The Coase Theorem at Sixty

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The Coase Theorem at Sixty

1. *Introduction*

The "Coase theorem" sits at once among the most influential and the most controversial ideas in the post-WWII history of economics.[1] Born out of the economic theory of externalities, its reach now extends to virtually every sub-field of economics and of law and, indeed, to fields of study across the academic spectrum and literatures around the globe.[2] Yet, its validity as a proposition in economic logic was for many years a bone of significant contention and, even today, is by no means universally accepted. The theorem's relevance to real-world problems, too, is highly contested. Some have suggested that it should be the default for externality policy analysis (e.g., Turvey 1963), while others would restrict its applicability to a "transactions costs-free fairyland" (Randall 1975, 741). It was Coase's University of Chicago colleague, George Stigler who provide the moniker by which Coase's (1960) negotiation result has come to be known—curiously enough, in his textbook, *The Theory of Price* (1966, 113). As we approach the 60th anniversary of Coase's development of his negotiation result, it seems appropriate time to take stock of its place in economic analysis.

It would be standard at this point to make a statement of *the* Coase theorem, but that is rather problematic. Though one would be hard pressed to find an economist who could not provide a statement of the theorem, assembling a collection of such statements would reveal a wide variety of opinions on the theorem's contents—specifically, the assumptions underlying it and the claims made by it. In fact, some economists subscribe to versions of the theorem that others consider to be demonstrably false. The same cannot be said of the other famous "theorems" of economics—theorems that, as it happens, feature far less prominently in the literature than does the one that bears Coase's name (figure 1). To understand how we arrived at this position requires an exploration of the theorem's history, which we shall undertake in some detail. This history will also point the way to a Coase theorem that is valid as a proposition in economic logic.

For those impatient to know how the story turns out, we shall state the Coase theorem here before moving on to an analysis of how we have arrived at this particular delineation of it.

> *Theorem: If agents are rational and the costs of transacting are zero, resources will be allocated efficiently independent of how rights over those resources are initially distributed.*

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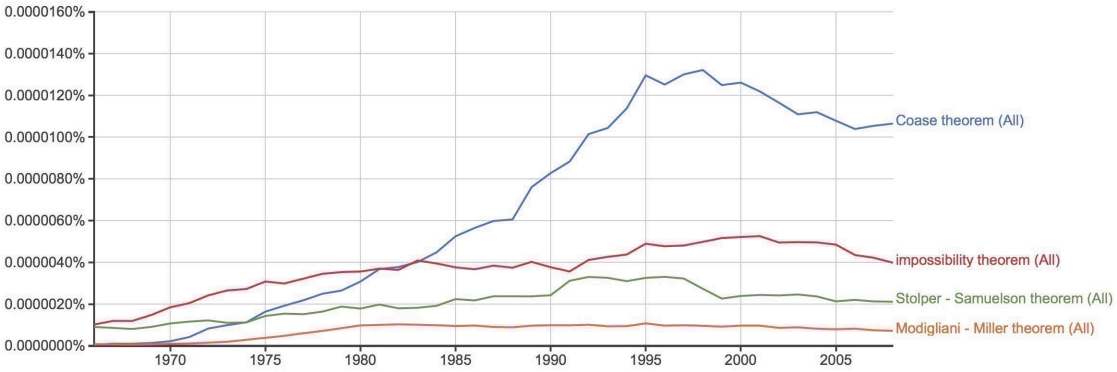
[1] The literature on the Coase theorem is voluminous. For overviews of the theorem from a variety of perspectives, see, e.g., Cooter (1982), Zelder (1998), Schwab (1989), Medema and Zerbe (2000) and Parisi (2008), as well as the essays reprinted in Posner and Parisi (2013). Robson (2012, ch. 3) provides a very nice formal treatment of the subject. Coase's own retrospective views are most expansively laid out in Coase (1988b, ch. 6).

[2] The theorem has been discussed in journals ranging from the *Slovenian Law Review* to the *Korean Journal of Sociology*.

Moreover, if utility functions are uniformly affine in private goods and the registration of subjective values is not wealth-constrained, this allocation is independent of the initial rights structure.

Figure 1

Citations to Famous Theorems in Economics, 1966-2008



Source: books.google.com/ngrams, accessed September 4, 2017

When Ronald Coase, then a member of the University of Virginia economics faculty,[3] wrote "The Problem of Social Cost" (1960), providing a critique of the received theory of externalities, he did not intend to offer the world a theorem. He did not even consider the proposition we now know as the Coase theorem to be the article's central insight. His discussion of negotiated solutions to externalities was little more than a convenient fiction designed to show the error of the equally fictional (in his mind) Pigovian tradition and to point the way toward a very different approach to thinking about externality theory and policy—a comparative institutional approach grounded in the reciprocal nature of externalities and the costliness of coordination, to which he devoted roughly two-thirds of his article. In fact, Coase penned not another word on his negotiation result for two decades.[4] What we now know as the "Coase theorem" is very much a creation of the community of economists and legal scholars who undertook to analyze and apply Coase's insight.

[3] It is often not recognized that Coase did not move to Chicago, to take up a position in the Law School, until 1964.

[4] Coase (1970) did provide a summary of "The Problem of Social Cost" a decade after the publication of this article, but his next commentary on the negotiation result came in Coase (1981), reacting to one of the many attempted refutations of the Coase theorem. It bears mentioning that Coase was the editor of the journal in which both this critique and his reaction were published—the *Journal of Law and Economics*—and, in fact, Coase published a host of articles that took up the negotiation result during his lengthy tenure as editor, thus participating indirectly in the debates over the theorem and its diffusion in the literature.

The theorem is, by any number of measures, one of the most curious results in the history of economic ideas. Its development has been shrouded in misremembrances, political controversies, and all manner of personal and communal confusions and serves as an excellent exemplar of the messy process by which new ideas become scientific knowledge. There is no unique statement of the Coase theorem; there are literally dozens of different statements of it, many of which are inconsistent with others and appear to mark significant departures from what Coase had argued in 1960. A small subset of these are presented in section 3, below. The theorem has never been given a generally accepted formal proof; yet it has been the subject of scores of attempts to "disprove" it in a stream of analysis and debate that continues to this day. It has been labeled "tautology" and the "Say's law of welfare economics" (Calabresi 1968, 68, 73),[5] an "illuminating falsehood" (Cooter 1982, 28), and even a "religious precept" (Posin 1993, 810). Halpin (2007, 339) calls the theorem "theoretically degenerate … and ideologically charged." Usher (1998) bundles these various charges together, claiming that the theorem is "tautological, incoherent, or wrong," with the specific verdict resting upon to which version of the theorem one subscribes. The skepticism about its status as a "theorem" is reflected in the various alternative labels put on it in the literature: the "Coase conjecture" (Stiglitz 2000, 1458; Chipman and Tian 2011, 322),[6] the "Coase proposition" (Samuelson 1995, 1), the "Coase hypothesis" (Conley and Smith 2005a, 688), and the "Coase parable" (Ackerman 1982, 1104).

The nature of the theorem's underlying assumptions is often said to make the its domain of direct applicability nil; yet, it has been invoked, criticized, and applied to legal-economic policy issues in thousands of journal articles and books in economics and law (see table 1, below), as well as in journals spanning fields from philosophy (Hale 2008) to literature (Minda 2001) to biology (Frech 1973). Indeed, the Coase theorem may be the only economic concept the use of which is more extensive outside of economics than within it. Though it is a positive statement without direct normative implications, it was both used as a justification for the application of economic principles in judicial decision making and viewed as an early salvo in what many perceive as a "Chicago school"-driven neoliberal turn of economics—the last in spite of the fact that the theorem's diffusion into the legal literature, at least, originated from well outside of (and, one could argue, to the left of that popularly associated with) Chicago and nearly a decade prior to the rise of "Chicago" economic analysis of law (Medema 2014d). It has been derided from one side as conservative ideology and from the other as liberal ideology.[7] Like Adam Smith's "invisible hand" proposition (Smith 1776,

[5] The "tautology" label is both common and persistent. We shall have more to say on this point in section 4.

[6] The "Coase conjecture" is more typically associated with Coase's (1972) argument regarding durable goods monopoly.

[7] Contrast, e.g., Samuels (1974), Kelman (1979), Hackney (2007), and Teles (2008) with and Block (2003) and North (2002).

IV.2.9), it was arguably a rather minor point in the author's work but took on a life of its own in the hands of subsequent commentators.[8]

Table 1[9]

Citations to the "Coase theorem" in Economics and Law Journals, 1960-2014

Years	Economics	Law
1960-1969	2	2
1970-1979	112	122
1980-1989	198	594
1990-1999	339	1089
2000-2009	367	1227
2010-2014	129	622
Total	1391	4860

Sources: Economics: dfr.jstor.org, accessed August 19, 2017; Law: heononline.org, accessed August 19, 2017.

Understanding the place that the Coase theorem occupies within economic analysis today requires that we first train our lens on the past. We begin with a brief discussion of the road that led to the writing of "The Problem of Social Cost" and of the early diffusion of Coase's result into the literatures of economics and law. Section 3 presents and analyzes a litany of Coase theorems found in the literature with a view to illustrating the diversity of views regarding the theorem's content and meaning. In doing so, an attempt is made to distill both common elements and points of contention, while not denying the essential ambiguity that surrounds the theorem. A good deal of this ambiguity is the result of several major controversies over the Coase theorem that emerged in the late 1960s and reached a crescendo in the 1970s and 1980s, and these are taken up in section 4. We will draw on the results of these controversies to state a valid Coase theorem and assess what that means for the uses to which the theorem is put. The more recent literature has focused on the theorem's domain of applicability. One aspect of this has been a wide-ranging set of "tests" of the theorem, through

[8] Samuels (2011) provides an extensive analysis of the use made of Smith's invisible hand concept.

[9] The economics citation count given here includes only JSTOR journals and so significantly understates the number of citations to the theorem in the economics literature during this period. The Hein database includes virtually all law journals and so provides accurate totals for that literature. It should also be noted the data given here includes only references to the "Coase theorem." Given that the term "Coase theorem" took some time to catch on, there are many references to Coase's result, particularly in the 1960s and 1970s, that are not captured in this table. Again, these would be included in any data reported in the article.

experiments, case studies, and econometric analyses. These are discussed in section 5. Section 6 examines some of the most significant among the myriad ways that the theorem's insights are being applied in economic analysis and beyond—applications that go far beyond its original base in externality theory proper. The concluding section provides a brief assessment of the implications of our discussion for the place of the Coase theorem in modern economic analysis.[10]

2. *The Road to the Coase Theorem*

"The Problem of Social Cost" was written against the backdrop of the post-WWII theory of externalities and as an attack on the "Pigovian tradition" that this literature was said to reflect. In reality, however, the externality literature was extremely thin during the four decades following the publication of Pigou's *The Economics of Welfare* (1920), and such discussion as took place was not targeted at the analysis of externalities per se, nor at policy measures to deal with them. Instead, the focus was on the efficiency properties of a competitive equilibrium system; externalities were simply one of the factors shown to impede the attainment of the theoretical optimum.[11] Externalities themselves were generally considered, as Scitovsky (1954, 143) put it, "exceptional and unimportant." It was only in the latter half of the 1950s that economists once again began to turn their attention to externality problems, and even then the support for Pigovian remedies was mixed, at best. Tax-subsidy, single owner, and negotiated solutions all figure in this literature, with Coase's former student, LSE's Ralph Turvey (1957, 94-99), laying out a result remarkably similar to that which Coase would set down not long thereafter.

The path that led Coase to his negotiation result and to writing "The Problem of Social Cost" was anything but direct. When he returned to LSE following the war, his research efforts were focused primarily on case studies of regulated industries in Britain—including the broadcasting industry.[12] Coase continued his study of the political economy of broadcasting after emigrating to the U.S. in the early 1950s, eventually turning his attention to the U.S. Federal Communications Commission (F.C.C.) and its fiat-based method of allocating broadcast frequencies. It was out of this work that his negotiation result originally emerged.

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[10] It is impossible to contemplate the Coase theorem's history without some attention to its influence within the legal arena. While that literature is far too vast to discuss at any length here, the analysis that follows will draw on the legal literature to the extent that it is relevant to our analysis.

[11] As such, the literature of this period reflects a significant break with Pigou's concerns, as Medema (2015b) has shown in his examination of the history of externality analysis prior to 1960. See also Papandreou (1994) and Cornes and Sandler (1996). The term "externality" did not appear in the literature until Francis Bator used it in the late 1950s (Bator 1957). Coase, for his part, never used the term, believing that it implied the need for some sort of state action—a proposition that he rejected.

[12] Coase's research trajectory is described in Medema's (1994) intellectual biography of Coase. Ménard and Bertrand (2016) have assembled an excellent collection of essays assessing Coase's work and its impact.

Coase was not the first to advocate use of the market for the allocation of broadcast frequencies. Leo Herzel (1951) had done so nearly a decade earlier,[13] but his analysis was not dispositive of the issue, as he did not account for interference externalities and the attendant inefficiencies. Coase's contribution was to demonstrate that private property rights in frequencies would eliminate these interference problems and that the market process would place those rights/ frequencies in the hands of agents who valued them most highly (1959, 25-31). He recognized that large numbers problems, incomplete information, and the like may make such negotiations cost-prohibitive in many circumstances, thus strengthening the case for regulation (1959, 29). But even in those instances where regulation was necessary, Coase argued, "the solution to be sought is that which would have been achieved if the institution of private property and the pricing mechanism were working well"—in short, mimicking the market (1959, 29). His message, above all, was that the F.C.C should at least *consider* allocating frequencies through the marketplace, and he was convinced that his analysis had demonstrated that the market could deal efficiently with the potential conflicting-use problems that were thought to pose a barrier to such an approach.[14]

When Coase submitted the F.C.C. paper to the *Journal of Law and Economics* in 1959, its editor, Aaron Director, disagreed with Coase's conclusions regarding exchange-based solutions to the interference-externality problem, a sentiment apparently echoed by other members of the Chicago faculty to whom Director showed the paper. The objection stated by Director was that if producers of harm are not made liable, costs will not be properly internalized and an inefficiently large amount of the harm-associated good.[15] Director thus urged that this section of the paper be removed. Coase flatly refused and also asked for the opportunity to defend his position to the Chicago faculty. This defense, which has been described by Stigler, took place in Director's home and converted those assembled—a group that included Director, Stigler, Milton Friedman, Arnold Harberger, Martin Bailey, H. Gregg Lewis, and a dozen others—to Coase's position.[16] Stigler later described the evening in vivid terms:

> At the beginning of the evening we took a vote and there were twenty votes for Pigou and one for Ronald, and if Ronald had not been allowed to vote it would have been even more one-sided. The discussion began. As usual, Milton did much of the talking. I think it is also

[13] See also Herzel (1998), in which he provides a retrospective commentary on his contribution.

[14] On Coase's FCC paper and its influence, see Hazlett et al. (2011).

[15] The objection to Coase's result has commonly been attributed to Reuben Kessel (Kitch 1983). However, correspondence between Coase and Director makes clear that the disagreement was, from the outset, more widespread and included Director himself (Director to Coase, August 2, 1959 and nd, Coase Papers, Box 21, Folder 6).

[16] Ironically, Martin Bailey (1954) had posited the theoretical possibility of negotiated solutions to externalities during the 1950s but, according to Stigler's account, was among those who initially objected to Coase's result.

> fair to say that, as usual, Milton did much of the correct and deep and analytical thinking. I cannot reconstruct it. I have never really forgiven Aaron for not having brought a tape recorder that night. He should have known this was going to be a great event because he is a wise man. My recollection is that Ronald didn't persuade us. But he refused to yield to all our erroneous arguments. Milton would hit him from one side, then from another, then from another. Then to our horror, Milton missed him and hit us. At the end of that evening the vote had changed. There were twenty-one votes for Ronald and no votes for Pigou. (Kitch 1983, 221)[17]

While it was Al Harberger who first realized that Coase's argument was going to carry the day,[18] it was Stigler who, at the end of the evening "went home with what he thought was a new theorem" (McCloskey 1998, 367). Director then urged Coase to write up his argument in a more general and expansive form, and the article that resulted was "The Problem of Social Cost."

While it is a commonplace to make the Coase theorem the centerpiece of "The Problem of Social Cost," nothing could be further from the truth. The article makes three basic points. First, externalities are reciprocal in nature. Yes, *A*'s action's impose costs on *B*, but to restrain *A* in favor of *B* imposes costs on *A*. The *economic* problem as Coase emphasized, is to avoid the more serious harm. This, as we shall see, may actually be the most controversial aspect of the article—and of the theorem. Second, if the pricing system works costlessly and rights are assigned over the relevant resources, agents will negotiate a solution that maximizes the value of output, and this outcome will be reached irrespective of to which party those rights are assigned—the idea that came to be known as the Coase theorem. But the negotiation result was merely a means to an end—a useful fiction to illustrate what Coase considered "the emptiness of the Pigovian analytical system" (Coase 1993, 252-53).[19] In the frictionless world of welfare economics circa 1960, the negotiation result shows that Pigovian remedies are completely unnecessary for an efficient resolution of externality problems. Third, in the real world of positive transaction costs, all coordination mechanisms—markets, firms, and government—are costly and imperfect, meaning that there is no route to the optimum. The best that we can do is to choose among imperfect alternatives—including doing nothing at all about the

[17] See also Stigler (1988). In fact, there were no votes taken, but Coase has indicated that Stigler's hyperbole is an accurate representation of the flavor of the evening (Letter from Coase to Joseph A. Morris, March 3, 1993, Coase Papers, Box 30, Folder 2). The debate apparently included the shuffling around of chairs to represent property rights—a form of argumentation not typical of the economics seminar room.

[18] Letter from Coase to George Priest, January 26, 1983, Coase Papers, Box 31, Folder 12.

[19] There is good reason to believe that Coase's criticism of Pigou himself was a bit wide of the mark, though it may have more validity against those who had built upon Pigou's work. For a variety of perspectives on Coase v. Pigou, united in the sense that Coase's take on Pigou's work was not wholly accurate, see Simpson (1996) and Coase's (1996) response, DeSerpa (1993), Aslanbeigui and Medema (1998), and Hovenkamp (2009).

problem (1960, 18-19).[20] Comparative institutional analysis, then, becomes the method of choice, and the goal, from an economic perspective, is to select the coordination mechanism that maximizes the value of output for the problem under consideration. As Coase (1988, 1992) took pains to emphasize later in his career, the negotiation result is the least of these points and, in fact, occupied only 14 of the articles 44 pages.[21] His message, then, was a call to move away from the frictionless world that he soon thereafter labeled "blackboard economics" (1964, 195). But this was not the message that economists and others seized upon.

The earliest reactions to Coase's analysis came out of LSE, Virginia, and Chicago—that is, from within what was at that time the relatively small orbit of the recently founded *Journal of Law and Economics*, and the group of people who were otherwise well-acquainted with Coase and his work.[22] Perhaps not surprisingly, the voices were almost uniformly accepting of the negotiation result, and this early literature evidences little hint of the controversy that was to come.[23] What might surprise, though, is the reason for this affirmation—the result's familiarity. Mishan tells us that, "To the best of my memory, this theorem was common knowledge in the London-Oxford-Cambridge graduate seminar, 1947-8 which included then, as students, Baumol, Graaff, Hahn, Turvey, and myself" (1976, 288n.1).[24] We also find a remarkably similar proposition in Turvey (1957, 94-99), as noted above, and even a small hint in Graaff (1957, 61).[25] Buchanan, meanwhile, found Coase's "proposition," as he called it, "almost self-evident" when he presented it at Virginia in the late 1950s and even 30 years later could recall the "surprise felt when Coase reported back to us about the controversial reaction to his presentation of the theorem at the University of Chicago" (Buchanan 1988, 11-12). In fact, the line of thinking reflected in Coase's negotiation result was very much in the

[20] Coase's emphasis on coordination costs, including "firm" or single-owner solutions to externality problems, makes "The Problem of Social Cost" of a piece with his other most well-known article, "The Nature of the Firm" (Coase 1937). These two articles share the basic thrust of contrasting a frictionless world with the real world of costly coordination and the demonstration of how economic outcomes are institution-independent in the former world and institution-dependent in the latter.

[21] For discussions of the place of the negotiation result in Coase's analysis, see, e.g., Coase's retrospective comments in Coase (1988, 1992), Medema (1996; 2009, ch. 5), and Bertrand (2010).

[22] These schools were, of course, Coase's past, present, and future academic homes.

[23] See, e.g., Buchanan (1962a; 1962b; 1962), Buchanan and Kafoglis (1963), Turvey (1963), and Davis and Whinston (1965). Samuelson (1963a) and Wellisz (1964) sounded more critical notes. Samuelson took up Coase's result only in passing but made no bones about his dim view of it: "The view that R. Coase has shown that externalities—like smoke nuisances—are not a logical blow to the Invisible Hand and do not call for coercive interference with laissez-faire is not mine. I do not know that it is Coase's. But if it had not been expressed by someone, I would not be mentioning it here. Unconstrained self-interest will in such cases lead to the insoluble bilateral monopoly problem with all its indeterminacies and non-optimalities" (1963b, 132n). Wellisz was on the Chicago faculty when he wrote his defense of Pigou against Coase—into which Lester Telser had significant input—but had moved to Columbia by the time it was published.

[24] A similar claim has been made by Cooper (1995, 30).

[25] Turvey (1957, 95n.2) attributes this insight to Arnold Plant, who was also Coase's mentor during his student days at the LSE. Unfortunately, Plant's published work and archives yield no further clues.

air at Virginia during the late 1950s and early 1960s[26] and is central to Buchanan and Tullock's analysis in *The Calculus of Consent* (1962).

These early discussions of Coase's result, along with Stigler's codification of a "Coase theorem" in his textbook in 1966, had the effect of exposing a much wider audience to Coase's negotiation analysis, as a result of which it received far more attention in the literature during the second half of the decade.[27] Some concerns regarding the validity of Coase's argument began to emerge during this time, but the attitude was largely one of acceptance—though generally with an acknowledgment that it was largely irrelevant to the problems the authors were considering, owing to the prevalence of transaction costs (Medema 2014a).

