls "a more general doctrine of 'direct interaction'" (1958, p. 358) and "gives rise to . . . [a] short circuit, as it were, of the signaling system" (*ibid.*, p. 361) that is suboptimal. For more details, see Papandreou (1994) and Berta (2014).

the same goal, saying, “surprisingly enough, nowhere in the literature does there appear to be a clear general definition of [the public good] concept or the more general one of ‘externality.’ The accounts given are usually either very general and discursive, difficult to interpret in specific contexts, or else they are rigorous accounts of very special situations” (1969, p. 133).

Along the same line as Meade’s unpriced factors, Arrow (1969) refers to externalities as interactions that escape the parametric price system induced by the assumption of perfect competition, and puts forward a new definition of externality as a kind of missing market—a definition that is now firmly established in general equilibrium theory.

Externality as a special case of missing markets

As is well known, Arrow’s early works contributed to the most solid and important results of general equilibrium theory: the existence proof (Arrow and Debreu 1954, with McKenzie 1954 and Gale 1955) and welfare theorems (Arrow 1951, with Debreu 1951). His deductive approach is part of this framework: “The corpus of neoclassical theory is rich enough to spin off a significant number of research problems endogenously. Improved formulations of general equilibrium theory and of welfare economics were obvious intellectual needs when I started my work” (Arrow 1985, p. iv). The problem of externalities can be seen as one of these endogenous research programs that required such improvements: within a competitive framework, where every choice is based on a given price signal, an externality is necessarily not taken into account by agents and, hence, automatically produces a Pareto suboptimality that has to be corrected. As such, an externality is a “market failure.”

The two concepts of externality and market failure are, nevertheless, not simply synonymous, and Arrow (1969), therefore, tries to clarify their meanings: “[M]arket failure is a more general category than externality; and both differ from increasing returns in a basic sense, since market failures in general and externalities in particular are relative to the mode of economic organization, while increasing returns are essentially a technological phenomenon” (1969, p. 134). Thus, the distinction between market failure and increasing returns is an essential one, and not formal: the problems with returns are technological, while failure problems are institutional.⁹ Although Arrow does not provide a precise definition of the notion of failure, he does give an implicit outline: the main violations of the two theorems of welfare economics are, according to him, (1) the absence of “universality of markets”—since equilibrium exists but is not Pareto optimal; and (2) the non-convexity of indifference maps and production sets—since the existence of an equilibrium is then no longer guaranteed. Only the first type of violation, that of missing markets, is considered as a “failure of markets to exist” (*ibid.*, p. 148).¹⁰ Externalities are, hence, missing markets, but missing markets

⁹In doing so, Arrow has a point of view different from Bator’s, who defines failures in a very broad manner—indivisibility, increasing returns, non-convexity, etc.—and identifies them all with externalities. However, as underlined by William J. Baumol and Wallace E. Oates, “[o]ne can only object that this broad connotation [Bator’s one] is not what most writers have in mind when they discuss externalities” (1988, p. 16). For an historical analysis of the various definitions of market failures, see Medema (2009), and, for a critique of this notion, see Zerbo and McCurdy (2000).

¹⁰The second violation—non-convexity—refers mainly to the presence of increasing returns that, as we said, Arrow excludes from the failure category.

also encompass other phenomena, including the absence of future markets or risk-hedging markets. This is why “[t]he problem of externalities is thus a special case of a more general phenomenon, the failure of markets to exist” (ibid., p. 148).¹¹

Externalities, therefore, invalidate the first theorem of welfare economics—since they are incompatible with the assumption of “universality of markets”—and, as they produce suboptimalities, they should be internalized. This is why we call them ‘absolute.’

The role of parametric prices in the definition of externality

Arrow establishes the conditions for Pareto optimality of a general competitive equilibrium with externalities. Formally, the consumption of a commodity by an individual i influences the utility of all others: agent i 's consumption is an argument of their utility function and produces numerous distinct externalities, as many as there are impacted agents. The solution is to show that “by suitable and indeed not unnatural reinterpretation of the commodity space, externalities can be regarded as ordinary commodities, and all the formal theory of competitive equilibrium is valid, including its optimality” (ibid., p. 146). Because externalities are now personalized—two different impacted persons correspond to two different externalities—we must create new commodities x_{ij} characterized by both agent i , who produces it, and agent j , who is impacted by it, and associate a price p_{ij} to them. Arrow undertakes to prove that such a system of personalized equilibrium prices exists and remains Pareto optimal.¹²

As stressed, for example, by Laffont, the perfect competition solution, therefore, requires an “economic policy [that] consists of establishing a complete system of competitive markets that incorporate externalities” (1988, p. 14). In other words, internalization requires broadening the assumption of the complete system of markets to externalities; i.e., creating the missing competitive market. In the general competitive equilibrium framework, such creation calls for a special institutional organization. Creating a missing competitive market means first creating and allocating property rights; but while such an initial allocation is necessary, it does not in and by itself ensure competitive exchange. A parametric price for the externality must then be set—i.e., a single price set by an auctioneer and taken as given by the agents—as required by the perfect competition assumption.¹³

This competitive solution, therefore, implicitly suggests a definition of externality that is closely related to the competitive equilibrium framework from which it originates. Externality here designates an effect that is external to the parametric price system, an effect outside a competitive market; i.e., externality is conceived of as a missing *competitive* market. The advantage of this perfect competition definition of

¹¹According to Papandreou, “[u]nlike Bator externality is not treated [by Arrow (1969)] as equivalent to market failure nor broken down into so many causes of failure, but is one among other identifiable *causes* of market failures” (1994, p. 49, our emphasis). However, as is clear in Arrow's quote, externality is here a *special case* of market failure and not a cause.

¹²For a rigorous proof of the existence of a general equilibrium with externalities, see McKenzie (1955). For another statement of the optimality conditions of such an equilibrium, see Arrow and Hahn (1971).

¹³“The key points in the definition [of the competitive equilibrium] are the parametric role of the prices for each individual and the identity of prices for all individuals” (Arrow 1969, p. 135).

externality is that it specifies the otherwise rather allusive reference to an ‘unpriced’ effect or missing market, since it explicitly refers to the institutional framework of perfect competition and to the associated price-taking assumption. Thus, it makes the exchange mode clearer, since it highlights the implicit theoretical framework. Underlining the institutional framework of competitive markets is important because it is not the only way of exchanging externality. As we shall see, Coase (1960) stresses the possibility of internalization through bilateral bargaining among agents, which does not require a price-taking assumption or the intervention of any auctioneer. It assumes a radically different mode of exchange and price setting from that of perfect competition.

Externality and the Bilateral Bargaining Solution (Coase 1960)

Another traditional means for internalizing externalities ‘by the market’ assigns a key role to decentralized negotiation between the emitter and the receiver of the externality. This solution is associated with the version of the “Coase theorem” originating in Coase (1960), which assumes bilateral bargaining between price-maker agents. This bilateral bargaining solution eliminates the Pareto suboptimality of the absolute externality, but in a different manner from the competitive solution.

Coase was not trained as an economist, but studied commerce at the London School of Economics; influenced by his professor and then colleague Arnold Plant, he acquired a special interest in the application of economic theory to practical matters. In the mid-1930s, he became interested in monopolies and did empirical research on public utilities, specifically on radio broadcasting (Medema 1994). His article on the Federal Communications Commission (Coase 1959) contained his first criticisms of the Pigovian analysis of externalities (Pigou 1932).¹⁴ His 1960 development of that argument was based on legal cases and simple examples and was very different from Arrow’s deductive and formalized approach.

The “Coase theorem” solution through bargaining

Asserting that, in the absence of transaction costs, the emitter and the receiver of an externality can negotiate to reach an optimal allocation of resources, “The Problem of Social Cost” (Coase 1960) puts forward the possibility of internalizing externalities through a decentralized price system. This criticism of the then-standard Pigovian analysis was later to be formulated as the “Coase theorem” by George J. Stigler (1966, p. 113).¹⁵ Coase’s statement is this: if property rights are defined and allocated, then “the ultimate result (which maximises the value of production) is independent of the legal position if the pricing system is assumed to work without cost” (1960, p. 8). The final allocation is obtained through negotiations between parties on a level of nuisance and a compensation payment, which are considered as sales of all or part of a property

¹⁴The centralized and administered allocation of radio frequencies was justified mainly by the problem of interferences, which is an externality problem. Coase (1959) argued that these interferences would not pose specific problems to the use of the price system for the allocation of frequencies.