The appearance of Coase's result in the *legal* literature dates to the mid-1960s, well before the modern economic analysis of law had entered the larger legal consciousness. It is noteworthy, though, that this entry point came not at the hands of economists, but of two of Coase's new colleagues at the University of Chicago Law School—Walter Blum and Harry Kalven (1964)—who were critical of Coase's result and its utility for legal analysis. Yale's Guido Calabresi, who in 1961 had suggested that the competitive market process could efficiently internalize externality-related harms associated with accidents and spent the middle third of the decade engaged in a debate with Blum and Kalven over the insights that economics could offer the analysis of accident law, had a much more positive view of Coase's result, however, and the use made of it by Calabresi and by his students played a significant role—well beyond that of Chicago—in the early diffusion of the theorem into legal analysis (Medema 2014d).[28]

The bit part played by the Coase theorem in economic and legal analysis during the 1960s provided little indication of the controversy just over the horizon or the central place that the theorem would come to occupy in these literatures in the ensuing decades. In fact, the theorem might well have had very little impact on either economic or legal reasoning were it not for the larger forces within which it became enmeshed. These larger issues, though, require that we understand how

[26] Buchanan made this point to the present author on multiple occasions.

[27] It is difficult to discern the extent of Stigler's influence on the theorem's diffusion. His textbook treatment was not regularly cited in the Coase theorem literature, but citations to textbooks are themselves extremely rare in scholarly articles.

[28] Some would say that Calabresi's 1961 article, "Some Thoughts on Risk Distribution and the Law of Torts" (1961), which, like "The Problem of Social Cost," appeared in print in early 1961, states a version of the Coase theorem. See also Calabresi (1965a; 1965b), as well as Medema's (2014e) discussion of Calabresi's use of the Coase theorem in his work. Benjamin Klein reports that, while visiting the University of Chicago Law School in the mid-1970s, he encountered a group of students "who had never heard of the Coase theorem," which came as a shock to him because at that time there was "no way you [could] go through the UCLA law school and take a course in torts without hearing about the Coase theorem" (Kitch 1983, 223).

economists have conceptualized the Coase theorem over the last sixty years, for this has much to do with both the controversies over the theorem and the use made of it.

3. *What is the Coase Theorem?*

One of the defining features of the Coase theorem literature is the absence of a singular, generally accepted statement of the theorem. The multiplicity of "Coase theorems" has fed the controversy over the theorem's correctness as a proposition in economic logic as well as disputes over the domain of the its real-world applicability. The roots of these varying perspectives lie in divergent views regarding the context within which the activity contemplated by the theorem plays out, the assumptions underlying the theorem (including the content given to them), and the results claimed for it. As Usher remarked, the Coase theorem is "the only theorem .. with an established name but no universally-recognized content" (1998, 3). No small amount of the responsibility for this falls on Coase himself. Being neither a modern economist as respects formal methods nor aware that he was laying out an idea that would be labeled a "theorem," his analysis exhibits a looseness that opens it up to multiple interpretations and, as we shall see, a wide range of criticisms.[29]

Utilizing the now-famous illustration of the rancher whose cattle trample a neighboring farmer's crops, Coase demonstrated that the two agents would negotiate to the outcome that maximizes the value of their joint output, regardless of to which of the agents the relevant rights were assigned. When wrapping up this analysis, Coase drew the following conclusion:

> It is necessary to know whether the damaging business is liable or not for damage caused since without the establishment of this initial delimitation of rights there can be no market transactions to transfer and recombine them. But 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. (Coase 1960, 8)[30]

This is as close as Coase came to a statement of what we now call the Coase theorem.

We can identify three assumptions underlying Coase's conclusion. First, the agents involved—Coase's farmer and cattle rancher—sell their outputs in perfectly competitive markets (1960, 6). Second, the pricing system works "without cost" (1960, 2) or, as he put it later in the article, there are "no costs involved in carrying out market transactions" (1960, 15). Finally, Coase assumed the existence of an initial assignment of legal rights over the relevant resources, on the grounds that the presence of such rights was necessary to induce negotiations.

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[29] Coase's *oeuvre* contains nary an equation. On Coase's methodological approach, see, e.g., Medema (1994; 1995), Posner (1993), Williamson's (1994) response to Posner, and Bertrand (2016).

[30] This is a virtually verbatim restatement of Coase's conclusion in his 1959 article. See Coase (1959, 27).

Given these assumptions, Coase asserted two things. First, the allocation of resources that emerges will be efficient, in the sense of maximizing the value of output. We shall label this the "efficiency claim." Second, the decision as to which of the parties rights are initially assigned will not affect the final allocation of resources. We shall label this the "invariance claim."[31] thesis."

Stigler's subsequent interpretation of Coase's finding, which he codified as the "Coase theorem," appeared in the third edition of his *Theory of Price* (1966). It was much more tersely stated than Coase's original formulation, calling to mind both the discussion of externalities in the literature of the 1940s and 1950s, which he had treated at some length in earlier editions of his price theory text,[32] and the first fundamental theorem of welfare economics:

> The Coase theorem … asserts that under perfect competition private and social costs will be equal. (Stigler 1966, 113)

In Stigler's hands, no explicit assumptions save that of perfect competition were necessary.[33]

The reason(s) behind Stigler's decision to codify Coase's result as the "Coase theorem" and to state it as he did are unknown, and even Stigler's extensive archive at the University of Chicago offers up no clues. But two possibilities suggest themselves. Stigler obviously was enamored of Coase's result, as he made clear in multiple subsequent commentaries (e.g., Kitch 1983, 220-21; Stigler 1988, ch. 5)—going so far as to label Coase a modern-day Archimedes. His decision to apply the "theorem" label may thus be nothing more than a Stiglerian provocative rhetorical flourish—one of many in the Stigler corpus. But there was more likely a method to Stigler's madness—a desire to elevate Coase's result to the level of a corollary to the First Fundamental Theorem of Welfare Economics, which explicitly assumed away external effects.[34] The Coase theorem, so read, was not so much a prescription for dealing with externalities as a rationale for not worrying about them, since the forces of competition would often eliminate this impediment to efficiency.

The respective statements by Coase and Stigler were both the launching point for subsequent restatements of the theorem and suggestive of one of the fundamental contrasts found in the Coase theorem literature—the larger framework within which the theorem is situated. Coase posited a scenario of small-numbers bargaining—each of his illustrations deals with only two agents—while

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[31] It is sometimes asserted that Coase was referring to *equally efficient* outcomes rather than identical outcomes, but Coase was very clear in his insistence on identical allocations.

[32] Given the lack of attention to externalities in the literature prior to the 1960s, Stigler's text was unusual in this regard.

[33] It may be that Stigler interpreted perfect competition to include zero costs of transacting and an assignment of relevant property rights, but he is not explicit on this point. For in-depth analyses of Stigler's several discussions of the Coase theorem, see Medema (2011) and Bertrand (2018).

[34] We shall return to the relationship between the Coase theorem and the First Fundamental Theorem in section 4, below.

Stigler's formulation, if not his actual textbook illustration,[35] suggests a theorem that is a proposition in the theory of competitive markets. Thus, we find the Coase theorem's prospective scope extending from the farmer and the rancher through a large-scale system of pollution permits within a Walrasian system.[36] The potentially very different implications of these two frameworks for the modeling strategies employed and for the conclusions reached have factored heavily into the debates over the theorem's validity.

3.1 *A Litany of Coase Theorems*

The Coase theorem has been stated in dozens of ways, some of them permutations of Coase's statement and others of Stigler's. The most important conclusion to take from this is that there is no consensus on what the Coase theorem *actually says*. The statements of the theorem set out below may appear similar at a casual glance, but they reflect differing assumptions, results, and emphases as between the efficiency and invariance that are at the heart of the debates over the theorem's validity and applicability. Though the emphasis in the litany of theorems that follows is on original statements of particular types of Coase theorem, contemporary counterparts can be readily identified in the literature. Italics have been added except where noted to emphasize original or unique elements in particular theorem statements.[37]

Table 2

Author	Statement of Coase Theorem
Calabresi 1968, 68	... if one assumes *rationality*, no transaction costs, and no legal impediments to bargaining, *all misallocations of resources* would be fully cured in the market by bargains. [The emphasis on "all" is Calabresi's.]
Buchanan 1972, 77	… in the absence of transactions costs and *income effects*, the assignment of property rights or claims does not affect resource allocation.
Regan 1972, 427	... in a world of perfect competition, *perfect information*, and zero transaction costs, the allocation of resources in the economy will be efficient and will be unaffected by legal rules regarding the initial impact of costs resulting from externalities.
Miller 1978, 461	Whenever contracting and enforcement of property rights are *relatively costless*, social costs and private costs will tend to be one and the same.

[35] Stigler (1966, 110-114) followed Coase in positing a two-agent (farmer-rancher) bargaining process, but two-agent competitive models were a staple of the (thin) externality literature of the 1940s and 1950s.

[36] On the latter, Cooter (1982, 9-12) is particularly instructive. Bramhall and Mills (1966) provide the first explicit analysis of Coase's result in a competitive markets context.

[37] The lack of italics in some statements indicates not a lack of originality or uniqueness, but that one must take the statement as a whole to see that. It should be noted that not all of these "theorem" statements were labeled as such by their authors. It took some time for the "Coase theorem" label to catch on, as a result of which one finds it used inconsistently prior to the mid-1970s.

Greenwood and Ingene 1978, 300	So long as negotiations (market transactions) are costless, the allocation of resources at the conclusion of the bargaining process is socially optimal because it has *the same characteristics as the equilibrium position attained by a merger of the affected parties* into a single firm which fully internalizes externalities.
Hoffman and Spitzer 1982, 73	... a change in a liability rule will leave the agents' production and consumption decisions both unchanged and economically efficient within the following (implicit) framework: (a) two agents to each externality bargain, (b) perfect knowledge of one another's *(convex) production and profit or utility functions*, (c) competitive markets, (d) zero transactions costs, (e) costless court system, (f) profit-maximizing producers and expected utility maximizing consumers, (g) no wealth effects, (h) agents will strike mutually advantageous bargains in the absence of transactions costs.
Cooter and Ulen 1988, 105	... when parties can bargain together and settle their disagreements by cooperation, their behavior will be efficient regardless of the underlying rule of law.
Schwab 1988, 242	… a change in [law] affects neither the efficiency of contracts *nor the distribution of wealth* between the parties.
Hurwicz 1995, 49	… the equilibrium level of an externality (e.g., pollution) is *independent of institutional factors* (in particular, assignment of liability for damage), except in the presence of transaction costs. (p. 49)
Russell 1995, 105-106	… the level of an externality produced in the competitive equilibrium of an economy is not affected by *a reallocation of tradeable property rights* in the activity which causes the externality.
Dixit and Olson 2000, 310-11	If transaction costs are zero, rational parties will necessarily achieve a Pareto-efficient allocation through voluntary transactions or bargaining.
Dixit and Olson 2000, 311	… if the Coase Theorem is true, so is a "super Coase Theorem," namely that "rational parties will necessarily achieve a Pareto-efficient allocation through voluntary transactions or bargaining, *no matter how high transaction costs might be*."
Allen 1999, 897	In the absence of transactions costs, the allocation of resources is independent of the distribution of property rights.
Foss and Foss 2005, 545-46	In short, the Coase theorem states that all value that can be created *from the exchange and use of an economy's available goods* will, in fact, be created when transaction costs are absent.
Rochet and Tirole 2006, 649	The Coase theorem states that if property rights are clearly established and tradeable, and if there are no transaction costs nor *asymmetric information*, the outcome of the negotiation between two (or several) parties will be Pareto efficient, even in the presence of externalities.
Foros and Hansen 2011, 215	Whenever there are gains from trade, … there exist contracts such that both [parties] are better off by signing a deal.

This litany of Coase theorems reflects a variety of underlying assumptions said to underpin the theorem and contrasting assertions as to what the theorem claims. We must thus devote some attention to teasing out these various assumptions and claims before turning our attention to the controversies that generated many of these contrasting theorem statements.

3.2 *Assumptions and Results*

Much of the ambiguity, confusion, and controversy surrounding the Coase theorem is an artifact of the collision of Coase's looser, more intuitive approach to the subject with the profession's increasing emphasis on formal modeling. Many of the subsequent restatements, then, can be seen as attempts to tighten up the theorem's underlying assumptions or better flesh out what Coase must have had in mind (in the commentator's view) when laying out his result.

As our litany demonstrates, subsequent commentators have laid a variety of additional assumptions onto Coase's formulation. Calabresi's 1968 restatement, which quickly became a touchstone in both the economics and legal literatures,[38] grafted on the rationality assumption, and others quickly followed suit, either explicitly in their statements of the theorem or in their analyses of it.[39] The rationality assumption, though, has important implications for game-theoretic and behavioral challenges to the theorem, as we shall see in section 4. Other assumptions, such as those pertaining to income (or wealth or welfare) effects and convex production/utility sets were added as the result of debates over the theorem's validity—though, as will become clear in the next section, there is no settled conclusion as to their necessity.

Calabresi's statement can be thought of as a more expansive and theorem-esque take on Coase's original. Regan's Stiglerian version of the theorem, laid out in his oft-cited critique of Coase's argument, both brings in an information requirement and explicitly links the theorem to the theory of competitive equilibrium.[40] Hoffman and Spitzer, meanwhile, assume both competitive markets and two agents to a bargain (as well as providing the most lengthy statement of the theorem in the literature). The tension between the competitive environment and Coase's small-numbers bargaining example formed the basis of Regan's and many other assaults on the theorem, as we shall see.

The content given to the assumption of zero transaction costs has been at the center of several of the controversies over the theorem.[41] Not everyone, though, felt compelled to restrict the Coase theorem to such a world. Ralph Turvey's early and widely cited restatement of Coase's result informed the reader that agents will negotiate efficient agreements in the face of externalities so long

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[38] Though Calabresi is best known to economists as a law professor and a pioneer in the economic analysis of law, he had significant formal training in economics as an undergraduate at Yale and a graduate student at Oxford.

[39] Contrary to what is sometimes asserted (e.g., Ellickson 1989, 612), Coase himself had made no specific behavioral assumption, and all that is implicit in his analysis is the idea that people will take advantage of (in the sense of doing what is necessary to realize) opportunities for gain. In fact, Coase was quite critical of the rationality assumption and a number of the results to which it gave rise, as well as its use by Becker and others to extend the boundaries of economics (Coase 1978).

[40] See also, e.g., Arrow (1969) and Hurwicz (1995).

[41] See section 4.7, below.

as they "are able and willing to negotiate to their mutual advantage" (Turvey 1963, 309), a sentiment reflected in the above-quoted statements from Miller, Cooter and Ulen, and Dixit and Olson. It has been suggested that the theorem holds if transaction costs are "negligible" (Worcester and Jr. 1972, 58), "sufficiently low" (Baird 1975, 222), "relatively costless" (Miller 1978, 461), "zero or close to zero" (Beckmann and Wesseler 2007, 224), or whenever the potential mutual gains "exceed [the] necessary bargaining costs" (Nicholson 1989, 726). This allowance for small but positive transaction costs has been particularly prevalent in the textbook literature (Medema 2015c).

Our litany of Coase theorems provides no more agreement on claimed outcomes or on the theorem's real message than it does on assumptions. Coase, as we have already noted, made both efficiency (maximization of the value of output) and allocative invariance claims. Many statements of the theorem replicate Coase's twin claims—sometimes referred to as the "strong" version of the Coase theorem—but others, such as Calabresi and Dixit and Olson, state the efficiency proposition alone (the "weak" Coase theorem).[42] For still others, though, the truly novel result is the invariance claim, and so we find statements, such as those by Hurwicz and Allen (as well as Lazear 2000, 131), informing us that the theorem encompasses the invariance claim alone, with efficiency typically assumed.[43] And though it has been almost universally admitted—as Coase himself did— that the distribution of income will vary depending upon to which party rights are initially assigned, Schwab has provided us with a theorem claiming that allocation *and* distribution are unaffected.

This difference of emphasis as between efficiency and invariance owes in part to the widely held belief that the invariance claim is incorrect as a matter of economic logic, the rationales for which will be probed in section 4. But it also tends to be a function of the interests of those utilizing the theorem. In the debate over the relative merits of negotiated and Pigovian solutions, which was particularly important during the first two-plus decades of the Coase theorem's life, efficiency was at the heart of the discussion. For many legal scholars, in contrast, and particularly before economic analysis came to occupy a prominent place within legal thinking, the invariant effects of legal rules was the revolutionary insight.[44]

This brings us to a final feature that emerges from our litany of Coase theorems—the theorem's domain. Calabresi's restatement extends it beyond externalities to *all* efficiency-related

[42] See also, e.g., Acemoglu (2003, p. 621). A number of commentators also substituted the Paretian conception of efficiency for the more Pigovian value of output maximization standard, which has important implications for judgments as to the theorem's validity and scope, as discussed in section 4.9, below.

[43] This diversity of views extends even to what one might call the "Chicago school," one prominent member of which suggested to this author that the invariance thesis is the central piece of the Coase theorem and another member of which suggested that invariance is a "red herring."

[44] Calabresi, with his focus on determining the cost-minimizing method for dealing with automobile accidents, was a prominent exception here, but this may go to his extensive training in economics (Medema 2014d).

market failures, and others, including as Foss and Foss, and Foros and Hansen, see the theorem as a general proposition in the exploitation of gains from exchange.[45] The implication for the invariance side is a more general one of *institutional* irrelevance. This, combined with the heightened attention paid to the effects of alternative institutional structures, helps us to understand the increasing emphasis placed by economists on the invariance claim in recent years.[46]

One take on this variety of Coase theorems is that many economists simply did or do not understand the Coase theorem. But that is to miss the historical point, for there has never been a singular "Coase theorem" to understand—a fact that, by itself, distinguishes the Coase theorem from other theorems in economics. The lack of any generally accepted statement of the theorem—as respects either the assumptions or the results—played a major role in stimulating the controversies over it and in the nature of the back-and-forth debate over both the theorem's theoretical validity and its relevance.

4. *Refining a "Theorem": The Coase Theorem Controversy*

Though a few voices questioning the Coase theorem were heard during the 1960s,[47] it was the 1970s that brought an explosion of controversy over the Coase theorem—a controversy that continues, albeit somewhat abated, to this day. The early years of the controversy featured a series of debates, played out over some two decades in the profession's leading journals, over the theorem's validity as a proposition in economic logic. The typical progression here was that of "disproof" by opponents of the theorem, often with an accompanying defense of Pigovian approaches, followed by attempts by theorem supporters to defend the theorem against the supposed disproof—usually by claiming to show the error of the disproof in question, though at times by modifying the theorem itself. In more recent years, however, the nature of the discussion has shifted somewhat, with some of the focus moving to the derivation of conditions under which the theorem can be shown to be valid and those under which it cannot. Given that many of the arguments against the theorem continue to be bandied about in the literature after refutations of those criticisms have been offered, it is important to come to grips with the various positions. As we shall see, much of this has to do with the definition of transaction costs and the nature of life in a world in which they are absent. And as we shall also see, this analysis of the theorem's history assists us in clarifying the conditions under which the theorem's efficiency and invariance claims can be sustained and so will bring us to the point where we can state a valid and useful Coase theorem.

[45] See also Fudenberg and Tirole (1991, 245) and Anderlini and Felli (2006, 223).

[46] See especially section 6, below. Of course, this increased attention to the role of institutions also owes in part to Coase's work.

[47] Medema (2014a) provides an analysis of economists' use of the Coase theorem during the latter half of the 1960s.

4.1 *Bringing Consumers Into the Picture*

Some of the trickiest challenges confronting the Coase theorem involve situations in which consumer-side effects enter the picture. The potential complications introduced here are several.

First, as Buchanan and Stubblebine (1962, 383-84) pointed out early on and Hovenkamp (1990) has more recently emphasized, the non-comparability of utility functions precludes any strong claims regarding invariance. Moreover, Hovenkamp noted, if consumers maximize utility rather than wealth, there is no guarantee that Coase's claim for wealth maximization or invariance (if the marginal utility of income is diminishing) will hold up—though Paretian claims for optimality continue to obtain.

A second set of issues arises because of the differential income effects that may attend alternative assignments of rights under either bargaining (Dolbear 1967) or competitive (Hurwicz 1995) conditions. Coase (1988b, 174), for his part, later waved aside these objections on the grounds that income effects "will normally be so insignificant that they can be safely neglected," but "normally" is not sufficient to rescue a "theorem's" invariance proposition.[48] What assumptions would be necessary to validate the invariance claim here and thus salvage a (strong) Coase theorem in this context? Dolbear (1967, 97) suggested that parallel preferences (quasi-linear utility) would preclude these problems, a result later formalized by Hurwicz (1995) and further refined by, e.g., Chipman and Tian (2011). The presence of public goods within the relationship—e.g., children in a marriage/divorce context—introduces a still further complication (Zelder 1993), and here, as Chiappori (2010) and Chiappori, Iyigun, and Weiss (2015) have shown, transferrable utility in all relevant institutional environments is required to ensure invariance. Bergstrom (2017) has recently generalized several of the aforementioned results by demonstrating that invariance obtains so long as utility possibility frontiers are parallel, which will be the case if utility functions are "uniformly affine" in private goods.[49] The rather restrictive nature of these conditions suggests a significant limitation in the scope of the invariance proposition, though this is mitigated somewhat by Russell's (1995) finding that an assumption of heterogeneous preferences salvages invariance in a competitive environment, independent of the shape of individual preferences—at least where large numbers assure sufficient diversity (and thus heterogeneity).

[48] Coase's response here is illustrative of Melvin Reder's (1982, 22) quip that the potential significance of income effects for the Coase theorem "is not always appreciated at Chicago. Not a few Chicago economists like to argue as though the efficiency locus of an economy were invariant to the distribution of wealth within it."

[49] Bergstrom (2017) also illustrates conditions under which the invariance proposition holds even in the presence of income effects.

Defenders of the theorem have emphasized that the income effects critique does not apply to *alterations in the existing structure* of rights.[50] The arguments here are two. First, with fully specified property rights, an alteration of liability cannot take place without full compensation; otherwise, the rights were not fully specified in the first place, in violation of what is generally regarded as one of the theorem's core assumptions. With that compensation being paid, the distribution of wealth is unaffected. This also obviates the criticism that the theorem fails to account for the interests of future generations.[51] Second, in a world of zero transaction costs, the potential impact of a redistribution of rights will be fully accounted for in contracts and/or capitalized into resource values, leaving the distribution of wealth unaffected and providing no scope for income effects.[52] As a practical matter, the increasing tendency to make the Coase theorem the basis for assessing the effects of alterations legal rules renders this conclusion non-trivial, as we shall see in sections 5 and 6, below.