¹⁵On Stigler and the “Coase theorem,” see Medema (2011). See Medema and Zerbe (2000) for a review of the meanings, implications, and criticisms of the “Coase theorem.”

right, or the right to use a resource, initially defined and distributed. Considering externalities as a conflict of use over a property right (and thus reciprocal by nature) was among the new insights of Coase's analysis.¹⁶

Coase's (1960) argument rests on fictitious examples, such as the rancher whose cattle destroy neighboring crops, describing a bilateral bargaining over the level of the externality and its price. Although Coase sets this bargaining process within a global framework of perfect competition (since the agents take the prices of other commodities as given), they act as price-makers regarding the externality, as noted early on by Stanislaw Wellisz (1964). For example, if the farmer's net gain from cultivating the land is \$2 and the rancher has to pay him \$3 for all damage caused by his herd, then both would gain if the farmer abandoned his culture in exchange for a payment from the rancher of between \$2 and \$3 (Coase 1960, p. 4). As Coase himself recognized, his framework is implicitly Edgeworthian:

Edgeworth had argued in *Mathematical Psychics* (1881) that two individuals engaged in exchanging goods would end on the 'contract curve' because, if they did not, there would remain positions to which they could move by exchange which would make both of them better off. Edgeworth implicitly assumed that there was costless 'contracting' and 'recontracting'; and I have often thought that a subconscious memory of the argument in *Mathematical Psychics*, which I studied more than fifty years ago, may have played a part in leading me to formulate the proposition which has come to be termed the 'Coase theorem.' (Coase 1988b, p. 160)

As in Edgeworthian bargaining, the final result of the Coasean negotiations over externalities is Pareto optimal because it is assumed that mutually satisfactory bargains are struck: "[O]f course, if such market transactions are costless, such a rearrangement of rights will always take place if it would lead to an increase in the value of production" (Coase 1960, p. 15). The result is on the contract curve, and specifically in the core (see, e.g., Hurwicz 1995).¹⁷

Despite its ambiguous formulation—"under perfect competition private and social costs will be equal" (Stigler 1966, p. 113)—Stigler's interpretation of Coase's assumptions follows the one we present here, since it is derived from the same example of cattle and crops as in Coase, and the rancher and farmer are price-makers. As in "The Problem of Social Cost" (Coase 1960, pp. 5 and 6), Stigler's perfect competition assumption applies to the markets for cattle and corn: the rancher and farmer *take* the prices of cattle and corn as given, but *make* the price of the externality. Stigler's interpretation of the "Coase theorem" is, therefore, also to be understood in a bilateral bargaining framework, as are the vast majority of

¹⁶The dual nature of property rights was already illuminated by Commons (1924). More generally, similarities can be found between Coase's and Commons's analyses, but the former did not really know the latter and was generally critical of old institutionalism (see Medema 1996c). Besides this, Coase's specific approach of externalities may be partly explained by his understanding of cost as an opportunity cost (see Bertrand 2014).

¹⁷The competitive solution is a specific point of the core, therefore a specific point in the set of bilateral bargaining solutions (Varian 1995, McKelvey and Page 1999). Besides this, there is a large consensus on the relevance of the formalization of Coase's approach in terms of cooperative game theory (see Arrow 1979, p. 24; Rob 1989, p. 308; Hurwicz 1995, p. 50); different solution concepts have been used, such as the Nash solution (Schweizer 1988, McKelvey and Page 1999).

statements of the “theorem” (e.g., Calabresi 1968, p. 68; Dahlman 1979, p. 142; Stigler 1992; Hurwicz 1995).¹⁸

Our characterization of the “Coase theorem” in the tradition of bargaining raises the question of the relationship between Walrasian perfect competition and Edgeworthian bargaining in the large number case. Do our two solutions prove to be equivalent in this case? Edgeworth’s conjecture, proved later as the limit-theorem (Debreu and Scarf 1963), asserts that if the number of agents of each type tends towards infinity, then the core of the economy is reduced to Walrasian equilibria. However, this identity of equilibria should not hide the differences in the two concepts of equilibrium or in the process of exchange that is assumed to lead to it: Walrasian price-taking in one case, Edgeworthian recontracting in the other.¹⁹

The assumption of exhaustion of gains from trade

The bilateral bargaining solution to externalities requires the creation and allocation of property rights²⁰ and the exhaustion of gains from trade to ensure the Pareto optimality of the agreement. From a theoretical perspective, the bargaining solution, like the competitive one, requires something more than the definition of property rights alone. In addition to property rights, the competitive solution requires the assumption of perfect competition; i.e., parametric prices. The bargaining solution requires instead that all mutually beneficial exchanges are contracted out. As Joseph Farrell writes: “The Coase theorem dispenses with the heavy assumptions of perfect competition, but replaces them with the strong assumption that no mutually beneficial agreement is missed. So while it economizes on formal institutions, it demands a lot of coordination and

¹⁸As we mentioned, Coase’s argument rests on a series of examples, which explains why there are as many “Coase theorems” as interpretations of these examples (Bertrand 2006a). Some authors (e.g., Zerbe 1980) interpret the “Coase theorem” in terms of Arrow’s competitive solution. More generally, the definition of transaction costs could be so broad that zero transaction costs could mean price-taking as well as price-making, Arrowian perfect competition as well as bargaining. However, this denies the specificity of each analysis, which we intend to stress in this article. Besides this, Coase’s assumption of zero transaction costs, as we showed, does not mean that prices are given: the farmer and rancher have to agree on a price. We thank Steven Medema for having helped us to clarify this issue.

¹⁹Edgeworthian and Walrasian equilibria remain different solution concepts: an allocation of the core is such that it cannot be broken by any coalition of individuals, and “this definition in no way involves the idea of prices, yet it is by means of prices that competitive allocations are normally defined” (Hildenbrand and Kirman 1988, p. 27). However, since Debreu and Scarf’s (1963) proof of Edgeworth’s conjecture, the fact that Edgeworthian equilibria—the core—shrink to Walrasian equilibria with a large number of agents is also largely accepted. Saying that the core shrinks to the set of competitive equilibria means that “as the situation becomes one in which competitive behavior is more and more plausible, the outcomes of cooperative behavior are very close to competitive ones” (Hildenbrand and Kirman 1988, p. 164). Actually, the outcomes are close, but not the exchange modes or the individual behaviors, since one is strategic and the other not, and the two theories of exchange cannot be assimilated. Moreover, the way the price-taking assumption can be justified by Edgeworth’s conjecture—i.e., the question of the foundations of perfect competition—is still a subject of controversy inside general equilibrium theory. For a history of these two kinds of markets and exchange views, see Berta (2000); for recent debates, see Berta, Julien, and Tricou (2012).

²⁰The assumption of zero transaction costs sometimes implies the definition and allocation of property rights. For example, Richard O. Zerbe writes that “zero transactions costs would imply optimal institutional arrangements, property rights would be fully defined” (1980, p. 87), and, for Douglas W. Allen, “[t]o say that a situation has zero transaction costs is to say that property rights are complete” (2000, p. 899). For a review of the definitions of transaction costs, see Allen (2000); for a history of the concept, see Klaes (2000).

negotiation” (1987, p. 114). The assumption of exhaustion of gains from trade is necessary, since, if all agents individually maximize their own part of the exchange surplus, they may not agree about the distribution of this surplus, in which case some mutually satisfactory bargains are not struck and the result can be non-optimal:

Let us be clear, though, that the rational self-interest of each of two free wills does not necessitate that there will emerge, even in the most idealized game-theoretic situation, a Pareto-optimal solution that maximizes the sum of the two opponents’ profits, *in advance of and without regard to how that maximized profit is to be divided up among them*. Except by fiat of the economic analyst or by his tautologically redefining what constitutes ‘nonrational’ behavior, we cannot rule out a non-Pareto-optimal outcome. (Samuelson 1967, p. 35, his emphasis)

This theoretical problem is one of the main challenges posed to the “Coase theorem” (Arrow 1979,²¹ Regan 1972, Polinski 1979, Cooter 1982, Veljanovski 1982, Coleman 1984, Samuelson 1985), as Coase himself later recognized.²² Hurwicz provides a concise summary of the problem: “It is, of course, not beyond the bounds of imagination that in this situation, in effect one of bilateral monopoly, a non-optimal solution might be viewed as realistic. But the spirit of Coase’s approach is that the parties will somehow arrive at a Pareto-optimal solution” (1995, p. 63). In the statements of the “Coase theorem,” the assumption of exhaustion of gains from trade is either included in (e.g., Calabresi 1991, p. 1222), or added to (e.g., Hoffman and Spitzer 1982, p. 75), the zero-transaction-costs assumption.²³

Arrow vs. Coase: What Is Missing?

This leads us to compare Arrow’s and Coase’s analyses of internalization, and their respective definitions of externality.