The third challenge to the Coase theorem on this front, first leveled by Mishan (1965, 29n.45),[53] goes to the concern that the value which individuals place on rights may be a function of ownership—as when the amount that a pollution victim is willing to accept (WTA) in payment for allowing the polluter to foul her air is greater than the amount that she is willing to pay (WTP) to induce an emissions reduction. The price at which a bargain is made likely will vary with the assignment of rights, giving rise to *different* (Pareto-optimal) equilibrium output and externality levels and negating invariance. These WTA/WTP divergences can occur for a variety of reasons, including diminishing marginal utility of income where agents bargain over utility rather than wealth *per se* (Hovenkamp 1990), minimal substitution possibilities (Hanemann 1991), and the endogeneity of consumer tastes and preferences (Kahneman and Tversky 1979; Samuelson and Zeckhauser 1988; Thaler 1980). Of particular concern here are endowment effects, which may generate less trading of rights than posited by the Coase theorem and, in the limit, the failure to consummate any bargain at all.[54] While the Paretian cannot look askance at such outcomes, the invariance claim clearly loses all of its force in the presence of such divergences—the extent of which is the subject of no small amount of controversy, some aspects of which will be explored in section V, below.

A fourth problem arises from situations in which one or more agents have insufficient income/wealth to pay an efficiency-generating bribe. This does not pose a problem when agents bargain over wealth, rather than utility, since wealth will increase by more than the bribe and agents

[50] See, e.g., Coase (1988b, 171), Stigler (1989, 632-33), DeSerpa (1992), and Allen (1995a, 10-11).

[51] See, e.g., Bromley (1989, 181) and Rangel (2003, 814).

[52] Parisi (1995, 157) contends that this result would not hold under "sudden and recurrent changes in the assignment of property rights," but as will become clear, the staunchest defenders of invariance would disagree.

[53] See also Mishan (1967b, pp. 256-57, 269ff; 1971b, pp. 42-43).

[54] Korobkin (2014) provides a useful survey of this literature. The experimental results bearing on the implications of endowment effects for the Coase theorem are discussed in section 5, below.

would borrow if necessary to finance the bribe in a world of zero transaction costs. Subjective values, though, present a greater difficulty, and Shavell's (2009, 103-104) contention that invariance "is likely to hold, or at least approximately so" if the subjective value of the right is not large relative to the parties' assets, again moves us some distance from the realm of "theorems."

What, then, are we to make of the implications of all of this for the Coase theorem? One approach would be to impose additional assumptions—e.g., rationality and appropriate restrictions on preferences so as to rule out these effects. Another approach is to insert an income effects qualification, a solution seen in several of the statements of the theorem that appear in our litany. A third response has been to state (or insist upon) the theorem sans the invariance thesis. This solution, though, robs the theorem of what many consider its core insight—that the initial assignment of rights does not impact resource allocation.

4.2 *Entry and Exit in the Long Run*

The early tendency to situate the Coase theorem in a competitive markets context—likely derivative of the competitive environment within which externalities had been modeled to that point—led to one of the most basic challenges to its validity—the implications for long-run equilibrium prices and outputs of the differential entry and exit effects associated with alternative specifications of rights (Calabresi 1965a; Bramhall and Mills 1966). In a zero-profit competitive equilibrium, bribes flowing from firms in industry *A* to firms in industry *B* will increase profits in *B*, leading to the entry of new firms, and reduce profits in *A*, resulting in exit from that industry. An initial assignment of rights in the other direction (or a rights reversal) would have the opposite entry/exit effects. As a result, the outcome will not be invariant under alternative assignments of rights. Moreover, it was argued, if one of these equilibria has associated with it a higher value of output than the other, there is no guarantee that efficiency will obtain, either.

The debate over the entry/exit critique raged for some two decades.[55] Along the way, four defenses of the theorem were offered. First, any inefficiencies resulting from the entry/exit would be corrected through bargaining (Calabresi 1968). A second counter, this one coming from Coase's former Virginia colleague Warren Nutter (1968), involved a twist on Coase's analysis in "The Nature of the Firm" (1937). Nutter's argument, which became central to several lines of debate over the Coase theorem, was that a single owner would efficiently allocate resources across the two affected activities. If the activities remain under the control of multiple agents, the allocation must be equally

[55] In addition to the references discussed in the text, see, e.g., Mohring and Boyd (1971), Tybout (1972), Frech (1973), Schulze and d'Arge (1974), Frech (1979), Hamilton et al. (1989), DeSerpa (1992; 1993; 1994), and Parisi (1995).

efficient under competitive conditions.[56] A slightly different version of this argument is that a single owner would emerge to exploit any remaining inefficiencies.[57]

The third counter is the most important, and the most general. The entry issue turns on the nature of property rights—in particular whether rights are assigned to closed classes of agents, where individuals can obtain a right only by purchasing it from a current class member, or to open classes, where entry is unrestricted (Frech 1979; Holderness 1985). When rights are assigned to closed classes, there is no incentive for entry because the value of the right is capitalized into resource prices. This is not the case, however, for open classes, which raises issues akin to the common pool problems identified by Gordon (1954). As Holderness pointed out, those finding in favor of invariance were dealing with closed-class situations, whereas critics were working in an open-class context.[58] While this line of argument would suggest that a further, closed-class qualification to the Coase theorem is in order, that is not the case, and for two reasons. First, following Landes (1987, p. 266), "A property right is a legally enforceable power to exclude others from using a resource, without need to contract with them." That is, the assumption of fully specified property rights rules out the possibility of entry as contemplated in these criticisms of the theorem. Moreover, as Henry Smith has noted, "If transaction costs were truly zero … bargaining could costlessly close all classes."[59] classes."

4.3 *Rents*

The competitive context within which Coase situated his analysis gave rise to a second, and related challenge: that Coase's result presumes the existence of rents sufficient to pay the bribes/ compensation, in apparent violation of the long-run zero-profit condition (Wellisz 1964). As Nutter (1968) pointed out, however, this argument holds no sway against the Coase theorem, since the externality would exist in the first place only if the value of output rose by enough to compensate for it. The argument here was later elaborated nicely by Zerbe (1980, 89) and, as Starrett (1972) and

[56] Stigler's (1988, 212-13) description of the genesis of Nutter's article is worth retelling here. Nutter was on his way to Rochester to present a paper that would show that the Coase theorem was wrong. On the first leg of his flight, he was seated next to Friedman, and they discussed Nutter's argument. By the time the plane landed, Friedman had convinced Nutter of his error, and Nutter continued on to Rochester to give a talk demonstrating that the theorem was correct—the argument underlying which appears in his 1968 article.

[57] Demsetz (2003, 286-89) provided a recent extension of this line of thinking. Coase (1960, 17) had previously argued the efficiency possibilities of a single owner, and Davis and Whinston (1962) provided a formal demonstration of the incentive to merge and the resulting efficiencies. the merger argument is reflected in Greenwood and Ingene's (1978, 300) statement of the theorem, quoted in the above litany.

[58] Pezzey (1992) applies this open- versus closed-class logic to demonstrate the equivalence of Pigovian tax-subidy schemes and quantity-control (e.g., marketable permits) measures.

[59] Henry E. Smith, "Two Dimensions of Property Rights" (Mar. 31, 2001), cited in Merrill and Smith (2001, 368n.45).

Starrett and Zeckhauser (1974) subsequently demonstrated, sufficient rents exist so long as production/profit sets are convex. The rents argument was revived Shapiro (1974) and more recently by Halpin (2007), but both of claims were effectively refuted.[60] The Starrett and Shapiro articles, though, factored into another debate over the theorem, this one going to the effects of nonconvexities.

4.4 *Nonconvexities*

Arrow (1969) has demonstrated that, if there exists a universality of markets, including one for the activity of *A* that confers harm on *B*, efficiency is assured. And, with convex indifference curves and production sets, any given Pareto optimal result can be attained as a competitive equilibrium through an appropriate initial redistribution of resources. The implication, then, is that the Coase theorem's twin claims are valid in a perfectly competitive system.

In 1972, however, Arrow's student, David Starrett (1972) demonstrated that externalities generate nonconvexities which give rise to existence problems,[61] and Starrett and Zeckhauser (1974) explicitly probed the implications of this for the Coase theorem. Suppose that the victim firms have the right to be free from harm but can offer for sale rights to inflict that harm. At the going market price for rights to commit harmful acts, the emitter has some profit-maximizing level of externality production that he will select. However, at any positive price this is not the level of the externality that is optimal for the victim. Instead, the victim will prefer an infinite amount of the externality, since this will garner him infinite profits. Thus, unless there is some "artificial restriction," put on the number of externality rights which can be sold by the victim to keep activity within the convex range of the profit set, there is no equilibrium here and the Coase theorem does not hold (Starrett and Zeckhauser 1974, 75). The supply of rights will exceed the demand at any positive price, while at a zero price the demand will exceed the supply, since the victim will not wish to offer any rights for sale at that price. Laffont (1978) later provided reinforcement for this conclusion.[62]

Starrett's argument led to perhaps the oddest moment in the Coase theorem's very unusual history. The publication of Shapiro's 1974 article on rents in the *Journal of Economic Theory*

[60] On Shapiro, see Endres (1975) and Crain et al. (1978). Only a handwritten draft of Endres' paper survives. Additional information on his argument comes from a letter from Alfred Endres to Karl Shell, editor of *JET*, dated February 16, 1976. On Halpin, see Kuechle and Rios (2012). For Coase's take on the rents debate, see Coase (1988b, 163-70).

[61] The nonconvexity issues attending external effects had been a subject of discussion in the literature since the early 1960s, but Starrett was the first to formulate the implications in sophisticated fashion.

[62] Laffont had originally formulated these ideas in his 1972 Ph.D. thesis (Laffont 1972).

prompted several responses,[63] all of which the editors declined to publish. Instead, they published, in 1977, an "Editorial Addendum" to Shapiro's article suggesting (correctly) that his rents argument turned on his introduction of a nonconvexity into the system and so had been anticipated by Starrett (1972). The rebuttals to Shapiro's argument, the editors concluded, were neither here nor there since effect of Starrett's 1972 analysis was to "*destroy the validity of the Coase Theorem*" (The Editors 1977, p. 222). In February 1977, then, the editors of *JET* wrote the Coase theorem's obituary.

While this claim of the theorem's demise was obviously premature, the editors' conclusion was also grounded in faulty economic analysis. Starrett's formulation had effectively ruled out—or at least ignored—negotiation possibilities.[64] There is a Pareto-better point available, but the market will not function in a way that allows society to attain that point. As Gifford (1978) was the first to note, however, in a world of zero transaction costs, including full information, the fact that, in the presence of a nonconvexity, there is no incentive to make the marginal move from externality level x to $x - \varepsilon$ is irrelevant. Knowing that a Pareto-better point exists, agents will negotiate their way to the optimal outcome. Moreover, as Cooter (1980) later demonstrated, the placement of legal liability on the polluter (with compensation restricted to minimum profit loss) will *not*, contrary to Starrett's assertion, lead to an infinite supply of pollution rights since, at the point of nonconvexity, the marginal benefit from offering additional pollution rights for sale is zero.[65] At this point, the question of marginal vs. non-marginal trades becomes moot, and the theorem survives the nonconvexities challenge.

4.5 *Non-Separable Cost Functions*

A further objection raised against the theorem, this from Marchand and Russell (1973) is that the efficiency and invariance propositions do not hold if the victim's cost function is non-separable.[66] Suppose that B's costs of production are given by $C_B = f(q_B) + D(q_A, q_B)$, where the q's are the outputs of firms A and B, respectively and D reflects the damage-related effects of A's output on B's costs. The level of harm to B is a function of B's output as well as that of the emitting firm, A, and a

[63] In addition to Crain et al. (1978), responses were submitted by Alfred Endres and Brian Horrigan. Neither of the latter was subsequently published, though a handwritten draft of Endres' paper survives.

[64] Starrett himself has acknowledged this in correspondence with the author, November 11, 2014. This counter also applies to Starrett and Zeckhauser (1974).

[65] See also Boyd and Conley (1997), DeSerpa (1994), Vogel (1987), and Hurwicz (1995, 60-62; 1999). Of course, the merger argument is also relevant here.

[66] The origins of the discussion of the effects of separability on externality analysis lie in Davis and Whinston (1962) and were further elaborated by Baumol (1976). The potential implications for the Coase theorem were first raised, in passing, by Kneese (1964, 46n.4). Gifford and Stone (1973) and Marchand and Russell (1973) demonstrate that efficiency and invariance are assured with separable cost functions.

given level of output by *A* causes *B* more harm (that is, causes a greater increase in *B*'s costs) the more output *B* produces. If *A* is liable for damages, *B* has no incentive to mitigate damages here, since it will be fully compensated for its externality-related costs. Thus, *B*'s output will be inefficiently high and *A*'s inefficiently low (Marchand and Russell, 1973, 613-15). As such, they concluded, Coase's result holds only when cost functions are additively separable, a condition which makes the harm to *B* independent of *B's* output. And, given that, as Baumol (1976) and Endres (1977) pointed out, it would be unusual to encounter a production externality that *is* separable, this critique, if valid, would put very tight restrictions on the theorem's domain.

Marchand and Russell's argument was quickly picked up on in the literature by opponents of the Coase theorem, but it also attracted significant opposition. Coelho (1975, 723) and Zerbe (1980, 87-88) argued that, absent transaction costs, agents will negotiate away this inefficiency—to which Zerbe also added the merger argument for good measure. More formal responses came from Gifford and Stone (1975) and Greenwood et al. (1975), asserting that Marchand and Russell had failed to properly account for costs and the effects of competitive environment—the corrections for which confirmed the theorem's claims.[67]

The nonseparabilities debate was in many ways a microcosm of the entire Coase theorem controversy and illustrative of the ambiguity to which we have referred. Sophisticated formalisms were met with intuitive counters that did not past muster with those more formally inclined, and competing modeling strategies yielded wildly divergent results. Marchand and Russell summed up the general flavor of things very nicely when responding to their critics: "Our critics' theme seems to be that models are misspecified when they do not yield the right conclusions." They charged, in turn, that the models employed by their critics, "while interesting, are based on specifications and behavioral postulates which are either logically and internally inconsistent or not fully and properly developed"—the critics having failed to formally specify how small-numbers bargaining would lead to a successful negotiated outcome—and were "not in the spirit of the original situation envisioned by Coase" (1975, 730, 732). The problem, of course, is that it was never entirely clear *exactly what was* in the spirit of Coase. The problem only intensified when the game theorists entered the fray.

4.6 *Strategic Behavior*

Defenses of the Coase theorem grounded in the theory of competitive markets did not sit well in some quarters. Farrell got to the crux of the matter when he pointed out that the message of Coase's result was that "complete competitive markets are *not* necessary for efficiency;" if inefficiencies arise, "people will get together and negotiate their way to efficiency" (1987, 113, emphasis added).

[67] See also Jaeger (1975) and Endres (1977).

But supporters of the theorem were silent on the details of how we get from *A* to *B*. It was simply assumed that, with gains available, agents would bargain their way to the optimum. It seems, said Whitcomb (1972, 17) that theorem proponents "are not at all fazed by the difficulties of bargaining"[68] Though Samuelson, never a fan of the Coase theorem, hinted at this tension already in 1963, emphasizing "the insoluble bilateral monopoly problem with all its indeterminacies and non-optimalities" (1963b, 132n),[69] the implications took some two decades to manifest themselves in the literature.

It bears emphasizing that, even as late as 1980, game theory occupied a very small place in economic analysis. When Regan (1972, 428) called the Coase theorem "a proposition in the theory of games" and, along with Daly (1974), attempted to nudge the literature in that direction, the response was minimal. But with time the growth in the use of game-theoretic modeling tools gave rise to a new breed of theorem critics who leveled two (related) charges at the theorem and its supporters. The fundamental problem, they said, is that small-numbers bargaining inevitably raises the specter of strategic behavior—a possibility all but ignored in the literature to that point. And then there was the issue of modeling—or the lack thereof. Those positing that agents would work their way to the optimum did so sans a formal game structure, a solution concept, or precise assumptions about preferences and information.[70] The whole process, said Usher, "is, for the economist, fundamentally mysterious" (Usher 1998, 8) and a claim for the theorem made on this basis "amounts to little more than faith" (Schwab 1989, 1176). Interestingly, Davis and Whinston (1965, 113-15) had considered, and rejected, both cooperative and non-cooperative approaches to modeling Coase's result, finding each in its own way inadequate to the task. In the decades to come, however each of these frameworks would become to play a prominent role in the Coase theorem literature.

4.6.1 *The Coase Theorem as a Cooperative Game*

Much of the literature claiming efficiency for the Coase theorem in a bargaining context gets there by implicitly or explicitly utilizing solution concepts from cooperative game theory—even if the environment contemplated is characterized in competitive terms by the authors.[71] And, as Aivazian and Callen (1981) demonstrated, the Coase theorem does indeed hold true in a two-person cooperative game context. The problem is that efficiency is a given in such situations, meaning the

[68] Whitcomb, it should be noted, was a student of Wellisz, who was the most vocal of the theorem's early critics.

[69] This claim is repeated in Samuelson (1967). See Coase (1988b, 157-63) for Coase's rebuttal. Samuelson (1995) later provided a more extensive commentary on the theorem, with critical flourishes that rival Stigler's laudatory ones.

[70] See Samuelson (1985, 322), Schweizer (1988, 263), Varian (1994, 1279), and McKelvey and Page (1999, 238).

[71] On this point, see Arrow (1979, 24), Samuelson (1985, 321), and Schweizer (1988, 263-64).

Coase theorem, so conceptualized, is not so much a theorem as "a mere hypothesis on the solution concept" (Schweizer 1988, 246)—or, some might say, a tautology. So conceived, the Coase theorem is only interesting to the extent that it includes the invariance proposition (Hurwicz 1995, 50-51).

A more serious problem arises in scenarios involving three or more persons. Here, as Arrow (1970) first hinted and Aivazian and Callen (1981; 1987) subsequently showed, the core may be empty, owing to the absence of a stable coalition. Their argument is, on the fact of it, straightforward. Assume *A* and *B* emit pollution that damages *C*, and that profit possibilities take the following form:

$$V(A) = \$3000; V(B) = \$8000; V(C) = \$24{,}000$$
$$V(A,B) = \$15{,}000; V(A,C) = \$31{,}000; V(B,C) = \$36{,}000$$
$$V(A,B,C) = \$40{,}000$$

The grand coalition, $V(A,B,C)$ is Pareto optimal and will be achieved if *C* is in possession of the relevant property rights. But suppose instead that *A* and *B* have the right to pollute. The grand coalition, achieved with *C* offering *A* $3000 and *B* $8000 to shut down could be blocked by a coalition between *A* and *B*, where *A* offers *B* $8300 out of $V(A,B)$. But this coalition can be blocked by one between *C* and *B*, where *C* offers *B* $8400 out of $V(B,C)$, … The result is endless recontracting. In fact, the Coase theorem's zero transaction costs assumption facilitates this instability by making endless recontracting costless. The explanation for the failure of the Coase theorem here, as can be shown directly, is that the grand coalition does not lie within the core when *A* and *B* have the right to pollute.[72]

Robson (2013) has recently refined Aivazian and Callen's analysis, demonstrating that bargaining failure is the *exception* here rather than the rule, and that if all payoffs are equally likely the Coase theorem holds 5/6 of the time. This, however, is less than fully satisfying. Coase's (1981) own attempt to defend his result against this challenge—his first new statement on the subject since 1960—was also met with skepticism.[73] He contended that repeated recontracting would make clear to each agent that the grand coalition was superior to other attainable outcomes and the agents thus would elect to adopt that solution. Individual rationality would, in essence, eventually reflect collective rationality. Alternatively, Coase said, the parties would adopt binding contracts with penalty clauses, a solution developed further by Bernholz (1997; 1999), who proved that a system of

[72] Mueller (2003, 30-31) provides an excellent summary. The equivalence of this result to the problem of cyclical social preferences in political decision making is discussed by Hovenkamp (1992, 331) and Bernholz (1997, 422).

[73] See Telser (1994), De Bornier (1986), and Aivazian and Callen (1987; 2003). While Coase and others (e.g., Hovenkamp (1992, 333) suggested that the empty core problem disappears when transaction costs are positive, as they are in reality, Aivazian and Callen (2003, 290-92) demonstrate that transaction costs may, in fact, exacerbate the problem.

binding contracts ensures Pareto optimality under separable individual preferences and, under certain conditions, with non-separable preferences.[74]

But the central problem with the empty core argument, as Magnan de Bornier (1986) demonstrated,[75] is that it is was predicated not on the existence of three or more parties, but on *two or more separate external effects* (e.g., firm *C* is polluted by firm *A* and by firm *B*). The absence of a stable coalition relies upon merger possibilities between *A* and *B*, which would occur only if there exist economies of scale—a phenomenon allowed for in Aivazan and Callen's model. Absent these economies, *C* would conclude separate bargains with *A* and *B*, as Aivazian and Callen (2003) subsequently acknowledged. And if such economies *did* exist, said merger would already have taken place, per Nutter (1968), in a world of zero transaction costs, meaning that *C* would have only the merged *A*-*B* with which to bargain—obviating the problem entirely. Indeed, Versaevel (2006) shows that a Coasean firm *will* emerge here, resolving the empty core problem and inducing efficiency.[76]

4.6.2 *The Non-Cooperative Environment*

While the cooperative environment is relatively congenial to the Coase theorem, it deftly avoids the processes through which agents arrive at a solution. Discomfort with this has led many commentators to turn to non-cooperative models, which bring with them forms of strategic behavior and associated inefficiencies that appear to be deadly to the theorem.[77] The earliest suggestions as to how strategic behavior might impede efficient negotiated settlements, dealing with the incentives present for extortion and free-riding, did not evolve out of game theory models per se, but the links will be evident to the modern reader. And as game-theoretic critiques of the theorem became more commonplace, the effects of these strategic moves were more formally elaborated and the more general problems associated with informational asymmetries came to the fore.

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[74] Aivazian and Callen (2003, 292) countered that the "penalty clauses, time limits and other contractual features" pointed to by Coase are "simply irrelevant" in a world of zero transaction costs, meaning that Coase's objection "contradicts the Coase Theorem." But one could argue against Aivazian and Callen that prolonged recontracting problems also become irrelevant in a world of zero transaction costs, where "eternity can be experienced in a split second" (Coase 1988, 15). All of this illustrates the difficulties with the zero transaction costs assumption in a game-theoretic environment—about which more below.

[75] See also Mueller (2003, 31-32).

[76] Those readers interested in a concise formal treatment of many of these issues would profit from the discussion in Robson (2012, 71-86).

[77] Despite the pessimism found below, it should be noted that the non-cooperative context is not inevitably fatal for the Coase theorem. One of the earliest illustrations of this is Nash's (1953) demand-game analysis which Crawford (1985, 824) suggests "can be viewed as a formalization of the Coase Theorem."

4.6.2.1 *Extortion*

One of the most frequent charges leveled against Coase's result, dating to the early 1960s, concerns the incentives for extortion, or blackmail. A debate over the implications of these phenomena played out across several journals during the 1970s, and objections to the theorem on these grounds continue even today.[78] The problems for the Coase theorem here come from two directions. First, under a system of victim liability, agents may threaten to emit (or increase emissions of) harm in order to secure a (larger) bribe.[79] As Wellisz (1964, 353) quipped, Coase's analysis "opens up magnificent business prospects," as "any activity can be turned to profit as long as it is sufficiently annoying to someone else." Rothenberg (1970, 115) went so far as to predict the establishment of a "highly profitable" industry selling protection against harmful effects in such situations. Second, agents may threaten to come to the harm, thereby increasing emitter liability, with the goal of securing a bribe to refrain from entering. Alternatively, victims may fail to take steps to efficiently mitigate damages if polluters are known to be liable.[80]

The extortion argument is a permutation of the entry critique, discussed above, and both are, at their heart, manifestations of incentives for rent seeking—as are the related problems of hold-ups arising from relationship-specific ex ante investments (Pitchford and Snyder 2007; Rosenkranz and Schmitz 2007) and attempts to influence the initial distribution of rights (Jung et al. 1995).[81] pointed out. The zero transaction costs environment contemplated by the theorem compounds the problem by facilitating these activities.[82] Inefficiencies resulting from (wasteful) resource expenditures toward these ends obviously conflict with the theorem's efficiency thesis.

As the critics of the theorem allowed, and its defenders were quick to stress, however, extortionary activity is of consequence only if resources are used in the process of seeking these rents. The absence of these costs, then, becomes an "implicit assumption" of the theorem (Usher 1998, 10). As it happens, Coase himself had made this assumption explicit—ruling out expenditures

[78] For extensive discussions of the extortion debates, which played out primarily in the *Economic Record* (Australia) and *Western Economics Journal* (now, *Economic Inquiry*), but also in the *AER* and *QJE*, see Medema (2014b; 2015a). It is indicative of the more provincial nature of scholarship in this era that the Australian and American debates took place simultaneously, but completely independently, and with the participants in each demonstrating no recognition of the other.

[79] See, e.g., Wellisz (1964), Shoup (1971), Kneese (1964), Mishan (1967b), Kneese and Bower (1968), Burrows (1970b), Rothenberg (1970), Schlicht (1996), Bütter (1997), Schlicht (1997), and Vahabi (2011).

[80] See, e.g., Shoup (1971), Mumey (1971), Ng (1971), Tybout (1972), Harris (1990), and Usher (1998). Coase had made this argument against Pigou's assertion that railroads should be made liable for damage from sparks emitted by their trains, claiming that farmers would then have no incentive to mitigate damages by planting fewer crops close to the tracks (1960, 32-33) However, he did not consider this line of reasoning in the context of his negotiation solution.

[81] See also Richer (1997), Corchón (2007), Dari-Mattiacci et al. (2009), Lai (2008) and Migué and Marceau (1993), the last of which contrasts Coase theorem and Pigovian solutions in light of rent-seeking/entry effects.

[82] See Mumey (1971, 718), Daly and Giertz (1975, 1001), and Jung et al. (1995, 262).

made "solely to establish a claim"—in his initial presentation of the negotiation result in 1959 (Coase 1959, 27n.54; Medema 1997), recognizing that they would invalidate his efficiency argument.[83] Why Coase did not repeat this qualification in 1960 is a mystery, but defenders of the theorem contend that the assumption of zero transaction costs effectively rules out the need to expend resources within these rent-seeing processes.[84] Perhaps more telling in favor of the theorem, though, is that the fully specified property rights argument that insulates the theorem from the entry critique also precludes extortion.

4.6.2.2 *Free Riding*

The free-rider problem is the flip-side of the extortion issue and becomes relevant when we move beyond Coase's two-agent negotiation framework. This possibility, also first introduced by Wellisz (1964, 353-54), was raised repeatedly in the ensuing years and has recently been taken up in more formal fashion by, e.g., Dixit and Olson (2000) and Ellingsen and Paltseva (2016).[85] If those affected by pollution must pay the polluter to reduce emissions, a payment by individual *A* to the polluter results in reduced emissions that benefit individual *B*, *C*, *D*, … as well as individual *A*. It is in *B*'s interest to free-ride off the payments of *A*, *C*, *D*, …, thereby benefitting from the clean air without having to pay for it. But as each agent faces this same incentive, total bribe payments to the polluter will fall short of the level needed to generate the optimal amount of pollution and polluting outputs. Parisi (1995, 164) considers these free-riding situations "most recidivous to the Coasian antidote," and Baliga and Maskin (2003, 308) tell us that "even a diehard Coasian" should agree that the Coase theorem fails to hold in these circumstances.

Baliga and Maskin (2003, 307) note, rightly, that the Coase theorem requires excludability, lest free-riding obtain. The question, then, is whether this requires laying on yet another assumption. The answer here, as with the entry and extortion questions, lies in the distinction between open and

[83] Coase attributes the original extortion objection to David Cavers of Harvard Law School, who was a fellow with Coase at the Center for Advanced Study in the Behavioral Sciences at Stanford in 1958-59 when Coase was working on the FCC article. It was presumably in response to Cavers' critique that Coase inserted this footnote. (Coase 1988a, 656-57). Coase (1988a) contains a much larger elaboration of the general subject of blackmail, including how his argument in "The Problem of Social Cost" relates to it.

[84] See, e.g., Demsetz (1971, 444-45) and Daly and Giertz (1975, 1000). Demsetz added a further counter, appealing to the competitive environment within which Coase situated his analysis to assert that competition between extortionists would drive the price of extortion to zero, effectively making extortionary activity a manifestation of monopoly power, which conflicts with the assumption of a competitive environment. See also Demsetz (1972, 23). Critics (e.g., Shoup 1971, 312), on the other hand, contended that rent-seeking inevitably utilizes resources and so impacts efficiency. But this argument goes to relevance, not to theoretical validity, and so leaves the theorem untouched.

[85] See also Feldman (1971), Shoup (1971), Buchanan (1973), Baumol and Oates (1975), Illing (1992), Cai (2000), Chari and Jones (2000), and Aivazian and Callen (2003). Major *et al*. (2016) make a related argument in the context of anti-commons.

closed classes (Holderness 1989). If *A* is purchasing *B* the right to be free from harm, that right is not complete unless it includes the ability to exclude others from its benefits. As such, the presence of free riding violates the the theorem's assumption of fully-specified property rights.[86] But there is a second line of attack against the free-riding argument, launched, ironically, by two of the theorem's most strident *critics*—Mishan (1967b, 64) and Dick (1974, 88)—during the earliest stages of the debate. Free riding, they argued, is a manifestation of positive transaction costs—it is costly information that makes possible incomplete preference revelation—and so is not a legitimate argument against the Coase theorem. This, then, brings us to what is perhaps the most contentious issue in the entire Coase theorem literature—the implications of private information for the theorem's validity.

4.6.2.3 *The Information Problem*

Extortion and free-riding are manifestations of incomplete or private information, and advances in the analysis of resource allocation under these conditions (e.g., Myerson 1979; Harris and Townsend 1981) raised a new round of questions about the theorem as the influence of game theory in economics surged beginning in the 1980s.[87]

The problems posed by uncertainty are nicely illustrated by Cooter (1982, 20-24), who points out that the expected utility-maximizing strategy which is optimal against the distribution of an opponent's strategies may not be optimal against the strategy actually played—giving rise to inefficient negotiated settlements when expectations and reality diverge.[88] An additional set of concerns results from the implications of the Myerson-Satterthwaite theorem (1983) for the Coase theorem's efficiency claims. What Myerson and Satterthwaite demonstrated, in a nutshell, is that, for an indivisible good, there is no efficient Bayes-Nash equilibrium when rational agents have private information. The difficulties that this presents for the Coase theorem have been noted by Samuelson (1985, 323) and by Fudenberg and Tirole (1991, 279), and expanded upon by McKelvey and Page (1999; 2002). McKelvey and Page's generalization of Myerson-Satterthwaite reveals that the ability of agents to strategically employ private information will bias the negotiated solution in the direction of the holder of the property rights, meaning that there will be an inefficiently high level of pollution when polluters are assigned the relevant rights and an inefficiently low level of pollution (an inefficiently high level of abatement) when victims are in possession of the rights. Based upon this, McKelvey and Page (1999, 246) offer a "private information" Coase theorem:

[86] Knight's (1924) classic analysis of social cost can be considered one manifestation of this point.

[87] See, in addition to the references cited below, Holmström and Myerson (1983), Schweizer (1988), Harris (1990), Mailath and Postlewaite (1990), and Lewis (1996).

[88] See also Arrow (Arrow 1979, 31).

> *Coase Theorem (Private Information): For two players with quasi linear preferences [and] private information …, in any non-cooperative game where property rights are defined and enforced, there does not exist any Bayes-Nash equilibrium which is fully efficient and the most efficient Bayes-Nash equilibrium exhibits a bias in outcomes in favor of the party who is assigned the property rights.*[89]

It would be difficult to formulate a version of the theorem more at odds with Coase's original.

The existence of private information does not inevitably entail the failure of Coase-theorem-type bargains. Maskin (1994) contends that monopoly power lies at the root of the "information" problems identified by Farrell (1987). If "no agent is big enough to have significant market power" and agents write surplus-maximizing contracts, they will contract their way to an efficient agreement. This, Maskin claims, "provides support for a fairly laissez-faire stance toward externalities" (1994, 333).[90] Gomes and Jehiel (2005), meanwhile, demonstrate that when agents are able to write long-term contracts over present and future actions, the resulting equilibrium will be efficient and, if players are sufficiently patient, independent of the starting point.[91] A very different approach to the problem comes from Schmitz (2001), who shows that the Coase theorem may hold with private information *when property rights have not been assigned*. The intuition here is that the incentive to overstate valuations diminishes when property rights are uncertain, since agents do not know whether they will be buyers or sellers of those rights prior to trial. This, in turn, increases the likelihood that the parties will reach an efficient solution without resorting to a trial.[92] The problem with all of these findings, of course, is that they lack the generality usually associated with the Coase theorem.

The inefficiencies resulting from private information ultimately owe to strategic behavior in the scramble over surpluses from bargaining. Coase (Coase 1988b, 161), for his part, considered strategic behavior unimportant. In his world, agents are amenable to a reasonable division of the gains from exchange; no one is going to threaten to tear apart the $100 bill that the group found laying on the sidewalk.[93] Cooter, on the other hand, considers these strategic concerns an almost

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[89] A proof of this proposition can be found in McKelvey and Page (2002). Empirical support for this conclusion is found in a separate experimental paper (McKelvey and Page 2000), discussed in section 5, below.

[90] See also Parisi (1995, 159).

[91] Hyndman and Ray (2007), however, show that if up-front transfers are not allowed, this result does not necessarily hold in games of three players and disappears completely in four-player games. See also Chatterjee et al. (1993) and Seidmann and Winter (1998) for background discussion.

[92] Of course, Schmitz's finding is at odds with Coase's assertion that an assignment of property rights is a precondition for the negotiation processes contemplated by the theorem.

[93] Farber (1997, 424) finds it "startling … that the person with this benign view of human nature is a member of the notoriously hard-boiled University of Chicago Department of Economics." The fact that Chicago price theory has traditionally eschewed game theory notwithstanding, Coase's aversion to rational choice theory is but one of many indications that he did not fit the modern "Chicago School" stereotype. See Coase (1978) and Medema (1994).

insuperable obstacle to efficiency-enhancing negotiated outcomes, making the case for a "Hobbes theorem"—that agents will *never* agree to a distribution of the surplus— that is perhaps as strong as that for the Coase theorem (Cooter 1982, 17-18). Hirshleifer similarly contrasts the Coase theorem ("people will never pass up an opportunity to cooperate by means of mutually advantageous exchange") with what he calls "Machiavelli's Theorem" ("no one will ever pass up an opportunity to gain a one-sided advantage by exploiting another party"). Both, he says, are "partial truths" and in reality agents will work out some optimal position between these two (Hirshleifer 1994, 3).[94]

All in all, it is difficult to avoid the conclusion that the presence of private information and the forms of strategic behavior it facilitates are deadly for the Coase theorem, a reality acknowledged even by some of the theorem's staunchest defenders.[95] The possibility that zero transaction (=communication) costs may actually *decrease* the probability of reaching an agreement by facilitating the transmission of threats and other strategic communications only strengthens this conclusion.[96] While the mechanism design literature offers possibilities for eliciting information and thus eliminating these inefficiencies,[97] such solutions also, as Farrell (1987) and Baliga and Maskin (2003) have pointed out, involve a measure of centralization that flies in the face of the decentralized nature of Coase's result.

The lesson that emerges here, then is that the Coase theorem *requires perfect information*—that is, "everyone must know what everybody else knows" and "each agent must know the preferences and characteristics of others" (Starrett 2003, 118).[98] If this condition is satisfied, strategic behavior, including the ability to manipulate the behavior of other agents via bribes, is effectively ruled out—along with the resulting inefficiencies (Farrell 1987, 115; Jackson and Simon 2005). The question, then, goes to the informational environments consistent with a Coase theorem world. This,

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[94] The Coasean-Hobbesian behavioral contrast is nicely modeled in Eastman's (1996a) comparison of the Coase theorem with the Prisoners' Dilemma. Further (and more optimistic) insight into the prospects raised by Cooter and Hirshleifer is provided by the experimental literature on the Coase theorem, which is treated in section 5, below.

[95] See, e.g., Zerbe (1976), Veljanovski (1977), Allen (1999), and Luppi and Parisi (2012).

[96] Our discussion here has focused on the implications of less-than-full information for strategic behavior. A number of results point to similar problems for the Coase theorem in a competitive environment. For example, Greenwald and Stiglitz (1986) and Shapiro and Stiglitz (1984) show that the separation of efficiency and equity does not hold when information is imperfect, which, as Stiglitz (2000, 1458) later emphasized, poses a challenge to both the Second Fundamental Theorem of Welfare Economics and the Coase theorem's invariance proposition. See also Klibanoff and Morduch (1995).

[97] See, e.g., Arrow (1979), Varian (1994; 1995) and Baliga and Maskin (2003). Starrett (2003, 119) contends that, with private information, efficiency *requires* appropriate mechanism design.

[98] See also, e.g., Calabresi and Melamed (1972, 1095), Arrow (1986, p. S392), Hovenkamp (1990, 790), Ausubel et al. (2002, 1908), Cole and Grossman (2002, 226), and Foss and Foss (2005, 545). Arrow contends, rightly, that the informational requirements of the Coase theorem are more stringent than those required for the competitive price system.

Eastman (1996b, 777) aptly notes, is a "somewhat theological question," one that requires us to explore the nature of life in a world of zero transaction costs.

4.7 *Wrestling with Transaction Costs*

The discussion to this point has largely glossed over what is perhaps the largest of the gorillas in the room—the ambiguity surrounding the concept of transaction costs and thus of the precise nature of the zero transaction costs environment.[99] This ambiguity has been much remarked upon in the Coase theorem literature and likely explains why (i) nearly all discussions of the theorem neatly bypass any serious attempt to rigorously define the concept and (ii) the content given to the term sends to serve the special purposes of the author whether in support or criticism of the theorem (Zerbe 1980, 84; Williamson 1989, 229).

Much of the responsibility for this confusion has, with some justice, been laid at the feet of Coase himself.[100] Indeed, Coase's description of transaction costs in "The Problem of Social Cost" goes no farther than this:

> In 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. (1960, 15)

Coase left a good deal of room for interpretation, and subsequent commentators have done little to further the cause, let alone give the term the sort of "precise, mathematically definable, content" that is typical of contemporary economic analysis (Parisi 1995, 160). While a handful of efforts have been made, stabilization of meaning remains elusive here, just as it does for the theorem itself. Because transaction costs are, as Lee and Smith (2012, 147) put it, the "linchpin" of the Coase theorem and most of the controversies over it boil down to "different conceptions of what is implied by zero transaction costs" (Zerbe 1980, 85), it is important that we devote some attention to this topic.

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[99] Klaes (2000; 2008) provides illuminating discussions of the history of and ambiguity surrounding the concept of transaction costs within economics generally.

[100] See, e.g., Zerbe (1980, 84), Schwab (1989, 1193), Williamson (1989, 229), and Hart (2008, 405). Hart, for example, says that "Coase has made life hard for his followers by never attempting to write down a formal model. Interestingly, as far as I know Coase has also never shown any indication that he thinks that such an activity is in the least bit worth while!" This last part is certainly true. See note 29, above.

4.7.1 *Conceptualizations of Transaction Costs*

Transaction costs are often conceptualized as the costs of getting together, paperwork, etc. and modeled in a manner similar to taxes on a transaction.[101] This is particularly true in textbook treatments of the Coase theorem. Cooter's widely referenced *New Palgrave* entry on the theorem broadens things a bit by breaking down transaction costs into two groups: the costs of "the time and effort required to carry out a transaction" and bargaining-related costs, where the latter include "the cost of information needed to formulate a bargaining strategy, the time spent higgling, and the cost of preventing cheating by parties to a bargain" (Cooter 1987, 457). Ellickson (1989, 615) extends this a bit further with a tripartite conception that includes "get-together costs," "decision and execution costs," and "information costs"—categories that he acknowledges involve a measure of overlap. The most expansive (and general) definition comes from Allen, who defines transaction costs as "the resources used to establish and maintain property rights" (1991, 3).[102] Each of these conceptions of transaction costs has different implications for the Coase theorem, due largely, but not exclusively, to the role of information that is implied.

4.7.2 *Information Costs*

Positions on the relationship between information and transaction costs do not fall into neat categories. Allen, a friend of the theorem, and McKelvey and Page, who are critical of it, contend that information costs belong in a category separate from transaction costs,[103] an approach that is standard in the game theory literature on the theorem. For Allen information costs are a necessary (but not sufficient) condition for the existence of transaction costs and pose no efficiency concerns if transaction costs are zero.[104] For McKelvey and Page and others applying game theoretic analysis to the theorem, in contrast, information costs and the strategic behavior to which they give rise, generate inefficiencies even when transaction costs are zero.

Others, though, believe that information costs should be subsumed within transaction costs, as in the case of Ellickson's definition of transaction costs, cited above.[105] The role ascribed to

[101] On this point, see especially Allen (1991, 11), who provides a critical commentary on this approach.

[102] Allen continues, "They include resources used to protect and capture (appropriate without permission) property rights, plus any deadweight costs that result from any potential or real protecting and capturing" (1991, 3). See also, e.g., Cheung (1969, 16) and Barzel (1985).

[103] This is reflected in the Regan (1972, 427) and Hoffman and Spitzer (1982, 73) statements of the theorem, quoted in our litany above.

[104] For example, some information problems can be efficiently managed through through appropriately structure contracts, including insurance contracts. See also Allen (1995b) and the references cited therein, as well as Aivazian and Callen (1980b).

[105] See also, e.g., McKean (1970b, 43n.108), Calabresi and Melamed (1972, 1094-95), Polinsky (1974, 1672),

information costs here is often significant, as with Ayres' (1995, 1030) assessment that private information is "a particularly pernicious form of transaction cost." Dahlman (1979, 148) represents the extreme version of this approach, making information costs the *essence* of transaction costs, which he defines as "resource losses incurred due to imperfect information." Cooter's depiction of this relationship falls somewhere in between these two views, including some information-related costs but not others.

If all information-related costs are part of transaction costs, three implications for the Coase theorem and its world of zero transaction costs follow directly. First, it eliminates the possibility of strategic behavior.[106] Second, risk and uncertainty cannot exist in a Coase theorem world, obviating claims that their existence invalidates the theorem.[107] Finally, the nonconvexities associated with external effects are not a barrier to the attainment of efficient solutions, reinforcing Gifford's (1978) finding. This, however, is only the beginning of what is implied by the broadest conceptions of transaction costs.

4.7.3 *The Mythical World of Zero Transaction Costs*

The broadest definitions of transaction costs locate the Coase theorem in what amounts to a world absent all frictions. Life within such a world is very difficult to conceptualize, suggesting that Coase was only partially correct in his regular chastising of economists for neglecting the analysis of transaction costs.[108] They have also spent very little time contemplating the implications of the absence of such costs. And perhaps for good reason. The implications of the broadest conceptions of zero transaction costs are enough to make one's head hurt. And, as one might expect, they tend to further buttress the Coase theorem.

One of the more significant features of such a world is that no assumption regarding property rights is necessary for the Coase theorem to hold, since zero transaction costs implies complete

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Gifford (1978), Zerbe (1980, 86; 1998, 350), Besanko and Spulber (1990, 871), North (1990, p. 27), Hovenkamp (1990, 785), Katz (1990, 225), Duxbury (1991, 309), Stiglitz (1994, 12, 174), Hurwicz (1995, 65), Parisi (1995, 160), Makowski (1995, 825), Anderson and Leal (1998, 113a), Schroeder (1998, 534), Hsiung (1999, 155), Endres and Rundshagen (2008, 62n.11), Myerson (2008, 596), Krutilla and Krause (2011, p. 271), and Fischel (2015, 230).

[106] This does not involve treating strategic behavior as a cost, as some have done (e.g., Katz 1990, 226-27; Farnsworth 1999, 408; Parisi 2008, 7)—a practice that Cooter (1995, 53) has brought in for strong criticism. Defining transaction costs to include information costs sidesteps Cooter's objection, making strategic behavior the *result* of costs—of information—the effects of which make such behavior possible.

[107] See, e.g., Greenwood and Ingene (1978), Cooter (1982, 20-24), Posin (1993), and Zivin and Small (2003). This definition of transaction costs also removes the need to appeal contracting and insurance processes employed by Allen (1991), Grillet (1992) and others to salvage the theorem.

[108] Two of the many examples of Coase's criticism of economists are Coase (1988) and his Nobel address (Coase 1992).

property rights, as per Allen's definition of transaction costs, quoted above.[109] As such, any arguments against the theorem derived from incomplete property rights—e.g., entry, extortion, and free riding—disappear under this definition of transaction costs.