We note, first, that although they both assert that internalization comes through exchange, they differ as to which institutions are required for this. From Arrow’s perspective, allocation of property rights alone cannot ensure internalization by exchange: to institute a competitive market for externalities in a general equilibrium framework, a parametric price must be set by an auctioneer. In contrast, as Arrow writes, Coase “argue[d] that in principle clear definition of property rights is sufficient to ensure efficiency. This position goes well beyond the standard neoclassical position that competitive markets suffice for efficiency. As is well known, defined property rights are

²¹Arrow (1969) also stresses the bargaining problem: “It is certainly a matter of common observation. . . . that mutually advantageous agreements are not arrived at because each party is seeking to engross as much as possible of the common gain for itself” (1969, p. 140). Later, he will explicitly refer to Coase: “The property rights theorists [including Coase (1960)] do not usually set out their underlying assumptions with the utmost clarity. But it appears that the basic postulate is the same one that underlies the theory of cooperative games That is, whatever else may be true about the outcome of the bargaining process, it will certainly be Pareto optimal” (1979, p. 24).

²²Coase asserts that the criticism in terms of bargaining problems is correct, “even in a world of zero transaction costs” (1988b, p. 161). However, as we will see, he denies its empirical relevance.

²³If it is assumed that all the mutually advantageous agreements are reached, of course the result is efficient: with this assumption, the efficiency of the result is assumed and not inferred, as emphasized since Calabresi (1968, p. 68). Only non-cooperative formalizations of the “theorem” can avoid circularity (see, e.g., Arrow 1979, Cooter 1982, Farrell 1987, Schweizer 1988), but they move us away from Coase.

only one of the necessary conditions for competitive markets” (1979, p. 24). From Coase’s perspective, bargaining is supposed to take place spontaneously and efficiently, which means that he implicitly assumes the exhaustion of gains from trade as soon as property rights are allocated and as long as transaction costs are nil. In fact, this link that Coase makes between the assumptions of exhaustion of gains from trade and of zero transaction costs is ambiguous. In a later commentary, he first asserted that the critique in terms of bargaining problems was theoretically correct even in the world of zero transaction costs (Coase 1988b, p. 161). But, immediately afterwards, he denied its empirical relevance: “[T]here is good reason to suppose that the proportion of cases in which no agreement is reached will be small” (ibid., p. 161); or, again: “I would regard such [not Pareto optimal] outcomes as being . . . most unlikely, particularly in a regime of zero transaction costs” (ibid., p. 163). This means that, in Coase’s view, the exhaustion of gains from trade is not *logically* included in the zero-transaction-costs assumption even if the latter *actually* makes the former far more likely. Finally, again in Coase’s mind, only their costs can prevent mutually beneficial negotiations from occurring in practice: “[T]he only reason individuals and private organizations do not eliminate [externalities] is that the gain from doing so would be offset by what would be lost (including the costs of making the arrangements necessary to bring about this result)” (ibid., p. 27). In his view, bargaining problems do not have much empirical relevance: the situation of zero transaction costs entails that no mutually advantageous bargain will be missed.²⁴ To sum up, the definition and allocation of property rights are, therefore, necessary, and are believed to be sufficient, even if this belief in the operation of the real world is, as stressed above, not theoretically grounded. Meanwhile, in Arrow’s framework, property rights are necessary but not sufficient to ensure the efficiency of (competitive) internalization.

Turning, second, to the definition of externality, we note that since both solutions assert that internalization comes through exchange, both refer to externality as a non-exchanged effect; i.e., an effect not taken into account by the agents. However, again, as each requires a different exchange mode, once the latter is specified, the definition of externality is specified, too. The Coasean definition differs from the Arrovian one in that no reference to parametric prices and perfect competition is necessary. In addition, the role of property rights is also different in the two definitions. In the bilateral bargaining framework, absence of exchange necessarily means lack of property rights, since the creation of property rights is believed to ensure internalization by exchange. Here, an externality could be defined more precisely as an effect without property rights rather than an effect without exchange, and the insistence of some authors on the role of property rights in the analysis of externalities (e.g., Buchanan and Tullock 1962, p. 44; Demsetz 1966, p. 62) must be understood along these lines. On the contrary, in the perfect competition framework, absence of exchange does not always imply a lack of property rights: property rights could well be allocated and yet not exchanged, if no competitive market over these rights is created. An externality cannot, therefore, be defined by the lack of property rights; it can be more precisely defined, as we did earlier, as an effect without parametric prices. In other words, saying that the two traditions refer to externalities as non-exchanged effects is correct but only in an

²⁴In a Coasean perspective, the situation of zero transaction costs does not have much empirical relevance, either.

allusive sense, since it does not set out the assumptions underpinning the exchange. When the kind of exchange is made clear, we see that the roles of perfect competition and of property rights differ between the two definitions.

Finally, in both analyses, externalities are necessarily inefficient, and therefore absolute, since they are not exchanged—no matter what is the exchange mode. What happens when the competitive or the bargaining solution restores optimality? Strictly speaking, the externality as a non-exchanged effect disappears, since it is now exchanged, either through competitive behavior or bargaining behavior. In the competitive case, for example, “since we are now assuming a market for pollution, (formally) there are no externalities present in this economy” (Hurwicz 1995, p. 55). But, of course, the interaction ‘phenomenon’ or the side effect remains; in common language, pollution is not zero at the optimum, it only becomes Pareto optimal.²⁵

In both traditions, the connection between externality and inefficiency is called into question once transaction costs are introduced.

III. WHAT HAPPENS TO EXTERNALITIES IN A WORLD WITH POSITIVE TRANSACTION COSTS

In the previous analyses without transaction costs, externalities are absolute: their suboptimality can always be eliminated through exchange. The introduction of transaction costs will modify the essential characteristic of externalities, since now they do not necessarily call for such an internalization. If bilateral bargaining (Coase) or competitive exchange (Arrow) is costly, transaction costs can exceed the gains from trade, and internalization through exchange is no longer appropriate. Finally, and rather strikingly, since they are coming from different theoretical frameworks, the authors seem to converge in their policy proposals: that different institutional solutions have to be compared in terms of their gains and costs. We shall explain this convergence by reference to their concern to apply economics to the real world.

The Introduction of Transaction Costs in the Bargaining World: The Irrelevance of the Concept of Externality

Coase’s call for realism explains his criticisms of standard microeconomics and the great majority of his insights. His work evinces an enduring search for realistic assumptions: this was already present in his 1937 article on the firm, was further developed in his response to Milton Friedman (1953) delivered at a conference in 1981 (Coase 1982), and has been reasserted in his latest book (Coase and Wang 2012). His

²⁵This is what Buchanan and Stubblebine (1962) make clear for the bargaining case, with their specific vocabulary: at the Pareto optimum, “Pareto-relevant externalities” disappear, since they are direct interactions characterized by the existence of gains from trade; the part of the interaction remaining at the optimum is the “Pareto-irrelevant externality.” With u_A denoting A ’s utility function and y one of B ’s activities, an externality exists when $\partial u_A / \partial y \neq 0$. Therefore, we can understand why “a position may be classified as Pareto-optimal or efficient despite the fact that, at the marginal [*sic*], the activity of one individual externally affects the utility of another individual” (ibid., pp. 380–381). In fact, they formally define an externality as a strict influence of one agent’s activity on the utility function of another so that the interaction as a phenomenon remains even if its suboptimality disappears when reintegrated in the market.

theory manifests a continuous back-and-forth between theory and facts (see Mäki 1998, Wang 2003, Pratten 2004, Bertrand 2013). “The Problem of Social Cost” is no exception, and it is in the name of realism that transaction costs are introduced in the analysis. Coase considers the assumption of zero transaction costs as “very unrealistic” (1960, p. 15). This assumption was aimed at “mak[ing] clear the fundamental role which transaction costs do, and should, play in the fashioning of the institutions which make up the economic system” (Coase 1988b, p. 13), a role neglected by later economists who thus narrowed the scope of his analysis (see, e.g., Medema 1999, Coase 1992).²⁶

Transaction costs arise from the fact that “[i]n order to carry out a market transaction it is necessary to discover who it is that one wishes to deal with, to inform people that one wishes to deal and on what terms, to conduct negotiations leading up to a bargain, to draw up the contract, to undertake the inspection needed to make sure that the terms of the contract are being observed, and so on” (Coase 1960, p. 15).

A second-best comparison: Keeping the reference to an optimal state without transaction costs

Introducing transaction costs implies that reaching a Pareto-optimal allocation by internalization is no longer straightforward. If a mutually beneficial exchange costs more than its expected benefits, this exchange of rights does not occur and the suboptimal initial allocation remains. If different allocations of rights are compared, “[o]ne arrangement of rights may bring about a *greater value of production than any other*. But unless this is the arrangement of rights established by the legal system, the costs of reaching the same result by altering and combining rights through the market may be so great that this *optimal* arrangement of rights, and the greater value of production which it would bring, may never be achieved” (Coase 1960, p. 16, our emphasis).²⁷ In other words, one allocation of rights maximizes the value of production and is Pareto optimal: either it is the initial situation, thanks to an appropriate allocation of rights, or it has to be reached by exchanges. If these exchanges are too costly, this *optimal* allocation of rights will not be reached: the situation in which a mutually beneficial transaction does not take place, since it is too costly, remains suboptimal. In other words, Coase retains the reference to an ideal world and to its Pareto optimality.