A second consequence of the absence of transaction costs is that utility is transferable. This obviates concerns, such as those raised by Zelder (1993) and Chiappori, Iyigun, and Weiss (2015) regarding the presence of public goods in the relationship.

A third feature of zero transaction costs, broadly conceived, is that the institutional structure of exchange—bilateral negotiation, the market, the firm relationship—is irrelevant.[110] This, of course is an extension of Coase's argument in "The Nature of the Firm" (1937) and is one of the links uniting that article and "The Problem of Social Cost." In a formal sense, then, any demonstration of the Coase Theorem in one of these contexts necessarily applies to all of the others.

But all of this merely scratches the surface. The world of zero transaction costs, Stigler (1972, 12) tells us, "turns out to be as strange as the physical world would be with zero friction. Monopolies would be compensated to act like competitors, and insurance companies and banks would not exist." But it is not only insurance companies and banks that would not exist. It has been argued that, absent transaction costs, there is no need for the state (Vahabi 2011, 244), for a legal structure to enforce property rights (Sobel 2005, 36),[111] or even for bargaining (Zerbe 1980, 85). And then there is the "violence that it does to our ordinary understanding of the importance of time" (Epstein 1997, 2092).[112] A zero transaction cost world, so conceived, is one without a time dimension, where all inefficiencies are resolved instantaneously, regardless of the number of agents involved—a feature which resolves the intergenerational critique referred to in section 4.1, above, as well as other dynamic problems.[113]

But it gets worse—or better, depending on one's perspective. Ralph d'Arge (1973, 558) neatly pointed out during the very early stages of the Coase theorem debates that, if transaction costs were zero, *there would be no externalities or other forms of market failure* to which to apply the Coase theorem, since they would have been internalized through bargaining before manifesting themselves. Coase's cattle would never have trampled an inefficiently large amount of crops in the

[109] See also Allen (1999, 897). Barzel (1985), and a later commentary by Coase (1988b, 15).

[110] Arrow (1986, S392) pushed tis logic still further, suggesting that, under these conditions, "the superiority of the market over centralized planning disappears."

[111] See also Usher (1998) and Allen (1999).

[112] See also See also Schwab (1989, 1180), Schroeder (1997, 1031-32), and Epstein (2010, 2).

[113] See, e.g., Burness and Bromley Burness (1986, 324), Bromley (1989, 181), and Endres and Rundshagen (2008). One could even argue that it overcomes Hansmann's (1990, 33-34) assertion that the Coase theorem cannot apply when the relevant rights belong to a dead person (as, for example, in the rule against perpetuities), since any relevant contingencies would have been known and negotiated in advance.

first place. So conceived, the Coase theorem becomes, in the words of one critic, "incoherent" (Usher 1998).[114]

4.7.4 *Between Scylla and Charybdis?*

We are left, then, in what many would consider a decidedly unsatisfactory position. If we adopt a narrow view of transaction costs, the Coase theorem is unambiguously invalid. The absence of transaction costs, so conceived, still leaves room for a good deal of interference with the theorem's laws of motion, particularly via strategic behavior. On the other hand, friends and foes alike tell us that invoking the sort of broad definition of transaction costs suggested by many of the theorem's proponents renders the Coase theorem little more than a tautology.[115] Allen's (1999, 905) insistence that transaction costs "must be those costs that cause the Coase theorem to not apply" does nothing to assuage the critics.[116] The modern theorist, with her penchant for tightly drawn axioms, can only wince.[117] We are caught, it would seem, "Between the Scylla of tautology and the Charybdis of invalidity" (Schlag 1989, 1675).

On the face of it, there would seem to be good reason to sympathize with the critics of the most broad definitions of transaction costs. Defenders of the theorem appear all too quick to swoop in and brush aside rigorous mathematical formalisms with invocations of a "transactions costs-free fairyland" (Randall 1975, 741) or, as Samuelson (1995, p. 6) liked to call them, "Santa Claus situations"—defenses that strain, and perhaps shatter, the bounds of credulity. Cooter and Farrell, to cite just two examples, argue that to locate the Coase theorem in such a world is to gut the theorem of any real meaning. In Freeman and Evan's (1990, 352) view it does even worse, relegating economics "to the realm of theology rather than science."

Ambiguity, then, abounds, and for the casual observer in particular, there is little basis for choosing among the competing claims. Any decision to support or oppose the theorem's validity based on the arguments put forward in these debates would be grounded in little more than which version of the theorem, what definition of transaction costs, and which of the various arguments pro and con resonates with the reader. For those wishing to see economic analysis put on a more

[114] Allen (2015) provides a rebuttal to Usher's wide-ranging criticisms of the theorem.

[115] See, e.g., Calabresi (1968), Veljanovski (1977), Hovenkamp (1990; 1995), Farrell (1987), Usher (1998), and Fischel (2015). Cooter (1982; 1987) seems to vacillate on this question. Posner (2003, 51) contends that the efficiency thesis, at least, falls into this category.

[116] See also Kidd (2014, 144) and Reder (1982, 22), the latter of whom says that, "In a sense, the Coase theorem is simply a convoluted definition of transaction cost."

[117] But this may be what Stigler was getting at when he argued that "Transactions do not have a natural definition" and that "the contrast between a transaction cost and a nontransaction cost is an empirical rather than a purely formal classification" (in Manne 1970, 128-29). So conceived, their magnitude can only be determined by the success or failure of the invariance proposition (Chelius 1976, 306).

"scientific" footing, the entire exercise is maddening. The long and the short of it is that there are a whole host of arguments that can be raised against the notions that competitive markets or bargaining processes will generate efficient and/or invariant allocations in response to inefficiency-generating interdependencies. The question, then, is whether these go to the theorem's validity as a proposition in economic theory, or merely to its direct relevance to the world in which we live.

4.8 *Is There a Coase Theorem?*

Some twenty years ago, McKelvey and Page (1999, 236) concluded that the Coase theorem "remains elusive," largely because it has been stated in "shifting versions" and with "ill-defined terms." The intervening period has done little to alter this perception. Margo (1992, 466), meanwhile, tells us that "Stating the theorem correctly is like interpreting a work of modern art—a great deal is in the eye of the beholder." The reality, though, is that the lessons gleaned from our discussion to this point allow us to state a valid Coase theorem—one that conforms with Coase's twin claims of efficiency and invariance, is demonstrably correct as a proposition in economic logic, and the claims of which are no longer guaranteed when its assumptions are loosened.

If transaction costs are to be what their name indicates, they must include *all* costs related to the transacting process. A world of zero transaction costs, then, is characterized by fully specified property rights, transferable utility, and costless information. The last of these merits some emphasis: Given the centrality of information acquisition within the transacting process, zero transaction costs implies that *all information relevant to the transacting process and its impacts can be acquired costlessly by all individuals affected by the transaction*. And given that information is costless, *everyone possesses all relevant information, including knowing everything about everyone else*. Combining our conception of zero transaction costs with the insights gleaned from other facets of the Coase theorem controversy, we can state a Coase theorem that passes muster as a proposition in economic logic:

> *Theorem: If agents are rational and the costs of transacting are zero, resources will be allocated efficiently independent of how rights over those resources are initially distributed. Moreover, if utility functions are uniformly affine and the registration of subjective values is not wealth-constrained, this allocation is independent of the initial rights structure.*
>
> Proof: For efficiency, see, e.g., Robson (2012). For invariance, see Bergstrom (2017).

The efficiency proposition is unambiguously true under our definition of zero transaction costs and the assumption of agent rationality. Any potential inefficiency would be instantaneously corrected by affected agents. The combined assumptions of agent rationality, uniformly affine utility functions,

and the absence of wealth constraints rule out income effects and the WTA/WTP disparities that could negate invariance.

> *Lemma: If agents are rational and the costs of transacting are zero,* alterations in the existing structure of rights *will have no effect on the allocation of resources.*

With zero transaction costs, all rights are fully specified. Given this, agents must be fully compensated for any alteration in those rights.[118] The absence of any effects on income and wealth negate the need to assume uniformly affine utility functions and the absence of wealth constraints.

Some will no doubt claim that this reduces the Coase theorem to a tautology. But the reality is that all provable theorems are tautologies and, as such, the Coase theorem is no more or less a tautology than any of the other well-known theorems in economics. The question then becomes whether this theorem is of any utility for economists and others. But we must postpone that discussion until we have dealt with the all-too-common tendency to invoke Coase theorems that allow for positive transaction costs.

4.9 *Is There a Positive Transaction Costs Coase Theorem?*

We have already noted that numerous statements of the Coase theorem found in the literature allow for positive—but low, or less than the gains from exchange—transaction costs. Though Coase's claims for efficient and invariant negotiated solutions were predicated on the absence of such frictions, meaning that positive transaction costs statements of the theorem misapprehend Coase,[119] the frequency with which they appear in the scholarly and textbook literatures suggests that we should not dismiss them out of hand.

It is almost trivial to demonstrate, in the cooperative spirit of Coase,[120] the *possibility* of achieving efficient and invariant negotiated outcomes in the presence of simple transaction costs, so long as these costs are less than the gains from exchange. But if the externality is continuous and transaction costs are not lump-sum, both the efficiency and invariance claims are demonstrably false: Negotiation will cease at a point $q > q^*$ or $q < q^*$, depending on the initial allocation of rights (Medema and Samuels 2000; Robson 2012). The additional complications introduced by

[118] See, e.g., Allen (1995a, 10-11).

[119] Zelder (1998) offers a defense of the position that Coase intended for his result to apply to a world of positive transaction costs. While this author believes that such a claim cannot be sustained, Zelder's view speaks to the variety of interpretations laid onto Coase's result.

[120] That is, we are ruling out strategic behavior here.

information-related transaction costs and the associated possibilities of strategic behavior only reinforce this result.[121]

It would appear, then, that the Coase theorem can be dispensed with in short order if transaction costs are positive. But there is one school of thought that argues differently. Demsetz (1964; 1968), drawing in part on Coase's 1960 insights, has argued that transaction costs are just like any other costs and should be treated as such when making welfare assessments. The implication of this, as respects the Coase theorem, are straightforward, as emphasized by Buchanan (1986) and Calabresi (1991), as well as by Dixit and Olson's (2000, 311) "super Coase Theorem," quoted in our litany. Agents will negotiate movements away from the status quo to the extent that the gains from doing so are greater than the associated costs of transacting. Thus, the point at which negotiation ceases must be Pareto optimal, since the expected benefit from further negotiation is outweighed by the cost. As such, *all* outcomes satisfy the Coase theorem in its weak (efficiency only) form, regardless of the magnitude of transaction costs.[122] While negotiation here generates *an* efficient result no matter how rights are initially assigned, it does not guarantee an *identical* result and so lacks the generality of our Coase theorem. But for those concerned with efficiency, this Paretian take on the theorem makes it a powerful weapon for assessing private solutions.[123]

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[121] See, e.g., Samuelson (1985), Farrell (1987), Illing (1992), Dixit and Olson (2000), Anderlini and Felli (2001; 2006), Lee and Sabourian (2007), Robson and Skaperdas (2008), Lee (2010), and Robson (2012). Lee and Sabourian show that in a negotiation game in which players have a preference for less complex strategies, the introduction of transaction costs pushes us into the world of Cooter's Hobbes theorem, in which "only the most inefficient equilibrium involving perpetual disagreement that survives" (2007, 216). While the authors listed here explicitly invoke positive transaction costs, any of the game-theoretic challenges to the theorem are also valid against the positive transaction costs variant even if not against the Coase theorem stated in section 4.7.

[122] See also Buchanan and Stubblebine (1962), as well as Mishan's (1967b, 268-69) critique. Buchanan's (1986) position is a bit more nuanced than Calabresi's, in that an efficiency judgment is dependent on the institutional setting and on whether that setting itself can be judged presumptively efficient. Boudreaux (1996) and DeAlessi (1998) invoke a similar line of argument in claiming that strategic behavior does not invalidate the Coase theorem. Coase has indicated that he agrees with Calabresi's conclusion (Letter from Coase to Calabresi, Ronald H. Coase Papers, Box 19, Folder 9, Letter of May 8, 1991).

[123] Milgrom and Roberts (1992, 302-303) object to this line of thinking on the grounds that what is joint-maximizing for the agents involved—e.g., a merger or a price-fixing agreement—may be inefficient for society as a whole. Thus, they conclude, this line of argument, "although provocative and informative, is surely wrong." But Calabresi's rebuttal, which, as he noted, involves an application of Coase's analysis in "The Nature of the Firm," is difficult to deflect: If these agreements were indeed inefficient, citizens would bribe the firms to block them. That they do not do so owes to transaction costs, meaning the outcome is efficient in the Paretian sense. The same argument applies against efficiency justifications for Pigovian remedies and other such interventions since, if they were Pareto superior, they would already have been adopted. It is impossible to avoid the conclusion that such an approach says that "What is, is efficient." And that, for Calabresi, is precisely the point. The consequence, he says, is that "a thoroughgoing and open discussion of distribution and of interpersonal comparisons" becomes "inevitable" (Calabresi 1991, 1224).

4.10 *Why It Matters: The Coase Theorem as Benchmark*

It may be tempting to conclude at this point that, having generated a provable Coase theorem, we are left with nothing more than a cute intellectual curiosity and that the road to this point amounts to little more than "more heat than light" puzzle solving. But that is far from the case. To see why the Coase theorem matters, it is important to be clear on what it is, and what it is not.[124]

Some believe that the theorem matters because they see it as an empirical proposition or a "prediction."[125] While it is certainly possible to create an empirical proposition that has some of the basic flavor of the Coase theorem—as in Miller's tendency statement version of the theorem found in our litany or Posner (2014, 52)—the Coase theorem is a *theorem*, and theorems, by definition, are not empirical propositions.[126] Others see the Coase theorem as a policy tool—one which indicates that we can rely on agents to work out efficient agreements, that legal rules and other institutions (or alterations in them) do not affect the allocation of resources, or that judges should assign rights based on efficiency principles (a version of the so-called "normative Coase theorem"). But the theorem is not that, either, for there are no policy situations that conform to the theorem's assumptions, and any loosening of those assumptions causes the theorem to fall apart.[127]

A more accurate and fruitful approach is to understand that the Coase theorem is a "benchmark," and nothing more than this. So conceived, the theorem serves a role no different from the First Fundamental Theorem of Welfare Economics, telling us that, under certain idealized conditions, a particular set of results will follow.[128] The First Fundamental Theorem is not, and is not treated by economists as, an empirical proposition or a policy tool. Nor should the Coase theorem be.[129] This benchmark perspective is true both to the "theoremness" of the Coase theorem and to

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[124] As Hovenkamp notes, this is yet another facet of the Coase theorem upon which scholars cannot agree (1990, 785-86).

[125] See, e.g., Hoffman and Spitzer (1993, 63), Hsiung (1999, 154), and Stevenson and Wolfers (2006, 270).

[126] See, e.g., Hovenkamp (1990, 786) and Schwab (1989, 1176). Coase certainly did not see his result as an empirical proposition when he formulated it in the late 1950s, nor do his retrospective comments on it, whether in his unpublished talks on the topic from the late 1960s and early 1970s, or in his much latter published work (e.g., Coase 1988b). On Coase's use of the negotiation result, see Medema (1994, ch. 4), McCloskey (1998), and Bertrand (2010).

[127] This then implies that one cannot use the Coase theorem to ground the efficiency criterion in legal decision making, as there is no invariant outcome to label "the" efficient one. This version of the "normative Coase theorem is discussed further in section 6.1, below.

[128] There are variety of perspectives on the relationship between the Coase theorem and the First Fundamental Theorem—some stressing commonalities and others differences. See, e.g., Polinsky (1974), Farrell (1987), Hovenkamp (1991), Makowski and Ostroy (1995), Heckman (1997), Boyd and Conley (1997), Campbell (2000), Conley and Smith (2005b), and Blaug (2007). Brito et al. (2006) have recently shown that with zero transaction costs (including full information), both the First and Second Welfare theorems hold under Coasean bargaining.

[129] An answer to why people have viewed the Coase theorem differently emerges from our discussion in section 4.11, below.

Coase's original crafting of his result. Though this view finds some support in the literature,[130] others question whether "something that is so patently impractical" (Blaug 2007, 200) and "depends for its validity on such an insane view of economic events" (Posin 1993, 852) can serve this purpose. This is a fair question, to which at least three (interrelated) responses can be offered. Taken together, they show not only why the theorem should be considered a benchmark, but why it is a useful one.

First, when used as a benchmark, the Coase theorem becomes "a heuristic generator of insight" (Bergstrom 1989, 1157-58),[131] allowing us to see *things previously not seen*—bargaining and market possibilities, the potential for institutional change to be without effect—and to understand things we *do* see in ways previously not contemplated. Differently put, contemplation of an ideal type can provide us with insights for understanding and dealing with situations that depart from from the ideal.

Second, the Coase theorem's benchmark function invites us to examine the consequences of loosening the theorem's assumptions—including (but certainly not limited to) the introduction of various types of transaction costs. So conceived, the theorem becomes a starting point for understanding (i) the origins of market failures[132] and (ii) why institutions, including property rights, matter,[133] as well as for developing testable hypotheses. This also tells us that the many "disproofs" of the theorem found in the literature are, in reality, applications of this benchmark role rather than refutations of the theorem.[134]

Finally, the benchmark view invites us to analyze the ways in which the real world departs from this benchmark, the consequences for allocative (and distributive) outcomes, and the potential implications for policy—including the efficacy of decentralized approaches, as with the Fundamental Theorems of welfare economics (Epstein 1993, 556; McCloskey 1998, 368).

So conceived, the theorem is not merely an "illuminating falsehood" (Cooter 1982, 28), making it all too easy to dismiss. Nor, as other critics have charged, is it a "religious precept" (Posin 1993, 810) that is at once "theoretically degenerate … and ideologically charged" (Halpin 2007, 339). It may well be the case that some have elected to use the theorem in these ways (and here, too,

[130] See, e.g., Hamilton (1993, 103), McKelvey and Page (1999, 238a), Miceli and Sirmans (2000, 785), Heyes (2001, 2), Hsiang (2001, 188), Acemoglu (2003, 622), Rochet and Tirole (2006, 649), and Monnet and Roberds (2008, 1429).

[131] See also Randall (1983, 141). Bergstrom finds a similar function in Becker's Rotten Kid theorem, which has much in common with the Coase theorem.

[132] See, e.g., Zerbe (1976, 32), Sobel (2005, 37), and Williamson (2005, 3-4).

[133] See, e.g., Hurwicz (1995, 65).

[134] D'Amato (2011, 766) classes the Coase theorem with Einstein's theory of special relativity here. Both, he says, are "Null theories" that highlight the consequences of introducing frictions.

things are in the eye of the beholder), but such uses are not true to the lessons that emerge from a theoretically valid Coase theorem.

4.11 *Explaining the Controversy*

Having revisited the Coase theorem debates, worked our way to a valid Coase theorem, and provided a justification for its import, it remains to address the question of why the Coase theorem has been the subject of so much controversy, and even disparagement. There appears to be something about the theorem, or the professional perception of it, that generates a reaction very different from other results in economics grounded in similarly abstract frameworks, such as the First Fundamental Theorem. And indeed there is.

One explanation given for the controversy lies in the challenge that the theorem posed to the Pigovian tradition.[135] As it happens, many of the attempts to refute the theorem included an accompanying demonstration of, or at least argument for, why Pigovian remedies would be successful where Coase theorem failed—often sans any attention to the problems that might afflict the implementation of such remedies.[136] Yet, we have already seen that this Pigovian tradition, such as it was, had until the 1970s occupied a relatively minor place in the economics literature, largely because externalities simply were not on the professional radar in any significant way prior to the 1960s (Medema 2015b). This, then, provides at best an incomplete explanation.

A second possible explanation derives from what Priest (2010, 5) has labeled the "political dimension" of the Coase theorem—the perception, found in the work of both its defenders and its critics, that the theorem is a "decentralization result" (Farrell 1987, 114), or, less charitably put, a prescription for limited government, or, still less charitably put, the embodiment of free-market ideology.[137] And if one wades at all deeply into the literature, it becomes difficult to quarrel with Priest's assessment that the theorem became an exemplar of "[t]he deep Chicago School belief in the superiority of markets" (Priest 2010, 5), or with Samuelson's conclusion that "[t]he vogue of vulgar and vague Coaseism … is strongest among libertarians and other devotees of laissez-faire who

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[135] See, e.g., Wellisz (1964), Baumol (1972), and Coase (2004).

[136] Dick's (1974) discussion is emblematic of this asymmetry.

[137] The references here are legion. A representative sample includes Samuelson (1963a), Welisz (1964), Randall (1974; 1985), Mishan (1971a), Samuels (1974), Cooter (1982), Hoffman and Spitzer (1985b), Farrell (1987), Schweizer (1988), Hamilton et al. (1989), Shogren (1992), Maskin (1994), Williamson (1995), Landa (1998), Gläser et al. (2001), Bohm (2003), Mueller (2003), Pearce (2004), Reisman (2005), and Sobel (2005).

Not surprisingly, this "political dimension" is even more prominent in the legal literature on the Coase theorem. For a variety of perspectives, see, e.g., Kelman (1979), Horwitz (1980), Hovenkamp (1991; 1993b), Duxbury (1991), Schwab (1992), Schroeder (1998), and Hackney (2012).

believe to find in it ammunition against regulation and voters' activism" (Samuelson 1995, 6).[138] Yet, this too provides a less than full explanation. A similar set of charges could be leveled against the First Fundamental Theorem which, like the Coase theorem, is a decentralization result with no direct bearing on the real world. But there is no First Fundamental Theorem controversy even remotely similar to that over the Coase theorem.[139]

A third possible explanation for all of the too-and-fro over the theorem is economists' fascination with intellectual challenge that it poses, owing to "its combination of counterintuitive conclusion with a straightforward and apparently unassailable demonstration" (Halpin 2007, 323). This is the force that seems to have attracted scholars such as Hurwicz, Chipman, and Bergstrom to its analysis and, in particular, to the attempt to work out in rigorous fashion the conditions under which it would be true and so might be policy-relevant.[140] But it, too, offers less than a full explanation. There are many interesting theoretical puzzles in economics, but no others have generated this level of controversy or been discussed with the heated (by scholarly standards) rhetoric that we find in the Coase theorem debates.

Forming a complete explanation—particularly for the raging debates of the 1970s and 1980s—requires that we turn to the larger context within which the these debates played out. Two contextual factors are particularly relevant here: The increased societal concern with problems caused by large-scale pollution and the rise of the economic analysis of law—itself a part of the larger (and then very controversial) expansion of economics beyond of its traditional boundaries. The first of these played the larger role in the debates over the theorem taking place within economics, while the latter was the more important force in the controversy that emerged within legal scholarship. The intersection of these contextual elements with the aforementioned explanatory factors goes a long way toward explaining both the extent of the controversy and the often heated rhetoric in which it was couched.

The heightened attention given to environmental issues at the social and political levels beginning in the late 1960s played a significant role in the development of environmental economics and in the dramatic expansion of the literature on externalities—the latter providing the theoretical

[138] See also Peck (2011), Eastman (1996b, 783) and Samuels (1974, 11), the last of whom asserted that the Coase theorem "is but an attempt to lend the credo of science to normative justification of the market and its fantasies of markets everywhere, and to have everything seen in that light."

[139] What makes this political element all the more curious is the realization that (i) centralized solutions are as good as private ones in a Coase theorem world and (ii) the Coase theorem suggests that preferences for outcomes, and institutional structures that generate them, grounded in distributional and other concerns can be indulged without sacrificing efficiency (Burrows 1970a, 44; Parish 1972; Schwab 1989, 1195; Hovenkamp 1990, 808-809; Tye 1992, 23-24; Krier and Schwab 1995, 448; Medema 1999). The Coase theorem is thus an equally powerful weapon for those whose positions are at odds with ideological implications typically associated with the theorem.

[140] This explanation for the attention paid to the theorem finds some support from Coase (2004, 205) himself.

grounding for the former. The Coase theorem thus grew up alongside and within the emerging field of environmental economics,[141] and the largest share of economics literature taking up the Coase theorem at this time did so in the context of pollution.[142]

At the most basic level, the Coase theorem was perceived as providing the underpinning for policies that posed a threat to improved environmental quality. If it was left to individuals to negotiate with polluters to achieve reductions in pollution, the impact on emissions was likely to be minimal. Such an outcome was anathema to those concerned with improving the environment—including many of those attracted to environmental economics in the early years. Randall (1974, 54) even went so far as to ask whether one can subscribe to the theorem's invariance position "without appearing blatantly anti-environment." On the face of it, the Coase theorem would seem to have far more to do with farmers and ranchers and with neighbors contending over music at played excessive volume than with large-scale particulate and CO_2 emissions. And though the Coase theorem was later to become associated with emissions trading, one searches in vain for an author suggesting during the 1970s that the theorem offered a remedy for large-scale environmental problems. Yet individuals who were on the scene during the 1970s speak of conversations in department hallways and common rooms to the effect that the Coase theorem rendered the Clean Air Act unnecessary,[143] and Boulding (1971, 167) railed in an AEA meetings session on "The Political Economy of Environmental Quality" against the profession's "lunatic fringe who virtually deny the existence of public goods and public bads and think that all things can be done by private bargains between smoky railroads and rational dairy farmers."[144]

Compounding the problems for the theorem was a concern found in both the legal and environmental economics literatures: The idea that the Coase theorem legitimated making victims—whether of pollution or accidents caused by defective products—liable for harm. This possibility brings to the fore the reciprocal nature of harm (Coase 1960, 2) that underpins the Coase theorem though, in fact, the reciprocity idea has a lengthy history in both law and economics.[145] The problem, for present purposes, was that its implications often ran counter to social norms, a good deal of legal

[141] Pearce (2002) and Crocker (2002) provide discussions of the formative years of environmental economics.

[142] The Coase theorem was perceived as sufficiently important for environmental economics that the *Natural Resources Journal* published two-volume symposium on the theorem and the *Journal of Environmental Economics and Management* included an article surveying *criticisms* of the theorem (Dick 1976) in one of its earliest issues.

[143] The same individuals confirmed the "environmentalist" orientation of many in the first generation of environmental economists, noted above.

[144] Kneese's (1971) article, on which Boulding was commenting, sounded a similar note, though in far less charged language, lamenting economists' focus on two-agent externalities and the propensity to generalize from that to bargaining solutions for large-numbers problems.

[145] See Hohfeld (1913), whose reciprocity analysis also had a profound impact on law and economics of the "old institutionalist" variety, as evidenced by the work of Commons (1924) and Samuels (1971).

precedent and the Pigovian approach, such as it was. One finds resistance to victim liability in the earliest discussions of Coase's analysis within environmental economics (Kneese 1964) and repeated suggestions that theorem posited—and even legitimated—a world in which "little children [would be] regarded as 'hitting' automobiles in pedestrian crossings" (Randall 1974, 53, citing Weld 1972) and potential victims of crimes would be required to bribe their assailants (e.g., Weld 1973, 612). As Baumol (1972, 309) put it, under this line of reasoning, "the murder victim too, is then always an accessory to the crime."

Despite its straightforward grounding in the opportunity-cost reasoning—a hallmark of LSE thinking during Coase's student days—the reciprocity principle has been called everything from "intriguing and counterintuitive" (Guerra-Pujol 2012, 141) to "idiotic" (Jules Coleman, in Hackney 2012, 227). Mishan, no stranger to the LSE way of thinking, even went so far as to deny its applicability—claiming that enacting a law protecting people from second-hand smoke or from noise and air pollution "does not, of itself, reduce the welfare of others" (Mishan 1971b, 25). The "economics" of the Coase theorem, then, ran headlong into a controversy grounded in ethics, giving rise to claims that it amounted to an "amoralization of the externality issue" (Randall 1974, 53)[146] and led to outcomes which are contrary to "social justice" (Mishan 1967a, 68).[147]

It bears emphasizing that the Coase theorem does not suggest that victims *should be* made liable for harm; it simply tells us that we achieve the same efficient allocative outcome under victim liability and under injurer liability. But the mere possibility that this could be used justify making "innocent" victims liable for industrial pollution or tortious harms was sufficient to generate vociferous opposition to the theorem. Add to this the perception that that it could be used to justify the status quo level of emissions—if lower pollution was efficient, agents would have negotiated their way to it—and you have a recipe for a felt need to demonstrate that the theorem was not merely irrelevant (a claim that would be a matter of perception and taste), but just plain wrong. It is as if

[146] See also Vatn and Bromley (1997, 141), Pearce (2004, 122), Rodgers (2006, 7-8), Blaug (2007, 200), and Milanovic (2016, 137). The Coase theorem's separation of efficiency from equity is little more than a reflection of Robbins' (1932) prescription for the discipline, one widely adopted in economics over the subsequent decades. Yet, this was regularly made the basis for criticism of the theorem. Heckman (1997, 329), though, sees matters differently, calling this separation "a matter of analytical convenience" and "professional competence" rather than a "political ploy."

[147] See also Mishan (1967b, 278-81) and Söllner (1994, 77). One even finds reference to the Coase theorem's problematic ethics in the economics textbook literature. See, e.g., Reynolds (1973, 214). One of the few exceptions to this view is Chavanne's recent contention that the Coase theorem's logic "closely aligns with everyday intuitions of fairness" (2016, 41).

admitting the theorem's validity as a proposition in economic logic equated to admitting its relevance for resolving real-world problems of externality.[148]

In sum, the origins of the Coase theorem controversy lay far more in a desire, among some, to ensure (i) that pollution was reduced and (ii) that "victims" were not made to bear the costs of harm done to them than about propping up Pigovian remedies or objections to free-market ideology per se. The perceived stakes here were significant, for if the theorem did not pass theoretical muster, Pigovian instruments—which satisfied both of these desires—would stand alone as efficiency-generating remedies to be recommended by the economist. All that said, we should not minimize the role that the ambiguity surrounding the theorem—its context, assumptions and their content, and claims—played in this controversy. The ambiguity made it a relatively simple matter for sophisticated modelers to construct "disproofs" of the theorem, and equally simple for theorem defenders to construct rebuttals. The debates over the theorem's validity were as much over competing theorem statements, definitions, and modeling strategies as they were over validity per se.

Eventually, of course, the debate died down, though articles claiming (wrongly) to refute the theorem continue to appear with some regularity.[149] Discussions of the theorem also took on a life far less closely tied to the environmental context—the latter due in no small part to the expansion of the theorem's domain far beyond the externality theory within which it originated. For some, the Coase theorem became a proposition in bargaining theory generally, asserting the efficiency of associated outcomes. For others, it became an assertion regarding the equivalence of outcomes under alternative institutional regimes. And its applications came to span the entire spectrum of economic analysis. As the theorem was put to new uses, additional reasons arose to further probe its validity.[150] Before turning our attention to this expansion of the theorem's domain and the uses to which it is being put in the more recent literature, however, we must consider a second strain of work attempting to assess the theorem—the efforts to conduct experimental and empirical tests of its validity and predictions.

5. *Testing the Coase Theorem*

The last three-plus decades have witnessed the development of an extensive literature, itself controversial, that purports to "test" the Coase theorem. It is rather odd to think in terms of "testing" a theorem. After all, given its premises the conclusions follow as a matter of logic. Mathematicians

[148] Pigovian taxes and regulations, in contrast, offered the prospect of both improved environmental quality and making the polluter pay. One could argue that the above reasoning also explains part of the preference for Pigovian taxes over Pigovian subsidies, as the latter can be construed as paying the polluter for behaving ethically.

[149] See, e.g., Ellingsen and Paltseva (2016).

[150] The detailed nature of our analysis of the various challenges to the theorem is important because, still today, critics fall back on one or more of these arguments to suggest that the the theorem is invalid.

are not prone to measuring right triangles to test the Pythagorean theorem. And if they did, and if certain triangles were found to violate the theorem, the results would be attributed to measurement error or the failure of the 90-degree angle assumption. Any true "test" of the Coase theorem would confirm its validity, and any result that questions this must involve a violation of one of the theorem's underlying assumptions.[151] But as we have already established, the Coase theorem is not your typical theorem. A significant share of these tests have taken place in the lab, but the theorem has also been the motivation for a number of case studies and for econometric testing of allocative outcomes under alternative legal regimes. More recent work examining the consequences of loosening the theorem's assumptions also bears some mention here.

5.1 *Experimental Tests*

On the face of it, at least, the laboratory would seem to be a fruitful environment to "test" the Coase theorem, as it offers the prospect of being able to control the environment in ways that minimize the costs of transacting (e.g., by providing full information to all agents), as well as to assess how certain types of transaction costs and rationality-violating behavioral phenomena may lead to departures from the efficiency and invariant outcomes attributed to a Coase theorem world.

5.1.1 *Taking Coase Into the Lab*

The first generation of Coase theorem experiments, undertaken at a time when experimental economics was both young and quite controversial as a methodology (Svorencik 2014),[152] appeared to provide significant support for the theorem's claims.[153] For example, roughly 95 percent of the full-information experiments conducted by Hoffman and Spitzer (1982; 1986) produced efficient bargains, and increasing the number of agents involved in the bargaining to more than three dozen did not significantly affect the propensity to reach efficient outcomes (and at times increased it). Interestingly, given the information-based challenges to the theorem, there was not an enormous efficiency drop-off in experiments conducted under incomplete information.[154]

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[151] See Hovenkamp (1990, 787-94) and Crespi (1991, 241n.45). Shogren and Nowell (1992, 121) insist that "Resources should not be devoted to testing tautologies." Hackney (1997, 304), on the other hand, criticizes Coase for *failing* to test his result.

[152] Norton and Patrick's (1985) dismissive response to Prudencio's experiments, questioning whether they tell us anything relevant to the real world, is indicative of the low esteem for experimental methods (and in their case, the Coase theorem) in the early 1980s. See also Prudencio's response to Norton and Patrick (1985).

[153] See Hoffman and Spitzer (1982; 1985a; 1986), Prudencio (1982), and Harrison and McKee (1985).

[154] In the full-information experiments, agents knew all payoff functions; in those with incomplete information, they knew only their own payoff functions unless and until others choose to reveal theirs.

The strength of their results led Hoffman and Spitzer to conclude that their findings "produce *a presumption in favor of the Coase Theorem*," including "for disputes involving substantial numbers of parties," meaning that

> a judge or legislator who is considering choosing a rule to govern a dispute in tort, contract, or property that involves as many as thirty-eight parties *should assume that the parties can and will exhaust the gains from trade* by voluntary agreement. One who would show that bargaining breakdown is likely must bear the burden of proof. (1986, 151, emphasis added)

While this seems a bold claim, perhaps more important is the implication that Hoffman and Spitzer drew for the debate over efficiency as a legal norm.[155] One of the arguments offered in support of 'efficiency as justice' is that it facilitates the achievement of the outcome at which agents would arrive if transaction costs did not get in the way. Hoffman and Spitzer (1986) suggested that their results demonstrate exactly this, and thus that judges should assign rights in accordance with the dictates of efficiency when transaction costs are perceived to be a barrier to negotiation—as they often will be for cases actually litigated.

Economists were largely silent on Hoffman and Spitzer's claim—though Hishleifer (1984) considered their results sufficiently important to merit discussion in his intermediate price theory textbook—but Stanford Law professor Mark Kelman (1985) suggested that the robustness of their results was open to challenge on multiple fronts, including the absence of a physical externality that might make people unwilling to monetize or negotiate over the problem.[156] To get at these issues, Coursey, Hoffman, and Spitzer (1987) introduced both asymmetric payoffs and a discomforting externality—the prospect that the "victim" would have to hold a safe but foul-tasting liquid in her mouth for 20 seconds.[157] In a set of results that the authors found "striking," the efficient outcome was selected in 38 out of 40 trials, leading the authors to conclude that the theorem could be fruitfully applied to real-world nuisance problems "among moderate numbers of actors" (1987, 236).

Perhaps the most infamous (alleged) experimental test of the Coase theorem did not occur in the lab, nor did it set out to test the Coase theorem. Instead, the Illinois unemployment experiment (Woodbury and Spiegelman 1987), which offered worker and employer bonuses for getting workers off the unemployment rolls, attempted to assess whether incentive schemes could reduce unemployment spells. The results were recast by Donohue (1989) as a test of the Coase theorem,

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[155] See, e.g., the "Symposium on Efficiency as a Legal Concern," *Hofstra Law Review* 8 (3) 1980 and "A Response to the Efficiency Symposium," *Hofstra Law Review* 8 (4) 1980.

[156] A second critique of the conclusions drawn by Hoffman and Spitzer, also from the legal side, can be found in Hovenkamp (1990).

[157] This method was originally utilized by Brookshire, Coursey, and Schulze in a study published several years later (Brookshire, Coursey and Schulze 1990).

which, he argued, predicts identical allocative and distributional effects across the two different bonus programs. Not surprisingly, the theorem failed on every front, with agents regularly failing to collect bonuses to which they were entitled, a greater rate of success under the worker-bonus program, and payment recipients capturing the largest share of the bonus. As both Lindgren (1989) and Ellickson (1989) pointed out in scathing commentaries Donohue's article, the Illinois experiment was riddled with transaction costs, particularly on the information front, and so did not function as a test of the Coase theorem at all. Instead it was an illustration of Chelius's (1976, 306) claim that an empirical finding against invariance is essentially a finding that transaction costs are significant and a confirmation of Coase's larger message that individuals respond "intelligently to the reality of transaction costs" (Ellickson 1989, 625).[158] The lesson that emerges, though, is that extending the theorem's insights into more complicated real-world environments is hazardous—a lesson that finds further support in experiments explicitly assessing the implications of loosening the theorem's assumptions.

5.1.2 *The Effects of Costly Transacting*

The results from experiments that intentionally introduce more informationally complex environments and other forms of non-negligible transaction costs are decidedly mixed. Harrison, Hoffman, Rutström, and Spitzer's (1987) effort to assess Coasean bargaining in a richer and more computationally complex informational environment, including private information on payoffs, provided substantial support for the Coase theorem's efficiency prediction. Other experiments allowing for private information, though, have tended to reinforce the lessons for efficiency drawn from the theoretical literature,[159] as do those allowing for imperfect contract enforcement.[160] McKelvey and Page also find "substantial" deviations from allocative neutrality and a greater propensity for bargaining to break down—the latter suggesting the relevance of both the "Hobbes" and Myerson-Satterthwaite theorems, discussed above. Uncertainty, on the other hand, seems to be less of a barrier to efficient Coasean bargains than private information (Shogren 1992).

Taken together, these results cast significant doubt on a "presumption in favor of the Coase theorem" for many real-world settings. Even so, some of the experiments shed light on factors that

[158] As Lindgren (1989, 578) noted, Donohue had chosen a particularly bad case study since, in a world of zero transaction costs, "there are no firms, no employers, no employees, no full-time jobs, and no job searches."

[159] See Schwab (1988), McKelvey and Page (2000), Rhoads and Shogren (2001; 2003), and Holt et al. (2012). Schwab also found that, contrary to the prediction in *his* statement of the Coase theorem (in our litany), the distribution of income *was* affected the initial distribution of rights, with a notable bias in the direction of the rights holder—providing evidence for the theoretical conclusions reached by Illing (1992) and McKelvey and Page (1999; 2002).

[160] See Shogren and Kask (1992) and Rhoads and Shogren (2003).

may facilitate efficient bargaining. Croson and Johnston (2000) and Cherry and Shogren (2005) find that uncertainty over property rights tends to *promote* efficient outcomes, consistent with the theoretical findings of Schmitz (2001), noted above.[161] Shogren (1998), meanwhile provides evidence that increasing delay costs—the erosion of gains due to the passage of time, as with environmental damage—provide a significant incentive to consummate efficiency-enhancing bargains,[162] while Spencer and Shogren (2000) discovered that utilizing a "cheap talk" protocol—whereby inexperienced Coasean bargainers engage in "informal, non-binding talk prior to formal negotiations" tended to increase the efficiency of final outcomes.[163]

5.1.3 *Rationality*

One of the more troublesome findings to emerge from the Coase theorem experiments is the apparent failure of agents to behave in ways predicted by the rationality assumption. The issues here are two: the division of the surplus from bargaining and endowment effects.

5.1.3.1 *Distribution of Gains*

Subjects participating in these Coase theorem experiments demonstrated a pronounced propensity to split payoffs fairly evenly.[164] This finding is at once consistent with Coase's view that agents tend to work things out and at odds with the dictates of individual rationality, which suggest that agents possessing property rights will utilize their position to secure virtually all of the gains from exchange.[165] This behavior was evident in both high and low transaction costs situations and was largely independent of the number of parties to the bargain. To the extent that the Coase theorem hinges on the assumption of agent rationality, these outcomes are problematic, and they also cast doubt on whether the theorem-affirming efficiency results extend to situations with rational agents.

There is a good deal of evidence that the propensity for equal payoff spits was a function of the experimental environment. Educating subjects on the meaning and implications of property rights

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[161] But see Aivazian et al. (2009), whose experimental follow-up to their work on the the Coase theorem and the core finds that cycling is common, and efficiency suffers, when the core is empty—particularly when property rights are not well defined. However, the extent to which rights are well-defined does not impact the propensity to reach efficient outcomes with or without an empty core.

[162] Non-increasing delay costs, in contrast, generated substantial inefficiencies.

[163] In light of the suggestions, discussed in section 4.4, above, that nonconvexities are fatal to the Coase theorem, it also bears noting that Shogren et al. (2002) find that nonconvexities—such as may be associated with ecological thresholds for habitat or species or pollution—do not reduce the efficiency of Coasean bargaining.

[164] See Hoffman and Spitzer (1982), Prudencio (1982), Coursey et al. (1987), Harrison et al. (1987), McKelvey and Page (2000), Aivazian et al. (2009), and Rhoads and Shogren (2001; 2003).

[165] This can also be interpreted as evidence against Cooter's "Hobbes theorem."

(Harrison and McKee 1985) and giving them a sense that they had "earned" these rights (Hoffman and Spitzer 1985a; 1986)[166] largely eliminated irrational behavior. And, in keeping with what we would expect from the theoretical literature, security of property rights (Cherry and Shogren 2005), private information (McKelvey and Page 2000; Rhoads and Shogren 2001; 2003), and an empty core (Aivazian, Callen and McCracken 2009) are associated with a greater propensity toward individually rational behavior, as is a time limit on bargaining (Harrison et al. 1987).

It may be that we can simply write off inclinations toward cooperation, altruism, and the like as a consequence of experimenting on student subjects without a good deal of skin in the game, so to speak. But it could also be that, as Coase seems to have suggested, people tend to work things out, even if in less than the fully rational fashion usually attributed to them by modern economic theory—perhaps because of a disposition toward collaboration and other forms of pro-social behavior.[167] This, in turn, suggests that we may be able to rely more heavily on private solutions than the game-theoretic literature predicts, even if not precisely for the reasons suggested by the Coase theorem (Ulen 1994, 516).[168]

5.1.3.2 *WTA, WTP, and Endowment Effects*

We have already noted the implications of divergences between WTA and WTP for the Coase theorem's invariance proposition. Willig's (1976) classic defense of consumer's surplus, emphasizing the "very small" distinction between WTA and WTP in most cases, provided some reassurance. But Kahneman and Tversky's (1979) contributions and the accumulating evidence for endowment effects and related phenomena raised new questions and stimulated experimental work attempting to assess the relevance these divergence for the theorem's claims.

The *locus classicus* of this literature is Kahneman, Knetsch, and Thaler's (1990) widely cited finding that agents in possession of the relevant "property right" (here, a chocolate bar) valued it more highly than they did when that same right was in the possession of another agent—a result that they attributed to the endowment effect. The result was a significant reluctance to trade, a result with

[166] Property rights holders were far more likely to split the payoff fairly equally when the right was secured by a coin flip and more likely to pursue an individually rational line of bargaining when they had "earned" the right (moral authority) by winning a game that secured it for them. This result that may lend itself to real-world situations in which rights are initially "earned" though the litigation process and its associated costs.

[167] See, e.g., Ellickson (1986), Calabresi (2016), and Basu (2018). That the property rights holders in the Coursey et al. (1987, 229) experiments with the foul-tasting liquid externality exhibited a strong tendency to share the gains equally was attributed by the authors at least in part to the right-holder's desire to compensate victims for having to taste the liquid.

[168] See, e.g., Thaler (1991; 1992).

implications not just for the Coase theorem, but for law and economics generally (Korobkin 2014, 300).[169]

Kahneman, Knetsch, and Thaler's study understandably stimulated a good deal of additional work in this area, as experimenters attempted to assess the accuracy and robustness of the claims for the endowment effect as well as the validity of and potential reasons for the WTA/WTP disparity. Plott and Zeiler's (2005; 2007) experiments suggest that the divergences between identified by Kahneman, Knetsch, and Thaler may be attributable to "subjects' misconceptions about the nature of the experimental task" (2005, 542),[170] but Tunçel and Hammitt's (2014) meta-analysis of WTA/WTP studies provides evidence for a more complicated story.[171] The weight of the evidence suggests that WTA/WTP disparities do exist, that they are larger for "public or non-market" goods—and particularly for environmental goods and goods related to health and safety—than for "ordinary private goods," and that the disparities tend to decrease with experience.