The fact that optimality cannot be obtained through exchange does not, however, mean that the initial situation is desirable *a priori*, since “[i]t is clear that an alternative form of economic organisation which could achieve the same result at less cost than would be incurred by using the market would enable the value of production to be raised” (ibid., p. 16). There is a role, therefore, for policy. Using an opportunity-cost approach, the policymaker has to compare the values of the production yielded by different institutional arrangements (net of their operation costs) and choose the one that yields the greater net value.²⁸ These different arrangements do, of course, include

²⁶On the roles that the “Coase theorem” plays in Coase’s analysis, see Bertrand (2010).

²⁷Buchanan (1984) blames Coase (1960) for making just this kind of reference to an objective optimal allocation of resources (see also Dahlman 1979, p. 150), while Coase (1938) introduced subjectivity of decisions and choices (see Bertrand 2014).

²⁸On Coase’s comparative institutional method, see Coase (1964), Medema (1996a, 1996b, 2014), and Bertrand (2014).

the market, but also encompass the firm (*ibid.*, p. 16), public regulation (*ibid.*, p. 17), and the status quo (*ibid.*, p. 18). This becomes a pragmatic problem: “Satisfactory views on policy can only come from a patient study of how, in practice, the market, firms and governments handle the problem of harmful effects” (*ibid.*, p. 18). Since “[a]ll solutions have costs” (*ibid.*, p. 18), none of them will be optimal. We have here a kind of second-best comparison between the values of the production yielded by different institutional arrangements; this is very different from the standard theory criticized by Coase, which designs policy through comparison between the real world and the ideal world of perfect competition.²⁹

Once we take into account the costs of the different solutions, externality should not necessarily be eliminated even where it is suboptimal: if market transactions and firm solutions are too costly, and “[i]f with governmental intervention the losses also exceed the gains from eliminating the ‘externality,’ it is obviously desirable that it should remain” (Coase 1988b, p. 27). The desirability of externality here is relative to the net gains of all the solutions. It is precisely to indicate that externalities should not automatically be suppressed that Coase does not use the standard established term:

To prevent it being thought that I shared the common view, I never used the word ‘externality’ in ‘The Problem of Social Cost’ but spoke of ‘harmful effects’ without specifying whether decision-makers took them into account or not. Indeed, one of my aims in that article was to show that such ‘harmful effects’ could be treated like any other factor of production, that it was sometimes desirable to eliminate them and sometimes not, and that it was unnecessary to use a concept such as ‘externality’ in the analysis in order to obtain the correct result. (*ibid.*, p. 27)

More on the irrelevance of externality: The Coasean tradition

A certain Coasean tradition draws out the consequences of positive transaction costs as regards the inefficiency of externalities in a radical manner. In this tradition, the introduction of transaction costs is known for causing the erosion of the concept of externality itself. Since, in the world of the “Coase theorem,” the existence of an externality does not preclude reaching a Pareto-optimal allocation, it is positive transaction costs and not externalities in and by themselves that stand in the way of reaching this optimum. The concept of transaction costs eventually replaces the concept of externality, as Carl J. Dahlman makes particularly clear:

Ultimately, the relevance of externalities must lie in the fact that they indicate the presence of some transaction costs. For if there were no costs of transacting, then the potential Pareto improvement could be realized by costless bargaining between self-interested economic agents. . . . The conclusion is thus unambiguous: in the theory of externalities, transaction costs are the root of all evil. But for transaction costs, such perversions of the invisible hand could not even occur much less persist. (1979, p. 142)³⁰

²⁹This “blackboard economics” can lead to nothing but abstract and unenforceable policies (see, e.g., Coase 1988b).

³⁰Harold Demsetz also writes: “What converts a harmful or beneficial effect into an externality is that the cost of bringing the effect to bear on the decisions of one or more of the interacting persons is too high to make it worthwhile” (1967, p. 348). See also Zerbe and McCurdy (1999).

Moreover, in this framework, a mutually beneficial exchange that would not be realized because it was too costly is, in fact, not Pareto-improving given transaction costs. If we approach transaction costs like any other production cost, as Guido Calabresi does, then “no less than existing technology, [they] define what is currently achievable in any society—the Pareto frontier. It follows that any given society is always or will immediately arrive at a Pareto optimal point *given* transaction costs” (1991, p. 1212, his emphasis). Therefore, “what is efficient” (*ibid.*, p. 1216), even if transaction costs are positive and even high.³¹ Thus, here, the concept of externality loses its relevance entirely, since it can never be suboptimal.³²

This interpretation of Pareto optimality given transaction costs encounters two problems. The first one is well known: it legitimates any existing situation as optimal. In this line of argument, the notions of efficiency and transaction costs are being interpreted in a circular way.³³ The second problem is that such an interpretation of efficiency finally contradicts the “Coase theorem,” since the assumption of zero transaction costs is no longer required to assert that the result is efficient. As Calabresi comments: “[A]ny starting point will be, or will immediately lead to, an efficient end point, *even with transaction costs*” (*ibid.*, p. 1215, his emphasis).³⁴ The argument with which we are faced is somewhat tortuous: since externalities can be solved by negotiation in the world of zero transaction costs, this notion (linked with suboptimality) is meaningful only in the positive-transaction-costs world. However, in this latter world, transaction costs are taken into account to specify the Pareto optimum, and externalities are not suboptimal, either.

Nevertheless, as seen above, Coase’s own analysis of externalities cannot be blamed for these difficulties of circularity and inconsistency. Since his conception of optimality is different from these, he does not add the transaction-costs proviso to the Pareto criterion, which makes him distinctive within the Coasean tradition he initiated: the externality inefficiency is relative to the net gains of alternative solutions, including bargaining. We will now see that the consequences Arrow draws from the introduction of transaction costs are rather similar.

³¹Also determining Pareto-optimal situations given the constraints of transaction costs, Dahlman writes: “The conclusion, unpalatable to many economists, would seem to be that if it exists it must be optimal, and if it does not exist it is because it is too costly, so that is optimal too” (1979, p. 153).

³²Again, Dahlman writes: “[T]he concept of externalities—insofar as the word is intended to connote . . . the existence of an analytically proven market failure—is void of any positive content” (1979, p. 143). Demsetz also stresses this issue: “[T]here exist no qualitative differences between side effects and what we may call ‘primary’ effects. The only differences are those that are implicitly based on quantitative differences in exchange and police cost” (1964, p. 25).

³³See the entertaining “Pangloss on Pollution” by Mishan (1971a), who anticipated these consequences of the “Coase theorem” and who had already argued that “[r]ationalizing the *status quo* in this way brings the economist perilously close to defending it” (1971b, p. 17). The circularity may, however, be avoided. For example, Buchanan (1984) adds a condition on judging a situation as efficient given transaction costs: that individuals are free to choose their institutional setting and to enter into exchange.

³⁴This is similar to Buchanan: “To the extent that trade is free to all parties in an interaction, and all parties have well-defined rights, resources will move toward their most highly valued uses without qualification” (1984, p. 15). However, Buchanan’s argument rests on his subjectivist–contractarian perspective: if agents do not realize an exchange, this is because the right is already in the hands of who values it the most. Efficiency is not due to the absence or not of transaction costs, but to the liberty of exchange: “‘Efficiency’ in resource use, *given the institutional setting*, is insured so long as A and B remain free to make the exchange or to refuse to make it” (*ibid.*, p. 13, his emphasis).

The Introduction of Transaction Costs in a Perfect Competition Framework: From “Failure of Markets to Exist” to “Failure of the Market to Achieve Efficiency”

Although Arrow is one of the main architects of the axiomatization of general equilibrium theory, he is cautious about the interpretation of its results. He thinks that one of its great benefits is that it can enlighten us regarding the assumptions required for existence and optimality. Furthermore, while he believes in the importance of these theoretical results, he also accepts that the conditions (perfect competition, universality of markets, convexity, and so on) required for existence and optimality are unrealistic (see Duffie and Sonnenschein 1989, p. 581). For example, regarding his existence proof of general equilibrium, he commented: “My own view of the matter is that the world is imperfectly competitive. I *do not* believe in the perfectly competitive view of the world, I think the general equilibrium theory is an imaginatively manipulative theory; one can get results out of it. It serves for many purposes as good approximation for reasons that one does not fully understand. Therefore, it is a useful tool” (1987, pp. 197–198, his emphasis). Because of this dissatisfaction and his concern for realism, he has always been interested in market failures—including externalities—imperfect competition models, and applied economics.³⁵ His interest both in the idealized general equilibrium theory and in the functioning of real economy explains his particular view of markets (and, consequently, of externalities). As has been stressed by Christopher Bliss:

To some theorists a market is an abstraction, no more; an idealized representation of the process of exchange. Arrow’s vision concerning the market is different: it is realistic and institutional. This is not to say, of course, that Arrow is uninterested in frank idealizations of markets. Such could hardly be supposed of the great co-architect of what has come to be known as ‘The Arrow–Debreu model’. Yet there is no doubt that pure general equilibrium is not for Arrow an end in itself. Its interest for him springs from its role as a point of reference for the evaluation of the performance and potential of real world markets. (1987, p. 303)

In the same vein, the solution via competitive markets elaborated in the 1969 article is to be treated cautiously.