All of this leaves one with some confidence that the theorem's invariance prediction may be accurate to a reasonable approximation in contexts, such as financial markets, where there is regular trading of well-known assets, or where litigants are experienced.[172] This, says List (2003, 70), means that "the basis for many normative arguments (Coase theorem) remains intact." The evidence that outcomes will be more in keeping with the predictions of rationality, and thus more efficient, as agents become more experienced in markets for environmental services provide some support for attempts to extend the theorem's insights,[173] but potential for behavioral effects give us pause in those contexts, such as environmental and other forms of externality, where trading is more irregular—all of this apart from concerns over transaction costs.

5.2 *Empirical Tests*

While the experimental literature focused on Coase theorem's efficiency proposition, to the almost total neglect of the invariance claim, the empirical literature has done just the opposite. Of course, the efficiency thesis is very difficult to test empirically, at least directly, whereas the invariance

[169] One of these implications goes to the valuation process associated with the so-called "normative Coase theorem," which recommends assigning rights according to the dictates of efficiency. For a variety of perspectives on this issue, see Hovenkamp (1990; 1991), Sunstein (1993), and Korobkin (1994; 2014).

[170] Klass and Zeiler (2013) provide a critical overview of the place of endowment theory in legal scholarship, where it has proved to be very popular, as well as a discussion of the ideological element in endowment theory arguments.

[171] Tunçel and Hammitt's updates and extends the earlier analysis of Horowitz and McConnell (2002).

[172] This should be qualified by Rachlinski and Jourden's (1998, 1545) finding that endowment effects are observed only when rights are protected by property rules, not when liability rules are employed.

[173] See Henrich et al. (2001) and Shogren (2012, 352-53).

proposition lends itself nicely to empirical examination and can be used, if one is so inclined, to infer efficiency.

5.2.1 *Farmers, Ranchers, and Other Parables*

Though Coase himself conducted no "tests" of his negotiation result, he did publish several articles that fall into this category during his tenure as editor of the *Journal of Law and Economics*, including articles by Steven Cheung (1973) and David Johnson (1973) which revisited Meade's (1952) classic illustration of externalities between beekeepers and orchard owners.[174] While only one of these articles (Johnson's) was explicitly billed as an assessment of the relevance of the Coase theorem, at the other (Cheung's) was inspired by Coase,[175] and evidence presented in these articles for thriving markets in pollination services, with "pricing and contractual arrangements … consistent with efficient allocation of resources" (Cheung 1973, 13),[176] was in keeping with the theorem's implication that contracting can resolve externality problems.

It is perhaps natural that two of the other early attempts to empirically assess the theorem's applicability drew on Coase's farmer-rancher parable. In 1982, Robert Ellickson (1986; 1991) immersed himself in the farming and ranching culture of Shasta County, California, to examine how farmers and ranchers resolve trespass disputes. What he found was that agents do indeed cooperate to resolve disputes and that the Coase theorem's predictions of the invariant impacts of legal rules are often fulfilled—but not for the reasons that the Coase theorem predicts. Rather than bargaining in the shadow of the law, agents ignored it and instead relied on well-developed norms and customs (e.g., the owners of livestock are responsible for the actions of their animals) to govern what were typically "complex continuing relationships" in which transaction costs—particularly in learning and enforcing legal rules—are high (1986, 628).[177] Studies by Hanley and Sumner (1995) and Fischel (1995) reveal similar behaviors, seemingly grounded in neighborliness and social custom, in other contexts.[178]

Vogel's (1987) study of nineteenth-century changes in animal trespass law in California offers a large-scale assessment of the invariance claim in the farmer-rancher context. Analysis of

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[174] Coase also published Hoffman and Spitzer's (1982) original experimental study. Lest one conclude that Coase was merely concerned with propping up the Coase theorem, he also published any number of articles that either were critical of the theorem (e.g., Aivazian and Callen 1981) or pointed to the influence of transaction costs on economic outcomes (e.g., Crocker 1971).

[175] See Cheung (1973, 11n). Cheung worked with Coase as a post-doc at Chicago in the late 1960s.

[176] See also Johnson (1973, 46).

[177] Bertrand (2011) provides an interesting discussion of the lessons of the Cheung and Ellickson studies for market and exchange-based approaches to externalities. On Ellickson, see also Hovenkamp (1990) and Cooter (1993).

[178] See also Dedeurwaerdere (2005) and Pargal et al. (1997).

cattle and crop output levels reveal that the move to a regime in which ranchers were responsible for damage caused by their cattle—that is, from "fence out" laws to "fence in" laws—led to significantly larger crop outputs, while cattle outputs increased in some cases and decreased in others. The lesson, then, is that baseline legal rights did indeed impact equilibrium outcomes as well as production efficiency. Vogel (1987, 186-87) acknowledged that his analysis was not a "test" of the theorem itself, owing to the influence of transaction costs and of nonconvexities in the production functions of farmers. Rather, he said, it is a cautionary tale about extending the domain of the invariance thesis to real-world environments—though Bleakley and Ferrie's (2014, 3) recent study of land use on the Georgia frontier suggest that invariance may indeed be "operative in the very long run."

5.2.2 *Post-Trial Bargains*

Coase's negotiation analysis contemplates a situation in which a judge has rendered a decision and the parties to the dispute then negotiate an alternative arrangement if it is in their interests to do so. Though Coase referenced several nineteenth-century legal cases and provided hypothetical discussions of how negotiation might play out (Coase 1960, 8-15), no attempt was made by Coase—or by anyone else—to assess the extent and results of post-trial Coasean bargaining until Farnsworth's (1999) study of the subject.

Farnsworth examined post-judgment behavior in twenty nuisance cases that had fact patterns similar to the cases discussed by Coase, seemed to involve low transaction costs, and were resolved with the award of a property right to one side or the other. He then contacted the attorneys of record, each of whom reported that there were *no* attempts at post-trial bargaining in the cases in question. Nor, Farnsworth reports, did these lawyers think that the bargaining situation would have been any different if the court's decision had gone in the opposite direction—a fact that is important in that one objection would be that the judges had assigned rights efficiently in the first place (1999, 384). The lawyers ascribed the failure to bargain to "acrimony between the parties" and to the parties' unwillingness to trade off rights to be free from nuisance for cash (1999, 384)—the latter of which, Farnsworth notes, is suggestive of, but may be more deeply rooted than, an endowment effect (1999, 396).

How might we reconcile this failure to bargain in the real world with the results of the laboratory experiments discussed above? One possibility, building on Farnsworth's (1999, 406-407) suggestion that acrimony could be considered a form of transaction cost, is that the laboratory environment does not capture important negotiation-impeding aspects of real-world legal disputes. A second possibility, suggested by Jolls, Sunstein, and Thaler (1998, 1499-1501), is that this failure to engage in post-trial bargaining *does* provides evidence for endowment effects, despite Farnsworth's

qualification. Posner (1998, 1571), writing in response to Jolls et al., offers still another possibility—that the courts may have assigned rights efficiently in the first place, meaning that no negotiation was necessary, Farnsworth's suggestion to the contrary notwithstanding.[179] A final possibility is that the economic approach to the problem simply gets it wrong as respects these untidy real-world scenarios—that agents exhibit neither the strong rationality of economic theory nor the "work things out" gain-seeking described by Coase in many of the situations to which the theorem's insights might be thought relevant by the economist. Some further insight into these issues can be found in the application of the theorem to messy world of divorce.

5.2.2 *Taking Coase to Divorce Court*

In 1977, Becker, Landes, and Michael presented an economic theory of divorce, asserting that "if all compensations between spouses were feasible and costless, a couple would separate if, and only if, their combined wealth from remaining married were expected to be less than their combined wealth when separated " (1977, 1144). In a world in which divorce requires mutual consent, if one spouse expects to gain from divorce while the other expects to lose, and combined wealth is expected to increase, the spouse who gains from the divorce will compensate the loser to secure agreement. This "compensation of a spouse to induce acquiescence," they said, "is *an excellent illustration of the* '*Coase Theorem*' that the allocation of property rights or legal liability does not influence resource allocation when the parties involved can bargain with each other at little cost" (1977, 1144).[180] One implication of this claim is that all marriages (and all divorces) are efficient. A second is that a change in the legal rules governing divorce, from mutual consent to unilateral divorce, will have no impact on the divorce rate. Chiappori et al. (2015, 157) have labeled the latter proposition the "Becker-Coase theorem."[181]

The move by Becker et al. to link divorce rates to the Coase theorem has stimulated "vast and contentious" (Voena 2015, 2299n.2) empirical literature debating the extent to which the move from fault-based to no-fault divorce accounts for the rise in the U.S. divorce rate that occurred around the same time. The opening salvo came from Peters (1986), who found that divorce rates did not differ significantly between unilateral divorce and mutual consent states but that settlement

[179] Posner (1998) also notes that Farnsworth's sample size is too small for the results to be statistically significant and offers a transaction costs-based argument for why his results vindicate rationality.

[180] See also Landes (1978) and Becker (1981).

[181] Invariance also implies that other divorce-related rules, such as those pertaining to alimony payments, will have no effect on the divorce rate (Chiappori et al. 2016).

payments associated with divorces are lower in unilateral divorce states.[182] Both of these results, she concluded, provide support for the Coase theorem. While Peters' conclusions attracted relatively little attention early on, studies casting doubt on her findings mushroomed in the 1990s.[183] These findings, though, were challenged by Wolfers (2006), who utilized a longer sample and a model specification that more explicitly accounted for divorce-rate dynamics. Wolfers found that divorce rates spiked immediately after the introduction of unilateral divorce (perhaps reflecting pent-up demand), but that these effects largely disappeared within a decade.[184] In light of this, he concluded that, though the predictions of the Coase theorem are not strictly satisfied, the negligible long-run effect on overall rates of divorce suggests that "the Coasian assumption of efficient bargaining arguably provides a more useful guide than the polar opposite assumption of no bargaining" (2006, 1817). Evidence for the theorem's invariance claim drawn from the examination of other divorce-related variables, though, suggests that Wolfers' claim may may not generalize.[185]

Despite the frequent suggestions that changes in divorce law function as a testing-ground for the Coase theorem, there are at least two reasons to be suspicious of any theorem-related claims. One, echoing the criticisms of Dohohue's use of the Illinois unemployment study, is the very real presence of transaction costs associated with both marriage and divorce, as Allen (1992) and Brinig and Alexeev (1993) first emphasized. A second and related issue here is the possibility of non-transferable utility in marital public goods (e.g., children), the complications associated with which were noted in section 4.1, above. As Zelder (1993) originally demonstrated, if utility is non-transferable, unilateral divorce laws may encourage inefficient divorces—a finding recently reinforced by Chiappori et al. (2015).[186] Taken together, these insights suggest that Wolfers' inference of efficient Coasean bargaining from his invariance results may be overly optimistic—

[182] Peters' was the first large-sample test of the impact of the change in divorce laws, as well as the first to link this to the Coase theorem.

[183] See, e.g., Allen (1992), Brinig and Alexeev (1993), Zelder (1993), Brinig and Buckley (1998), and Friedberg (1998).

[184] González and Viitanen (2009) and Kneip and Bauer (2009) found similar results for formal changes to unilateral divorce in Europe, though the latter's results are less clear-cut.

[185] Studies examining alimony payments, property division, and child custody (Brinig and Alexeev 1993), female labor supply (Gray 1998; Genadek, Stock and Stoddard 2007; Stevenson 2008; Stevenson and Wolfers 2006; Voena 2015), investments in marriage-specific human capital (Stevenson 2008), accumulation of household assets (Voena 2015), and female suicides and domestic violence rates (Stevenson and Wolfers 2006) tend to point against invariance. Analysis of the effects of divorce-relevant governmental transfers (Blackburn 2003; Tjøtta and Vaage 2006) and child support enforcement and guidelines (Hoffman and Duncan 1995; Nixon 1997; Argys, Peters and Waldman 2001; Allen 2006) on marital dissolution have yielded conflicting results.

[186] See also Clark (1999) and Fella et al. (2004). Under non-transferable utility, a move to unilateral divorce laws also reduces the incentive to marry—contrary to the Coase theorem—and so, via a selection effect, generates a decline in steady-state divorce rates (Rasul 2006).

though, as Chiappori et al. point out, in the face of the mixed evidence on transferable utility, "the Becker-Coase theorem … may remain an acceptable approximation" (2015, 175).

5.2.4 *Free Agency in Professional Sports*

The economics of sports has also provided, in the minds of many, a fertile testing ground for the Coase theorem, this going to the effects of changes in labor law—specifically, allowing players free agency—on professional sports leagues. The typical sports fan is of the mind that free agency for players favors the wealthiest teams, allowing them to stockpile the best talent. And, in fact, this logic was used by team owners to justify various versions of the "reserve clause," which bound players to their teams even when their contracts had expired and so gave owners significant monopsony power. A move to free agency, it was argued, would give rise to increased player movement and reduced competitive balance. The Coase theorem, though, suggests otherwise if transaction costs are zero. An alteration in the legal rule governing player movement will not affect the allocation of players across teams, nor the competitive balance. At most, it will shift the distribution of income from team owners to players.

Though this logic is regularly identified with the Coase theorem, it originated in an article by Rottenberg (1956), then of the University of Chicago, in what is generally considered the first article in sports economics, "The Baseball Players' Labor Market."[187] It was Demsetz (1972, pp. 16-18) who, in the midst of the legal challenge to baseball's reserve clause, first connected player movement to Coase's negotiation result, defending its application on the grounds that the transaction costs involved in player-club negotiations "would seem to be negligible."

The arrival of free agency in U.S. professional sports beginning in the mid-1970s allowed economists to test the Coase theorem's predictions. Spitzer and Hoffman (1980) provided the first empirical evidence that the abolition of the Major League Baseball (MLB) reserve clause did not affect player movement, a finding echoed in a number of more extensive subsequent studies.[188] Several however, have found evidence of increased in player movement under MLB free agency,[189] a

[187] Rottenberg's invariance claim has been called an anticipation (Cymrot, Dunlevy and Even 2001, 595) "illustration" (Miceli 2004, 213), and a "particular application" (Daly 1992, 15) of the Coase Theorem. Besanko and Simon (1985, 71) apply the "Coase-Rottenberg theorem" moniker. Fort (2005, 348) argues that the focus on the Coase theorem rather than Rottenberg in the sports context does the latter an injustice, given Rottenberg's priority.

[188] See Besanko and Simon (1985), Drahozol (1986), Cymrot et al. (2001), Marburger (2002), and Surdam (2006).

[189] See Krautmann and Oppenheimer (1994), Kahane and Shmanske (1997), Hylan et al. (1996), Maxcy (2002), and Schmidt (2011), as well as Lin's (2011) findings from his study of the National Basketball Association. Fort and Quirk (2007) recently showed that the invariance principle holds for leagues where season ticket sales and home-team talent drive revenue (e.g., the National Football League), but not for those where single-day tickets and visiting-team talent are important for revenue (e.g., MLB).

result that has been attributed to divergent owner-player goals,[190] as well as to the greater outside income opportunities (e.g., endorsements) that a move to a larger market may afford a player (Vrooman 2000). The evidence for the effects of free agency on competitive balance is similarly mixed, both within and across professional sports, with studies finding increase, decreases, and no change in this balance.[191] Nor can any firm conclusions be drawn from the literature on the institution of player drafts, which are often justified on the grounds that they redistribute income from winning teams in larger markets to losing teams in smaller markets and so preserve competitive balance.[192]

If Demsetz was correct in his opinion that the transaction costs involved in player-owner negotiations are negligible, the many findings against invariance here not not comforting for the Coase theorem's empirical relevance. On the other hand, this inconsistency of this evidence may provide support for the idea that transaction costs are relatively low, and that something approximating invariance is a realistic assessment of the outcome.

5.3 *Interpreting the "Tests"*

There are two problems with any experimental or empirical test of the Coase theorem. The first is that the theorem's conditions are not fully satisfied in any real-world setting. The second is that any true "test" of the Coase theorem would confirm its validity, and any conflicting results must involve a violation of one of the theorem's underlying assumptions. Given this, these tests of the theorem must be interpreted as explorations of situations in which the theorem's severe restrictions are loosened—applications of the theorem's benchmark function—rather than as tests of the theorem itself, even if that is not what is claimed by those doing the testing. Nor is this a problem, as Stigler—a proponent of such studies—noted, since, "after all, it is a theory's domain of applicability that determines its importance to a science" (1992, 458). What *is* clear from the Coase theorem literature is that the questions raised by the empirical and experimental literature about the extent of this domain have done nothing to slow its expansion on the theoretical front.

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[190] For example, if players maximize income but owners are more interested in winning, and winning is not tightly linked to profits, invariance may not apply.

[191] In MLB, Daly and Moore (1981), Lehn (1982), and Cymrot (1983), and Cymrot and Dunlevy (1987) find that competitive balance decreases, while Scully (1989), Balfour and Porter (1991), Vrooman (1995), Fort and Quirk (1995), Quirk and Fort (1997), and Schmidt and Berri (2003), generate results supporting invariance. Surdam (2006) results are consistent with invariance for the National League but not for the American League. Eckard (2001) and Maxcy (2002), meanwhile, find that free agency increased competitive balance. On the NBA, see Noll (1991) and Maxcy and Mondello (2006). On the NFL, see Balfour and Porter (1991); Maxcy and Mondello (2006). On the National Hockey League (NHL), see Maxcy and Mondello (2006) and Fenn et al. (2005). On European soccer, see Dejonghe and Van Opstal (2010).

[192] Daly and Moore (1981), Fort and Quirk (1995), and Maxcy (2002) find that the draft increases competitive balance in MLB, while Grier and Tollison (1994) find the same for the NFL. But the results of Schmidt and Berri (2003) for MLB, Fort and Quirk (1995) for the NFL), and Fenn et al. (2005) for the NHL suggest otherwise.

6. *The Many Faces of the Coase Theorem*

If there is a defining feature of the Coase theorem's more recent history, it is the expansion of the theorem's domain beyond the realm of externalities. There is virtually no corner of economic analysis untouched by the Coase theorem, even if those uses sometimes stray far from the role that the theorem, as refined here, properly plays.[193] In its more recent renderings, the theorem (i) tells us that agents will always negotiate their way from sub-optimal outcomes to Pareto efficient points if transaction costs do not get in the way, whatever the context (Farrell 1987),[194] (ii) predicts and explains symmetries across the spectrum, and (iii) suggests that inefficient institutions will be replaced with efficient ones (Palfrey and Srivastava 1989, 669; Vermeule 2010, 1428). So conceived, the theorem becomes a general proposition, akin to the law of demand, with wide-ranging application.

While environmental and legal issues have been at the center of Coase theorem scholarship from the start, its tentacles began to spread early on, with Calabresi suggesting already in 1968 that the theorem's domain was the entire realm of market failures, from monopoly to public goods. The theorem has even born progeny. It was one of the inspirations for Becker's (1974) "Rotten Kid theorem,"[195] which in turn spawned Benjamin's (2007) "Rotten Firm theorem."[196] We also have a "political Coase theorem," a "linguistic Coase theorem," a "federal Coase theorem," and a "Coase theorem about theories"[197] —in addition to *two* "normative Coase theorems" and a "Becker-Coase theorem" on divorce. Others have retroactively painted the Ricardian Equivalence Theorem, the Modigliani-Miller theorem, and the invariant incidence of sales taxes, ad valorem and per unit taxes,

[193] The discussion in this section of the paper focuses on how economists and others have used the theorem and not on the question of whether those uses are somehow appropriate or inappropriate. Constraints on both space and and the reader's attention span simply do not allow for the latter. The implications of our discussion in sections 4.8 - 4.10, above, for the appropriateness of many of these uses likely can be inferred by the reader.

[194] One could even argue, with Anderlini and Felli, that the theorem "shapes the way economists think about the efficiency or inefficiency of outcomes in most economic situations" (2001, 377). At the very least, it is a prime example of the increasing pervasiveness of "the idea that any gains that can be obtained are in fact picked up" within economics (Olson 1996, 3).

[195] The "Rotten Kid Theorem" states that "Each beneficiary, no matter how selfish, maximizes the family income of his benefactor and thereby internalizes all effects of his actions on other beneficiaries" (Becker 1981, 183). Bergstrom (1989, 1138) calls the Rotten Kid Theorem the "younger sibling" of the Coase theorem.

[196] Benjamin's "Rotten Firm theorem" suggests that a firm and a fair-minded worker, the latter of whom is concerned with his own wage and effort, and the firm's profit, will agree on a contract that generates an efficient equilibrium outcome. Benjamin's paper was eventually published as Benjamin (2015), without the references to this "theorem."

[197] Peltzman 's "Coase theorem about theories" states that, "If one model generates unexploited gains, another model will come along with some set of deals that realizes those gains" (1987, 943).

and tariffs and quotas as "special cases" or applications of the Coase theorem.[198] Though the Coase theorem has often been described as an illustration of Smith's "invisible hand" proposition,[199] one is surprised to find no one claiming that Smith gave us little more than a special case of Coase.

The literature clearly leaves one with the feeling that there are practically no limits to the theorem's perceived domain. It has been applied to topics as far flung as sex and rape (Schroeder 1999), construction management (Lai, Ngar Ng and Yung 2008), satellite launch and placement (Doherty 1989), social norms (Ellickson 2001), the cancellation of a long-running UK folk music festival (Hojman and Hiscock 2010), "internalities" and paternalism (Whitman 2006; Dodd 2008),[200] squatter communities and eviction programs in third-world urban areas (Hoy and Jimenez 1991), and the disposal of cow manure and the determination of the formulation of the cattle feed that gives rise to it (Vukina 2003). It has even been employed to analyze the movie, *Blade Runner* (Guerra-Pujol and Martinez-Garcia 2011). Turning an eye to history, the theorem has been used to explain institutional obstacles to technological change in eighteenth-century French agriculture (Hoffman 1989), bargains between pirate privateers and their victims (Leeson and Nowrasteh 2010), the English practice of trial by battle (Leeson 2011), indentured prostitution in imperial Japan (Ramseyer 1991), and manumission in the US and other slave societies (Cole 2005). It has even been located in the Bible (Schein 2004).[201] The nimbleness of the theorem, which no doubt accounts for some of the suspicion of it, is reflected in its use to construct explanations for why Medieval English agriculture was inefficient (McCloskey 1976, 1991) and a more recent explanation for why it was efficient (Richardson 2005), as well as arguments for and against privatization (Gerbasi and Warner 2007; Guriev, Kolotilin and Sonin 2011).