The limits of Arrowian markets and the introduction of transaction costs

Arrow himself emphasizes that the abstract, theoretical solution of creating the competitive missing market has limitations.

First, the price-taking assumption is especially ill-suited to the kind of personalized externalities that he introduces in his demonstration, since it applies to only one buyer

³⁵On Arrow’s concern for realism, Janos Kornai writes: “More than one of his studies are *extremely abstract* analyses. However, to complement the speculative and deductive intellectual work, he reverts repeatedly to *the timely and practical questions of everyday life*” (1979, p. 201, his emphasis; see also Arrow’s own preface to Arrow 1985). This is why Arrow’s research agenda is so large: see his collected papers (Arrow 1984, 1985), which, inside the limits of neoclassical theory, deal with various themes, such as information problems, markets for risk bearing, principal-agent models, medical care, etc.

and one seller (Arrow 1969, p. 146).³⁶ Second, Arrow, in fact, wants to stress the causes of missing markets and tries to explain precisely what impedes this mode of internalization. Externalities are usually not appropriable.³⁷ This is why Arrow, when studying the reasons why markets for externalities are missing, underlines that “[i]t is not the mere fact that one man’s consumption enters into another man’s utility that causes the failure of the market to achieve efficiency. . . . Pricing demands the possibility of excluding nonbuyers from the use of the product, and this exclusion may be technically impossible or may require the use of considerable resources” (ibid., p. 146). In fact, as soon as he goes beyond the simple observation of the presence of externalities and attempts to explain their causes, Arrow needs to introduce transaction costs. In so doing, he partly steps outside the general equilibrium approach. He posits two sources of transaction costs, or causes of the “failure of markets to exist”: not only the exclusion costs, but also “the costs of information and communication” (ibid., p. 149).³⁸ The absence of the market is, hence, due to the costs of its creation, and the very notion of market failure becomes relative: “Market failure has been presented as absolute, but in fact the situation is more complex than this. A more general formulation is that of transaction costs, which are attached to any market and indeed to any mode of resource allocation” (ibid., p. 149). Consequently, “[m]arket failure is the particular case where transaction costs are so high that the existence of the market is no longer worthwhile” (ibid., p. 149). Market failure now refers to a situation in which creating a market is no longer a solution, since transaction costs are too high. This is why Arrow concludes that “it is better to consider a broader category, that of transaction costs, which in general impede and in particular cases completely block the formation of markets” (ibid., p. 134). This means that the absence of a market *per se* is not the problem, for its creation may be too costly; the root of the problem is transaction costs. A few years later, Arrow confirmed this interpretation: “[T]he optimal resource allocation will not be achieved by a competitive market system if there are technological externalities. These are goods (or bads) for which no market can be formed. The usual reason given is that the good is not property in law or in practice, the latter covering the cases in which the act of enforcing property rights is itself costly and may therefore not be worthwhile” (1979, pp. 23–24).

³⁶This feature is also underlined by Hurwicz: “So in order to apply classical theorems one must treat the externality as a commodity . . . and possibly with a very thin market” (1995, p. 50; see also Laffont 1977 and Cornes and Sandler 1996). Another criticism can be addressed at internalization by creation of competitive markets: if the externality is negative, its internalization can produce non-convexity of the production sets (Starrett 1972, Laffont 1976, but see Cooter 1980, Boyd and Conley 1997).

³⁷It is worth noting that Arrow cites the example of the lighthouse (1969, pp. 146–147), and his argument will be tackled by Coase in his famous article on lighthouses (1974, p. 375n43) (see Bertrand 2006b).

³⁸Implicitly referring to Coase (1937), Arrow introduces the concept of transaction costs, defined as the “costs of running the economic system” (1969, p. 134). Ten years earlier, in a different context, when studying situations of monopoly or disequilibrium, he had already underlined that price adjustments were costly: “Any method of resource allocation requires a process for equating supply and demand (or some equivalent), and such a process may be in itself costly, though such costs are not considered in the usual formal analysis of welfare economics” (1959, p. 50). Later, although mainly working on imperfect competition without introducing transaction costs (see Arrow 1962 and 1963), he recognizes the importance of such costs and insists on the necessity of comparing different institutional solutions (see Arrow 1965, where he comments on the absence of these costs in his 1963 paper on medical care). For an analysis of Arrow’s (1965) introduction of transaction costs, see Klaes (2000).

A second-best comparison: The relativity of market failures

Transaction costs, therefore, lead to “welfare losses,” and different solutions have to be compared, all of them costly: “Removal of these welfare losses by changing to another system (for example, governmental allocation on benefit-cost criteria) must be weighed against any possible increase in transaction costs (for example, the need for elaborate and perhaps impossible studies to determine demand functions without the benefit of observing a market)” (Arrow 1969, p. 149). As he explains, this analysis “involves the recognition that the instruments available to the government or other nonmarket forces are scarce resources for one reason or another, so that all that can be achieved is a ‘second best’” (ibid., p. 134).

The concepts of externality and of market failure are now relative to the level of transaction costs of the market. When a market is too costly—i.e., not worthwhile—alternative modes of resource allocation must be envisaged and compared according to their respective costs. This introduction of transaction costs and relative market failures leads us to make several observations.

First, while introducing transaction costs, Arrow could be seen as having one foot in each theoretical world. The concept of externality—which is derived from the ideal framework of perfect competition—is exported to a world of positive transaction costs. But it is difficult to extract a concept defined in a specific analytical framework—here, a world of perfect competition without transaction costs, where markets and institutions are exogenous and never explained—and to export it to another analytical framework where transaction costs are used to explain missing markets and institutions more generally.³⁹ Externality as absolute market failure and externality as relative market failure belong to different analytical worlds.

Second, and perhaps as a consequence, Arrow’s argument appears almost paradoxical. He starts with a characterization of missing markets in terms of absolute market failure, systematically producing suboptimalities that can be corrected by creating competitive markets. Then, when introducing transaction costs, he undermines his previous characterization of externality and market failure. The definition of externality—as direct interaction without parametric price, or as a missing market—is not challenged. However, its close relationship with the previous account of the inefficiency of such missing markets is called into question, as is his definition of market failures. As we said, in the high-transaction-costs case, if missing markets remain suboptimal—because we are trying to reach only a second best and nothing can be optimal—they are no longer creating inefficiency *per se*. On the contrary, and as we have already seen, they reveal the inefficiency of creating markets: “[m]arket failure is the particular case where transaction costs are so high that the existence of the market is no longer worthwhile” (ibid., p. 149). Therefore, the introduction of transaction costs entails moving from a world in which missing markets are necessarily inefficient to a world in which, on the contrary, missing markets can prove to be worthwhile. If market failure simply referred to missing markets, with or without

³⁹See also Dahlman’s (1979) criticism of Arrow (1969), inspired by Demsetz’s attack (1969) on Arrow (1962); and Papandreou, who writes: “Rather than starting with a model where transaction costs are fully endogenous . . . [Arrow (1969)] transplant[s] these concepts [of externality or market failure] as understood within a transaction-costless model (Arrow–Debreu framework) to a world of ubiquitous transaction costs” (1994, pp. 82–83).

transaction costs—i.e., only to the fact that a market was missing and without any normative judgment—it would not be a specific concept. But if it refers to *failure proper*, a “failure of markets to exist,” as suggested by Arrow, it appears peculiar to define a market that does not, and should not, exist as a ‘good’ or efficient missing market. For, one could ask: where is the *failure* if the absence of market is a good thing?⁴⁰ We suggest that Arrow moves implicitly from “failure of markets to exist” (ibid., p. 148) to “failure of the market to achieve efficiency” (ibid., p. 146): previously, a market was considered to *fail* to exist, since it should exist; now a market *succeeds* in not existing in the sense that it would fail to be efficient, since it would be too costly to be worthwhile.

To retain the same relationship between inefficiency and missing markets (i.e., the same normative meaning) before and after introducing transaction costs, Arrow could have defined market failure as the situation in which the creation of markets would be worthwhile; i.e., as the situation in which transaction costs are low rather than high (or, more precisely, inferior to the gains of the creation of a perfectly competitive market). In this case, market failures would refer to situations where missing markets are inefficient and externalities require internalization, in the world of zero transaction costs just as in the world of positive transaction costs.⁴¹ More radically, though, another way to avoid the ambiguity of such a concept of “failure” could have been not to have used it, following Coase, who avoids using the term “externality” precisely because of its lack of straightforward normative content.

The Difficult Switch from One World to Another

The authors draw on different analytical frameworks and have different methodological approaches—a more deductive one for Arrow, a more inductive one for Coase—which cannot be reconciled. Nevertheless, both share a concern for realism, or for real-world markets, which may explain the degree of convergence we note with respect to their policy designs. Obviously, though, this does not mean that Arrow practices a Coasean institutional comparative method.

Because of this concern for realism, Arrow partly steps outside the general equilibrium framework, where every institution is taken as either given or missing, with no explanation in either case. He does, indeed, investigate the possible causes of externality, trying to explain why markets are actually missing. He then introduces transaction costs in the manner of Coase, and, like him, suggests a second-best comparison between different institutional solutions. Therefore, they arrive at quite similar policy recommendations. Of course, the pragmatic comparison of the costs and benefits of the various institutional arrangements studied by Coase—and which is one of the main insights of his thought—is not something that is carefully analyzed by Arrow. As Andreas A. Papandreou emphasizes, “once transaction costs are incorporated and one moves to a new sense of market failure . . . , [o]ne would expect that a ‘relative’ notion of market failure would involve comparison of the market with

⁴⁰This is why Papandreou asks: “Is it useful to describe failure of the market *system* as the case where some *particular* market is not worthwhile? If it was too costly to make it worthwhile forming a market . . . would we treat this as a market failure?” (1994, p. 94, his emphasis).

⁴¹This is the choice made later by Heller and Starrett (1976).

alternative modes of organization. . . . The problem is that Arrow never discusses a comparison set of modes of organization and we are left with non-existence as an explanation of failure” (1994, p. 95). Papandreou is probably a bit harsh here: Arrow does identify alternative organization modes and asserts that “[t]he identification of transaction costs in different contexts . . . should be a major item . . . of the theory of resource allocation in general” (1969, p. 134). Even though he himself recognizes that “[o]nly the most rudimentary suggestions are made here” (ibid., p. 134), he comments that various kinds of “collective action” are alternatives to the market: public intervention, firms with their “authoritative and hierarchical controls” (an implicit reference to Coase 1937), and “norms of social behavior, including ethical and moral codes” (Arrow 1969, p. 151).

However, Papandreou is correct: Arrow stresses the importance of transaction costs, but does not draw the full consequences of introducing such a notion. Even in his later research programs, he does not direct his inquiries in that direction. And, similar to the way in which Arrow does not adopt a world of positive transaction costs, Coase does not really let go of the zero-transaction-costs world. In his analysis of the positive-transaction-costs world, and despite his pragmatism, Coase retains a reference to the zero-transaction-costs world and its Pareto optimality.

In this twilight zone between the worlds of zero transaction costs and of positive transaction costs, both authors face certain difficulties. Their introductions of transaction costs call into question the relevance of the concepts of externality and failure, since they modify the previously accepted link between these concepts and suboptimality. The efficiency of market internalization, by competitive markets or bilateral bargaining, becomes relative to transaction costs, and the concept of externality loses its clear normative content. The authors do not manage this issue in the same way. Coase avoids using the term “externality” and prefers to refer to “harmful effects,” which evokes the phenomenon itself rather than its normative consequences. For his part, Arrow implicitly changes his definition of failure, switching from a “failure of markets to exist” to a “failure of the market to achieve efficiency,” and from the notion of an inefficient missing market to a “worthwhile” missing market. This is an implicit challenge to the notion of a *missing* market, which is thus called into question, since it cannot be said to be ‘missing’ anymore.

IV. CONCLUDING REMARKS

The general-equilibrium-theory account of externality and the criticisms leveled at it from the perspective of property-rights theory are well understood. However, this paper’s focus on Arrow’s and Coase’s analyses of externality has highlighted a theoretical difference (namely, that they are based on different definitions and assumptions) as well as an empirical convergence (that their suggestions for policy design are quite similar), which have not previously been underlined (see Table 1).

First, from a theoretical point of view, both authors assert that absolute externality produces a suboptimality that internalization through exchange can always correct. However, as long as the mode of exchange and its institutional framework are not specified, a definition of externality as a non-exchanged or unpriced effect

Table 1. Arrow (1969) and Coase (1960) on externalities: definition, efficiency, solutions

Absolute externality if transaction costs are zero		
	<i>Mode of exchange</i>	<i>Definition of externality</i>
Arrow (1969)	Perfect competition market	Effect without parametric price
Coase (1960)	Bilateral bargaining	Effect without property right
		<i>Internalization and optimality conditions</i>
		Property right and parametric price
		Property right (provided that gains from trade are exhausted)
Relative externality if transaction costs are positive		
	<i>Inefficiency of externality</i>	<i>Design of policy</i>
Arrow (1969)	Relative	Second best
Coase (1960)		Firm, public intervention, etc.
		<i>Alternative solutions to exchange</i>

remains underspecific. As Arrow and Coase do, indeed, refer to two different modes of exchange—perfect competition and bilateral bargaining, respectively—the institutions needed for exchange are different: property rights and parametric prices for Arrow, property rights alone for Coase (under the assumption of exhaustion of gains from trade, which is theoretically required for efficiency). The specific definition of externality, or the answer to the question of what is missing in a case of externality, is, therefore, also different: parametric prices in the former case, property rights in the latter.

Second, even if they are generally associated with different theoretical traditions, Arrow and Coase coincide in their introduction of transaction costs. And, in doing so, both call into question not only the systematic need for their ‘market’ internalization, since this can be too costly, but also more generally the inefficiency of externality, which now becomes relative. Moreover, introducing transaction costs leads both authors to envisage institutional arrangements other than the market for internalization, none of them optimal, and to compare their respective costs.

This is not as paradoxical as it might seem: although Arrow and Coase have different methods—primarily deductive for the former, primarily inductive for the latter—they share a common concern for realism. Arrow starts from a theory-based analysis, but is always concerned by its possible applications and the functioning of real markets. This is why he finally joins Coase in introducing transaction costs. Conversely, Coase is closer to Arrow than a focus on the Coasean tradition would have us believe, since he, like Arrow, retains a reference to an ideal and optimal world. Each author is, consequently, more complex than the traditions associated with them would suggest, and certain aspects of their articles have been forgotten or misinterpreted: Arrow’s original introduction of transaction costs in the general equilibrium theory of externalities; Coase’s reference to an exterior Pareto-optimal state, which some of his followers (e.g., Demsetz and Dahlman) would later abandon.

This discussion implicitly raises another methodological question, which has not been mentioned so far in our comparison. Arrow assumes rational maximizing agents, while Coase vehemently criticized this assumption as unrealistic (Coase 1988b, for example). Their respective views of the agent and the market are tightly intertwined: the perfect competition model of the market needs rational maximizers with specific beliefs; while Coase’s bilateral bargaining needs only agents that exhaust gains from trade. Although Arrow’s—and, more largely, general equilibrium theory—assumptions about agents and their rationality have a definite meaning, already examined in the literature, the decision theory or the view of human nature underlying Coase’s economics is still to be investigated.

Finally, looking at the meanings of our comparison between two kinds of ‘market’ internalization for applied economics, a common misunderstanding appears. Coase (1960) is usually seen, in environmental economics, as the father of permits markets, since he was one of the first to stress the need for property rights and, more precisely, for *tradable* property rights—later followed by John H. Dales (1968). Actually, however, the efficiency of permits markets is usually justified by the assumption that, at equilibrium, firms will equalize their marginal abatement costs to permit price, thus adopting a price-taking behavior in a competitive framework. Henceforth, these markets—the SO₂ American market or the European carbon market, for instance—are built with reference to centralized competitive and Arrowian markets rather than to decentralized Coasean bargaining.

REFERENCES

- Allen, Douglas W. 2000. "Transaction Costs." In Boudewijn Bouckaert and Gerrit De Geest, eds., *The Encyclopedia of Law and Economics*, vol. I: *The History and Methodology of Law and Economics*. Cheltenham: Edward Elgar Publishing, pp. 893–926.
- Arrow, Kenneth J. 1951. "An Extension of the Basic Theorems of Classical Welfare Economics." In Jerzy Neyman, ed., *Proceedings of the Second Berkeley Symposium on Mathematical Statistics and Probability*. Berkeley: University of California Press, pp. 507–532.
- Arrow, Kenneth J. 1959. "Towards a Theory of Price Adjustment." In Moses Abramovitz, ed., *The Allocation of Economic Resources*. Stanford: Stanford University Press, pp. 41–51.
- Arrow, Kenneth J. 1962. "Economic Welfare and the Allocation of Resources for Invention." In Richard R. Nelson, ed., *The Rate and Direction of Inventive Activity: Economic and Social Factors*. Princeton: Princeton University Press, pp. 609–626.
- Arrow, Kenneth J. 1963. "Uncertainty and the Welfare Economics of Medical Care." *American Economic Review* 53 (5): 941–973.
- Arrow, Kenneth J. 1965. "Uncertainty and the Welfare Economics of Medical Care: Reply (The Implications of Transaction Costs and Adjustment Lags)." *American Economic Review* 55 (1–2): 154–158.
- Arrow, Kenneth J. 1969. "The Organization of Economic Activity: Issues Pertinent to the Choice of Market Versus Non Market Allocation." In Joint Economic Committee, ed., *The Analysis and Evaluation of Public Expenditures: The PPB System*, vol. 1. Washington, DC: Government Printing Office, pp. 47–64. Repr. in *Collected Papers of Kenneth J. Arrow*, vol. 2: *General Equilibrium*. Oxford: Basil Blackwell, 1983, pp. 133–155.
- Arrow, Kenneth J. 1979. "The Property Rights Doctrine and Demand Revelation under Incomplete Information." In Michael J. Boskin, ed., *Economics and Human Welfare: Essays in Honour of Tibor Scitovski*. New York: Academic Press, pp. 23–39.
- Arrow, Kenneth J. 1984. *Collected Papers*, vol. 4: *The Economics of Information*. Oxford: Basil Blackwell.
- Arrow, Kenneth J. 1985. *Collected Papers*, vol. 6: *Applied Economics*. Oxford: Basil Blackwell.
- Arrow, Kenneth J. 1987. "Oral History I: An Interview." In George R. Feiwel, ed., *Arrow and the Ascent of Modern Economic Process*. Basingstoke: Macmillan, pp. 191–242.
- Arrow, Kenneth J., and Gérard Debreu. 1954. "Existence of an Equilibrium for a Competitive Economy." *Econometrica* 22 (3): 265–290.
- Arrow, Kenneth J., and Frank H. Hahn. 1971. *General Competitive Analysis*. San Francisco: Holden-Day.
- Bator, Francis M. 1958. "The Anatomy of Market Failure." *Quarterly Journal of Economics* 72 (3): 351–379.
- Baumol, William J., and Wallace E. Oates. 1988. *The Theory of Environmental Policy*. Second edition. Cambridge: Cambridge University Press.
- Berta, Nathalie. 2000. "Origines et Fondements de la Représentation du Marché dans la Théorie de l'Équilibre Général Concurrentiel." PhD thesis, University of Paris I.
- Berta, Nathalie. 2014. "On the definition of externality as a missing market." Mimeo.
- Berta, Nathalie., Ludovic Julien, and Fabrice Tricou, eds. 2012. *On Perfect Competition From Past to Present: Definitions, Usages and Foundations*. Special issue of *Papers on Political Economy / Cahiers d'Économie Politique* 63.
- Bertrand, Elodie. 2006a. "La Thèse d'Efficiencia du 'Théorème de Coase': Quelle Critique de la Microéconomie?" *Revue Économique* 57 (5): 983–1007.
- Bertrand, Elodie. 2006b. "The Coasean Analysis of Lighthouse Financing: Myths and Realities." *Cambridge Journal of Economics* 30 (3): 389–402.
- Bertrand, Elodie. 2010. "The Three Roles of the 'Coase Theorem' in Coase's Works." *The European Journal of History of Economic Thought* 17 (4): 975–1000.
- Bertrand, Elodie. 2013. "Coase's Choice of Methodology." Mimeo.
- Bertrand, Elodie. 2014. "From the Firm to Economic Policy: The Problem of Coase's Cost." Mimeo.

- Bliss, Christopher. 1987. "Arrow's Vision of the Economic Process." In George R. Feiwel, ed., *Arrow and the Ascent of Modern Economic Process*. Basingstoke: Macmillan, pp. 295–305.
- Boyd, John H. III, and John P. Conley. 1997. "Fundamental Nonconvexities in Arrowian Markets and a Coasian Solution to the Problem of Externalities." *Journal of Economic Theory* 72 (2): 388–407.
- Buchanan, James M. 1984. "Rights, Efficiency, and Exchange: The Irrelevance of Transactions Cost." In Manfred Neumann, ed., *Ansprüche, Eigentums, und Verfügungsrechte*. Berlin: Duncker and Humblot, pp. 9–24. Repr. in James M. Buchanan, ed., *Liberty, Market and the State: Political Economy in the 1980s*. New York: New York University Press, 1986, pp. 92–107.
- Buchanan, James M., and W. Craig Stubblebine. 1962. "Externality." *Economica* 29 (116): 371–384.
- Buchanan, James M., and Gordon Tullock. 1962. *The Calculus of Consent: Logical Foundations of Constitutional Democracy*. Ann Arbor: Michigan University Press.
- Calabresi, Guido. 1968. "Transaction Costs, Resource Allocation and Liability Rules—A Comment." *Journal of Law and Economics* 11 (1): 67–73.
- Calabresi, Guido. 1991. "The Pointlessness of Pareto: Carrying Coase Further." *Yale Law Journal* 100 (5): 1211–1237.
- Coase, Ronald H. 1937. "The Nature of the Firm." *Economica* 4 (16): 386–405.
- Coase, Ronald H. 1959. "The Federal Communications Commission." *Journal of Law and Economics* 2: 1–40.
- Coase, Ronald H. 1960. "The Problem of Social Cost." *Journal of Law and Economics* 3: 1–44.
- Coase, Ronald H. 1964. "Discussion of 'Direct Regulation and Market Performance in the American Economy', by Richard E. Caves, and 'The Effectiveness of Economic Regulation: A Legal View', by Roger C. Crampton." *American Economic Review* 54 (3): 194–197.
- Coase, Ronald H. 1974. "The Lighthouse in Economics." *Journal of Law and Economics* 17 (2): 357–376.
- Coase, Ronald H. 1981. "The Coase Theorem and the Empty Core: A Comment." *Journal of Law and Economics* 24 (1): 183–187.
- Coase, Ronald H. 1982. "How Should Economists Choose?" G. Warren Nutter Lecture in Political Economy, Washington, DC: The American Enterprise Institute for Public Policy Research. Repr. in Ronald H. Coase, *Essays on Economics and Economists*. Chicago: The University of Chicago Press, 1994, pp. 15–33.
- Coase, Ronald H. 1988a. "Blackmail." *Virginia Law Review* 74 (4): 655–676.
- Coase, Ronald H. 1988b. *The Firm, the Market and the Law*. Chicago: The University of Chicago Press.
- Coase, Ronald H. 1992. "The Institutional Structure of Production: 1991 Alfred Nobel Memorial Prize Lecture in Economic Sciences." *American Economic Review* 82 (4): 713–719.
- Coase, Ronald H., and Ning Wang. 2012. *How China Became Capitalist*. New York: Palgrave Macmillan.
- Coleman, Jules L. 1984. "Economics and the Law: A Critical Review of the Foundations of the Economic Approach to Law." *Ethics* 94 (4): 649–679.
- Commons, Jules R. [1924] 1974. *Legal Foundations of Capitalism*. Clifton: A. M. Kelley.
- Cooter, Robert D. 1980. "How the Law Circumvents Starrett's Nonconvexity." *Journal of Economic Theory* 22 (3): 499–504.
- Cooter, Robert D. 1982. "The Cost of Coase." *Journal of Legal Studies* 11 (1): 1–33.
- Cornes, Richard, and Todd Sandler. 1996. *The Theory of Externalities, Public Goods and Club Goods*. Second edition. New York: Cambridge University Press.
- Dales, John H. 1968. *Pollution, Property and Prices: An Essay in Policy-Making and Economics*. Toronto: University of Toronto Press.
- Dahlman, Carl J. 1979. "The Problem of Externality." *Journal of Law and Economics* 22 (1): 141–162.
- Debreu, Gérard. 1951. "The Coefficient of Resource Utilization." *Econometrica* 19 (3): 273–292.
- Debreu, Gérard, and Herbert Scarf. 1963. "A Limit Theorem on the Core of an Economy." *International Economic Review* 4 (3): 235–246.
- Demsetz, Harold. 1964. "The Exchange and Enforcement of Property Rights." *Journal of Law and Economics* 7: 11–26.

- Demsetz, Harold. 1966. "Some Aspects of Property Rights." *Journal of Law and Economics* 9: 61–70.
- Demsetz, Harold. 1967. "Toward a Theory of Property Rights." *American Economic Review* 57 (2): 347–359.
- Demsetz, Harold. 1969. "Information and Efficiency: Another Viewpoint." *Journal of Law and Economics* 12 (1): 1–22.
- Duffie, Darrell, and Hugo Sonnenschein. 1989. "Arrow and General Equilibrium Theory." *Journal of Economic Literature* 27 (2): 565–598.
- Edgeworth, Francis Y. 1881. *Mathematical Psychics. An Essay on the Application of Mathematics to the Moral Sciences*. London: Kegan Paul.
- Farrell, Joseph. 1987. "Information and the Coase Theorem." *Journal of Economic Perspectives* 1 (2): 113–129.
- Fox, Glenn. 2007. "The Real Coase Theorems." *Cato Journal* 27 (3): 373–396.
- Friedman, Milton. 1953. "The Methodology of Positive Economics." In *Essays in Positive Economics*. Chicago: University of Chicago Press, pp. 3–43.
- Gale, David. 1955. "The Law of Supply and Demand." *Mathematica Scandinavica* 3: 155–169.
- Heller, Walter P., and David A. Starrett. 1976. "On the Nature of Externalities." In Steven A. Y. Lin, ed., *Theory and Measurement of Economic Externalities*. New York: Academic Press, pp. 9–21.
- Hildenbrand, Werner, and Alan P. Kirman. [1988] 1991. *Equilibrium Analysis: Variations on Themes by Edgeworth and Walras*. Second edition. Amsterdam: North-Holland.
- Hoffman, Elizabeth, and Matthew L. Spitzer. 1982. "The Coase Theorem: Some Experimental Tests." *Journal of Law and Economics* 25 (1): 73–98.
- Hurwicz, Leonid. 1995. "What Is the Coase Theorem?" *Japan and the World Economy* 7 (1): 49–74.
- Klaes, Matthias. 2000. "The History of the Concept of Transaction Costs: Neglected Aspects." *Journal of the History of Economic Thought* 22 (2): 191–216.
- Kornai, Janos. 1979. "The Oeuvre of Kenneth J. Arrow." *Acta Oeconomica* 23 (1–2): 193–203.
- Laffont, Jean-Jacques. 1976. "Decentralization with Externalities." *European Economic Review* 7 (4): 359–375.
- Laffont, Jean-Jacques. 1977. *Effets Externes et Théorie Economique*. Paris: Editions du CNRS, collection Monographies du séminaire d'économétrie.
- Laffont, Jean-Jacques. 1988. *Fundamentals of Public Economics*. Translation by John P. Bonin and Hélène Bonin of *Cours de théorie microéconomique*, vol. 1: *Fondements de l'Economie Publique* (Paris: Economica, 1982). Cambridge: MIT Press.
- Lagueux, Maurice. 2010. "The Residual Character of Externalities." *The European Journal of the History of Economic Thought* 17 (4): 957–973.
- Mäki, Uskali. 1998. "Is Coase a Realist?" *Philosophy of the Social Sciences* 28 (1): 5–31.
- McKelvey, Richard D., and Talbot Page. 1999. "Taking the Coase Theorem Seriously." *Economics and Philosophy* 15 (2): 235–247.
- McKenzie, Lionel W. 1954. "On Equilibrium in Graham's Model of World Trade and Other Competitive Systems." *Econometrica* 22 (2): 147–161.
- McKenzie, Lionel W. 1955. "Competitive Equilibrium with Dependant Consumer Preferences." In Henry A. Antosiewicz, ed., *Proceedings of the Second Symposium in Linear Programming*. Washington, DC: National Bureau of Standards and Directorate of Management Analysis, pp. 277–294.
- Meade, James E. 1952. "External Economies and Diseconomies in a Competitive Situation." *Economic Journal* 62 (245): 54–67.
- Medema, Steven G. 1994. *Ronald H. Coase*. London: Macmillan.
- Medema, Steven G. 1996a. "Coase, Costs, and Coordination." *Journal of Economic Issues* 30 (2): 571–578.
- Medema, Steven G. 1996b. "Of Pangloss, Pigouvians and Pragmatism: Ronald Coase and Social Cost Analysis." *Journal of the History of Economic Thought* 18 (1): 96–114.
- Medema, Steven G. 1996c. "Ronald Coase and American Institutionalism." *Research in the History of Economic Thought and Methodology* 14: 51–92.

- Medema, Steven G. 1999. "Legal Fiction: The Place of the Coase Theorem in Law and Economics." *Economics and Philosophy* 15 (2): 209–233.
- Medema, Steven G. 2009. *The Hesitant Hand: Taming Self-Interest in the History of Economic Ideas*. Princeton: Princeton University Press.
- Medema, Steven G. 2011. "A Case of Mistaken Identity: George Stigler, 'The Problem of Social Cost', and the Coase Theorem." *European Journal of Law and Economics* 31 (1): 11–38.
- Medema, Steven G. 2014. "Neither Misunderstood Nor Ignored: The Early Reception of Coase's Wider Challenge to the Analysis of Externalities." *History of Economic Ideas* (forthcoming).
- Medema, Steven G., and Richard O. Zerbe Jr. 2000. "The Coase Theorem." In Boudewijn Bouckaert and Gerrit De Geest, eds, *The Encyclopedia of Law and Economics*, vol. I: *The History and Methodology of Law and Economics*. Cheltenham: Edward Elgar, pp. 836–892.
- Mishan, Ezra J. 1965. "Reflections on Recent Developments in the Concept of External Effects." *Canadian Journal of Economics and Political Science* 31 (1): 3–34.
- Mishan, Ezra J. 1971a. "Pangloss on Pollution." *Swedish Journal of Economics* 73 (1): 113–120.
- Mishan, Ezra J. 1971b. "The Postwar Literature on Externalities: An Interpretative Essay." *Journal of Economic Literature* 9 (1): 1–28.
- Papandreou, Andreas A. 1994. *Externality and Institutions*. New York: Oxford University Press.
- Pigou, Arthur Cecil. [1932] 1948. *The Economics of Welfare*. Fourth edition. London: Macmillan.
- Polinsky, A. Mitchell. 1979. "Controlling Externalities and Protecting Entitlements: Property Right, Liability Rule, and Tax-subsidy Approaches." *Journal of Legal Studies* 8 (1): 1–48.
- Pratten, Stephen. 2004. "The Conflict between Formalism and Realisticness in Modern Economics: The Case of the New Institutional Economics." In John B. Davis, Alain Marciano, and Jochen Runde, eds., *The Elgar Companion to Economics and Philosophy*. Cheltenham: Edward Elgar, pp. 339–363.
- Regan, Donald H. 1972. "The Problem of Social Cost Revisited." *Journal of Law and Economics* 15 (2): 427–437.
- Rob, Rafael. 1989. "Pollution Claim Settlements under Private Information." *Journal of Economic Theory* 47 (2): 307–333.
- Samuelson, Paul A. 1967. "The Monopolistic Competition Revolution." In Robert E. Kuenne, ed., *Monopolistic Competition Theory: Studies in Impact; Essays in Honour of Edward H. Chamberlin*. New York: Wiley. Repr. in Robert C. Merton, ed., *The Collected Scientific Papers of Paul A. Samuelson*, vol. 3. Cambridge: MIT Press, 1972, pp. 18–51.
- Samuelson, William. 1985. "A Comment on the Coase Theorem." In Alvin E. Roth, ed., *Game-Theoretic Models of Bargaining*. Cambridge: Cambridge University Press, pp. 599–611.
- Schweizer, Urs. 1988. "Externalities and the Coase Theorem: Hypothesis or Result?" *Journal of Institutional and Theoretical Economics* 144 (2): 245–266.
- Scitovsky, Tibor. 1954. "Two Concepts of External Economies." *Journal of Political Economy* 62 (2): 143–151.
- Starrett, David A. 1972. "Fundamental Nonconvexities in the Theory of Externalities." *Journal of Economic Theory* 4 (2): 180–199.
- Stigler, George J. 1966. *The Theory of Price*. Third edition. New York: Macmillan.
- Stigler, George J. 1992. "Law or Economics?" *Journal of Law and Economics* 35 (2): 455–468.
- Varian, Hal R. 1995. "Coase, Competition, and Compensation." *Japan and the World Economy* 7 (1): 13–27.
- Veljanovski, Cento G. 1982. "The Coase Theorems and the Economic Theory of Markets and Law." *Kyklos* 35 (1): 53–74.
- Viner, Jacob. 1931. "Cost Curves and Supply Curves." *Zeitschrift für Nationalökonomie* 3: 23–46.
- Walras, Léon. 1874. *Elements d'Economie Politique Pure ou Théorie de la Richesse Sociale*. Lausanne: Corbaz. *Elements of pure Economics, or the Theory of Social Wealth*, translated by William Jaffé. London: Routledge, 2010.
- Wang, Ning. 2003. "Coase on the Nature of Economics." *Cambridge Journal of Economics* 27 (6): 807–829.

- Wellisz, Stanislaw. 1964. "On External Diseconomies and the Government-assisted Invisible Hand." *Economica* 31 (124): 345–362.
- Zerbe, Richard O. Jr. 1980. "The Problem of Social Cost in Retrospect." *Research in Law and Economics* 2: 83–102.
- Zerbe, Richard O. Jr., and Howard E. McCurdy. 1999. "The Failure of Market Failure." *Journal of Policy Analysis and Management* 18 (4): 558–578.