In the remainder of this section, however, we will focus on a narrower range of applications of the Coase theorem to various fields of economics. These applications, though, show the full spectrum of Coase theorem uses—policy tool, empirical proposition, and benchmark—on display.

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[198] See, e.g., Allen (1999, 904-905) and Logue and Slemrod (2010, 798-99), as well as the references provided in the discussion later in this section. Stigler (1966, 113) pointed to the correspondence between the Coase theorem and invariant sales tax incidence already in his original statement of a "Coase theorem."

[199] See, e.g., McCloskey (1998, 368), Samuelson and Nordhaus (1992, 379), and Starrett (2003, 113).

[200] An "internality" is a spillover effect between the present and future selves, such as with present behaviors that lead to future obesity—the idea being that present self can (Whitman 2006) or cannot (Dodd 2008) bargain with future self to generate Pareto optimal outcome, with corresponding implications for the desirability of paternalistic government-imposed restrictions, such as soda bans, on individual choices.

[201] The passage in question is Deuteronomy 23: 25-26. One could argue that it is a rather tortured case.

6.1 *Law and Economics*

Daniel Farber has said "if there is anything that can be described as the canon of 'law and economics,' the Coase Theorem is at the heart of it" (1997, 397).[202] It has both occasioned "an irreversible transformation in the traditional methods of legal interpretation" (Parisi 1995, 149) and attracted significant criticism for doing so.[203] But it is fundamental to the field in a peculiar way, in that, if the theorem were universally applicable, there would be no need for an economic analysis of law; rights would find their efficient final resting place without the assistance of economics.[204] Lawyers, then, "earn their livelihood from transaction costs" (D'Amato 2011, 762n.15).

The Coase theorem plays three basic roles in the economic analysis of law. First, it is used to prioritize contract when low transaction costs generate a presumption that agents can negotiate. Though Farnsworth's (1999) empirical analysis of nuisance cases cast some doubt on the willingness of agents to engage in post-trial bargaining, *pre-trial* settlement negotiations, long portrayed as an example of the Coase theorem at work, are commonplace.[205] The only analytical distinction here is that agents are bargaining in the shadow of *expectations* regarding judicial decisions rather than the concrete decisions themselves. Perhaps because of this, Schwab's results have not slowed the tendency to support negotiated solutions.

Second, and in keeping with its benchmark function, the Coase theorem highlights the inefficiencies generated by transaction costs and the contribution that legal rules can make to increasing or reducing these costs. The idea that legal rules should be designed to minimize transaction costs and so facilitate Coasean bargains—one version of the "normative Coase theorem"—is an outcome of this.

The third major role played by the theorem here lies in the justification that it provides for the deployment of the efficiency criterion in legal decision making—the second version of the "normative Coase theorem."[206] The theorem tells us that agents will negotiate to an efficient and

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[202] Posner (2014, 8) calls the theorem "[t]he most celebrated application of the concept of opportunity cost in the economic analysis of law."

[203] The citations here, too, are legion. See, in particular, Dorfman (1970) from the perspective of economics, Kelman (1979) from law, and Rodgers (2011) from history.

[204] This statement could be qualified by recognizing that distributional consequences would remain, meaning that an economic analysis of law could concern itself with those, but examining distributional issues has never been at the heart of the economic analysis of law.

[205] The Coase theorem was part of the inspiration for Landes's original analysis of pre-trial settlement (Landes 1971, 102; 1997, 34), as well as for the argument that law should promote both pre-trial settlement (Schiff 1995, 326-27) and mediation (Duke and Jost 2003). See also, e.g., Posner (1986, 537-42), Shavell (1982), Donohue (1991), and Hylton (1993) (contrasting how the British and American rules for allocating litigation costs affect settlement incentives), as well as Stevenson (2012) and Schmitz (2001). Stevenson also takes up the application of the theorem to the jury-selection process.

[206] This normative thrust originated with Calabresi (1968, 69), who, having established the validity of Coase's result

invariant outcome if transaction costs do not get in the way. This suggests to some that the role of law in a positive transaction costs environment is to facilitate the attainment of that outcome by resolving disputes as those agents would have done if they were able. In doing so, it is argued, the court serves both efficiency and "ethical" objectives (Easterbrook and Fischel 1993, 427).[207]

6.1.1 *Real Property*

Given that Coase situated his negotiation result in the realm of property law, it is no surprise that the theorem has been influential in this area. But the nature of its influence has as much to do with how property is conceived as with negotiations over rights. The Coase theorem has been held responsible for the decline in the *in rem* conception of property—providing security against interference by others—and the rise of the *in personam* view that property is simply a bundle of individual use rights (Merrill and Smith 2001).[208] It is true that, absent transaction costs, property has no distinctively useful character; all rights would be costlessly and infinitely divisible.[209] Here, property rights have no function other than to provide the basis for contracting and for setting down use rights, and the Coase theorem's contribution is to show that, under these conditions, each stick in the property bundle will gravitate toward its highest-valued use.[210]

The *in personam* view of property has come to pervade post-Coasean views of property, as Merrill and Smith (Merrill and Smith 2001, 375ff) illustrate.[211] It introduces a problem, though, when transaction costs, including those associated with delineating, understanding and enforcing rights, abound (Merrill and Smith 2011, S100). Application of the *in personam* view can generate highly

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to his satisfaction, said that one of its "practical implications" is that "The resource allocation aim is to approximate, both closely and cheaply, the result the market would bring about if bargaining actually were costless." It bears emphasizing that the Coase theorem itself provides no justification either of these "normative Coase theorems." We need not wade into a discussion of Hume's guillotine here.

[207] Epstein (1993) makes a similar argument (sans the claim for ethics), drawing on the single-owner defense of the Coase theorem—that the law should attempt to mimic the outcome that would occur if the relevant resources were under the control of a single owner.

[208] The latter viewpoint was not new with Coase; it originated with Wesley Hohfeld (1913; 1917)—who also gave us reciprocity—and was central to the activist agenda of the legal realists. There is no small amount of irony in the fact that the legal realists and Chicago-inspired law and economics embraced these this views of rights.

[209] This, of course, resonates with the idea of infinitely divisible goods that is a commonplace in economic theory.

[210] An excellent early and influential statement of this perspective comes from Demsetz (1972, 16): "Private property takes the form of a bundle of rights, of which different components may be held by different persons. In the absence of significant negotiating cost, the use to which these property rights is put is independent of the identities of the owners since each owner will be given market incentives to use his property right in the most valuable way. Just what is the most valuable way depends on market conditions and not owner identities."

[211] The Merrill-Smith position has some commonalities with the strident criticisms of the theorem that come from certain quarters of Austrian economics and libertarianism. Gary North, for example, contends that the Coase theorem "undermines the very concept of private property rights" (North 2002, 84). See also, e.g., Block (1977; 2003), Rothbard (1982), Fox (2007), and Barnett, Block, and Callahan (2005).

fragmented rights, exacerbating the influence of transaction costs.The *in rem* tradition in property law thus can be seen as an efficient response to the pervasiveness of transaction costs—an application of the version of the so-called normative Coase theorem which says that rights should be structured so as to minimize these costs (2011, S94-95).[212] Ellickson's (1986; 1991) findings, discussed above, are illustrative of why the Coasean view can be misleading. *In rem* rights offer a low-cost means of protecting property against what could be a large number of potential violators by bundling these rights together within a system of clearly delineated rules. The norms against cattle trespass found by Ellickson are essentially an example of "an *in rem* norm" that facilitates exactly this and serve an important transaction-cost reducing function through their ease of delineation and communication (Merrill and Smith 2001, 390ff).

The Coase theorem has been used to provide insight into the manner in which property interests should be protected and, in particular, into the distinction between property rules (prohibiting non-consensual takings of property) and liability rules (allowing nonconsensual takings so long as compensation is paid).[213] The theorem tells us that, when transaction costs are *zero*, property rules and liability rules are allocatively equivalent. The conventional wisdom for situations outside of this world, following the seminal work of Calabresi and Melamed (1972), has been that property rules are preferred for situations involving low transaction costs because they promote bargaining. Liability rules, in contrast, are preferred in high transaction cost environments because they facilitate efficiency-enhancing reallocations of rights while bypassing the hold-out, free-rider, and other transaction costs-related problems that would plague—and often preclude—property rule-induced negotiation.[214]

More recent work has led to a reconsideration of the efficient rule for *low* transaction cost environments, where Coasean bargaining is feasible and perhaps should be encouraged but these costs, including those resulting from private information, raise the specter of inefficiency. Ayres and Talley's (1995a; 1995b) insight is particularly relevant for the present discussion.[215] A liability rule, they pointed out, effectively divides the legal entitlement: The rancher has the right to allow his cattle to roam on the farmer's land, while the farmer has the right to compensation for any harm that results. As in the biblical story of Solomon's resolution of conflicting claims over the parentage of an infant, this divided entitlement provides superior incentives for the revelation of private

[212] See also Lee and Smith (2012). In a more general sense, *in rem* property becomes an efficient substitute for an extensive array of contracts, functioning in a way similar to the firm in organization theory. For a different but complementary perspective on *in rem* property and the economic analysis of law, see Arruñada (2012; 2017).

[213] See the discussion of open and closed classes in section 4.2, above.

[214] See, e.g., Posner (1977, 51) and Cooter and Ulen (1997, 97-100).

[215] But see Kaplow and Shavell (1995; 1996) for an alternative perspective on why liability rules may be preferable.

information—including cheap talk—and so reduces the probability of strategic behavior.[216] This line of thinking also has relevance for the analysis of fragmented property where, as Parisi and others have demonstrated, liability rules and mixed remedies often have superior properties.[217]

6.2.1 *Intellectual Property*

The initial application of Coase's insights to the law of intellectual property came at the hands of Stephen Breyer (1970), later of the U.S. Supreme Court, whose message was that the significant transaction costs attending, e.g., permission-seeking, spoke in favor of loosening copyright protections. A signifiant amount of the subsequent literature followed this line of thinking, arguing that intellectual property situations, more so than for physical property, are riddled with transaction costs. An inventor (whether of a physical product or software), for example, has significant informational advantages over potential contracting partners and will not be inclined to reveal information that compromises trade secrets. Proper assessment of benefits and costs, then, becomes problematic and hold-ups a very real possibility (Merges 1994; Witt 1996, 123).[218] These costs work against innovation-facilitating agreements and suggest the need for more narrowly defined intellectual property rights (Landes and Posner 2003, 421).

A second school of thought, though, contends that transaction costs are, in reality, *low* here and finds in the Coase theorem an argument for *strong* protection of patent (Kitch 1980; Cheung 1982) and copyright (Dam 1995) and (Easterbrook 2005; 1999). Strong patents both preserve innovation incentives and, per the Coase theorem, facilitate efficient licensing agreements (Hopenhayn and Mitchell 2001, 158).[219] This view also suggests the need to scale back the application of antitrust laws to patent pools and cross-licensing arrangements, since, far from being

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[216] King Solomon announced that he would cut the baby in half and give one half to each of the two women claiming to be the child's mother—a decision that caused the child's true mother to offer to give up her claim if Solomon would spare the child's life. The benefits of cheap talk in a Coasean bargaining environment receive some experimental support from Spencer and Shogren (2000), discussed above.

[217] See, e.g., Schulz et al. (2002), Parisi et al. (2004), Parisi (2006), and Luppi and Parisi (2011). Wiggins and Libecap (1985) provide an illustration of the propensity of bargaining to break down even when there is a surplus from unitization.

[218] This issue is germane to recent debates over copyright in music and file sharing. Because there is no centralized database of copyrighted music, determining rights holders is very costly and suggests against any assumption that music licensing follows market principles (Perritt 2010, 848).

[219] Rachlinski and Jourden (1998, 1545) find that endowment effects are observed only when rights are protected by property rules and not when liability rules are employed. This is particularly relevant for intellectual property, where property rules are the standard form of protection, in part because their exchange-friendly nature (Buccafusco and Sprigman 2010).

anticompetitive, they are simply examples of "the Coase theorem at work" (Lemley 2000, 147-48).[220] The case on the copyright front, for Easterbrook, is even more optimistic. The transaction cost-reducing effects of technology in the copyright realm, he says, are moving us "toward the world where transactions costs are close to zero, and the Coase Theorem can be a reality rather than a thought experiment" (Easterbrook 2005, 966-67).[221]

Still others object to forming any hard and fast conclusions about the strength of intellectual property protection, drawing from the Coase theorem the need to discriminate between low transaction cost situations, where bargaining is more likely to occur, and situations of high costs, where negotiation possibilities are limited. The implication, consistent with Coase's larger message in "The Problem of Social Cost," is that efficient intellectual property protection requires that protections vary within and across its forms and uses.[222]

6.1.3 *Antitrust*

The propensity of antitrust scholars working in the Chicago tradition to find competitive justifications for seemingly restrictive practices found an ally in the Coase theorem, which suggests that actions taken by monopolists may well *lower* rather than increase distortions (Barzel and Kochin 1992, 23).[223] The theorem has been invoked on several fronts as justification for narrowing the application antitrust law.[224] Meese (1996; 2005), for example, draws on it to suggest that courts are too quick to see anticompetitive behavior in non-standard contracts—such as tying contracts—that work to reduce transaction costs and therefore promote efficiency. That such contracts can be manifestations of available mutual gains rather than market power/anticompetitive behavior, he says, "is a necessary implication of the Coase theorem" (1996, 131). So read, the theorem informs us that market power goes only to the division of the surplus and not to efficiency concerns (Brickley, Misra and Horn 2006, 173-74).

Hovenkamp (1993a, 383) suggests the need for pause here, however, because while transaction costs may be low for some of the bargains being studied, they may not be for others that

[220] Erik Hovenkamp (2017) has recently shown that antitrust concerns can interfere with efficiency-enhancing transfers of patent rights, though he does not go so far as to recommend a narrowing of antitrust laws to accommodate Coasean bargaining.

[221] See also Easterbrook (1999) and Cohen (1998, 561).

[222] See, e.g., Landes (1992), Choi (2002), and Crouch (2010). Landes (1992, 105-106) uses the entry problem to draw a distinction between the copyright protection for "reproductive" (e.g., collected letters) and "productive" (e.g., the preparation of a biography) works. As he notes, this is a form of the open- vs. closed-classes argument employed by Holderness (1985), discussed in section 4.2.1, above.

[223] Barzel (1992) provides a nice discussion of the augmentation of the Director-inspired Chicago antitrust tradition by the Coase theorem.

[224] See, e.g., Johnsen (1991), Tye (1992), Harrison (1997), Easterbrook (2000), and Meese (2005).

bear on efficiency judgments. The danger lies in affixing the "efficient" label to agreements that may be joint-maximizing for the agents involved but not welfare maximizing. Examples include cartel-like behavior among competitors (Hovenkamp 1995, 338) and exclusionary rebates to complement suppliers (Brennan 2008, 364). The lesson, says Hovenkamp, is that "the Coase Theorem is not a general equilibrium theorem;" instead, "[i]t is concerned only with the result in a particular market, and that market may be very small" (1995, 338).

6.1.4 *Accident Law*

Accident law may appear to be a most unlikely and fruitful arena for application of Coase's negotiation result, given nature of "accidents" and the seeming impossibility of having agents negotiate regarding the placement of liability. (Think, for example, of drivers negotiating with potential pedestrian victims of their careless driving).[225] And, in fact, the theorem's use in this literature is confined primarily to a normative extension—placing liability on the least-cost avoider. But as Stanford law student Gerald Wright (1969) demonstrated,[226] the theorem itself is not without relevance to accident situations, as it provides a justification for the class-action lawsuit. When an agent's actions cause harm to many victims—as, for example, with defective products—negotiations are prohibitively costly. By collapsing the class of victims into a single unit, Wright said, the class action reduces transaction costs and so promotes efficient bargained solutions, all the while obviating difficulties associated with the judicial determination of the least-cost avoider.

The more significant mark on accident law has been left by the competitive markets version of the Coase theorem, which has been employed as a vehicle for analyzing accidents involving agents in a pre-existing relationship—in particular, products liability and worker's compensation. The Coase theorem suggests that, in a competitive environment, the location of liability for injuries caused by product defects or workplace accidents is irrelevant; prices will simply adjust to reflect the exposure to injury-related costs.[227] The application of the theorem to products liability occurred first in the legal literature (Franklin 1966; Kessler 1967), but was given extensive treatment by economist Roland McKean (1970a; 1970b) who, not long thereafter, used the theorem to ground his case for the utility of an *economic* approach to law in general and products liability in particular. Despite this

[225] Of course, there is the further question of whether "accidents" even exist in a world of zero transaction costs. See Dorfman (1970, 95-98).

[226] Wright was simultaneously pursuing his economics Ph.D.

[227] This insight, sans mention of Coase's result, features in Calabresi's (1961) classic analysis of accident costs. Priest (1992, 252) has set out three conditions for invariance here: "that product markets are competitive; that consumers are well-informed: and that both manufacturers and consumers have sufficient access to insurance so that there is no effective differential between manufacturer and consumer risk aversion." This, he says, "is simply a refinement of the Coase Theorem."

long history of connection, there has been virtually no empirical work done to assess the impact of changes in products liability law—either the move toward increased manufacturer/seller liability through much of the twentieth century or more recent reforms that have reduced its extent. However, a recent study by Shepherd (2013) provides evidence that some among the recent reforms restricting products liability, including limitations on the time period during which manufacturers are liable for product defects, the introduction of comparative negligence defenses, and limitations on non-manufacturer liability have had positive effects on economic activity.[228] Others reforms, though, such as caps on non-economic and punitive damage awards, appear to have minimal effects.

The economic theory of the neutrality of liability for workplace accidents goes back to the early twentieth century (Taussig 1911, 327-27; Brown 1922). Its identification with the Coase theorem, though, was first made by another law student, Yale's Harry Woodward (1967) and was subsequently elaborated by Chilius (1974).[229] In reality, however, asymmetric information and insurance that is not perfectly experience-rated are particularly problematic for the theorem's application (Butler and Worrall 1983, 582-83; Butler 1996, 407; Hylton 1997, 272), though, as Hylton points out, competition may lead to information revelation by employers that allows these risks to be properly accounted for in employment contracts. Empirical studies by Chelius (1976; 1982), Fishback (1987), Fishback and Kantor (2000), and Butler and Worrall (2008) find that modifications to the liability regime, including the establishment of workers' compensation systems, did indeed affect both accident rates and the severity of injuries and that, consistent with what transaction costs might suggest, these effects varied with differences in supervision and accident-prevention costs across industries.[230]

6.1.5 *Contract*

The Coase theorem tells us that, in a zero transaction costs world, any negotiated contractual terms can be presumed to be efficient—an insight that has been used justify a default toward the enforcement of contracts as written. Though the reality of transaction costs is rightly considered a barrier to the operation of the Coase theorem's magic in myriad situations, contract disputes regularly involve situations in which the contract in question *was negotiated* by the parties to the suit—as

[228] The second of these reduces seller liability if the defendant contributed to her injuries though her own negligence when using the product. The last shields a retailer from liability for injuries caused by a product it did not manufacture.

[229] Chelius also applies Coasean bargaining analysis here. The initial application of Coasean bargaining analysis to workplace injuries came from Williamson et al. (1967), though they made Turvey's (1963) restatement of Coase's analysis the basis for their theoretical framework.

[230] This should not be taken to imply that firm-level Coasean bargains are not feasible for workplace safety conditions. See, for example, Ogus's (1995) discussion of the move in Britain from a litany of safety rules to broader parameters from which employers and unions bargained to specifics appropriate for the firm in question.

against, say, a standard-form contract governing liability for the use of a product—and thus where transaction costs may be relatively low. This has led a number of commentators to extend the zero transaction costs enforcement logic to low transaction costs situations—with applications ranging from contracted price discounts (Gordon and Frankel 1993, 1547-48) to parental surrogacy contracts (Trebilcock and Keshvani 1991, 584-85)—both because of the efficiency presumption and because the failure to enforce contracts negotiated under these conditions can generate inefficient litigation or breach (and has, according to Mattei (1995, 436-37).[231]

Incomplete contracts are the norm even when the costs of transacting are low, and when disputes arise courts fall back on default rules to fill the gaps. But what should these default rules be? The Coase theorem tells us that default rules may not matter (Ayres and Gertner 1991; Bainbridge 1999), but the evidence is unclear.[232] Ayres and Gertner (1989) fall back on the "normative Coase theorem," where efficiency dictates that default rules be set to mimic the result that parties would have reached if the Coase theorem applied. Easterbrook (1993), in contrast, makes the case for forcing negotiation, particularly for complex relationships, such as fiduciary duty, where courts are ill-equipped to determine optimal relational structures.[233] But default rules also influence the costs of transacting, and selecting the "wrong" rule can force needless expenditures on negotiation (Farber 2005, 932). The need to account for transaction costs, such as the effects of private information, led Talley (1993) to use mechanism design and the Coase theorem to construct a case for *non-enforcement* of penalty clauses that include sub- or supra-optimal liquidated damages.[234] This, Talley showed, provides agents with an increased incentive to accurately reveal valuations in the renegotiation process, enhancing the probability of efficient breach and minimizing information-related inefficiencies.

6.1.6 *Constitutional Law*

The Coase theorem has been applied to constitutional questions only infrequently, though one of hits earliest applications (Buchanan and Tullock 1962) indirectly implied that a constitution can be

[231] Rainer's (2007) application of the Coase theorem to prenuptial agreements is less optimistic, recognizing that norms, wealth constraints, and information problems may limit the theorem's applicability here.

[232] See, e.g., the survey in Kessler and Rubinfeld (2007, 349-350).

[233] The primacy of contract here is nicely illustrated by Easterbrook (1999, 110-11): "Let me give you a theorem: the more complex the problem, the more the 'right' answer varies over time and the affected population; and the easier it is to address the problem by private contract, the less we should attempt to resolve it by law. Actually, that theorem has a name: The Coase Theorem." For an alternative view, see Johnston (1992).

[234] Liquidated damages are penalties for breach that are agreed to during the contract formation process and stipulated in the contract.

conceived of as a set of Coasean bargains.[235] The one area where Coase's result *has* been frequently invoked is in discussions of the Fifth Amendment takings clause,[236] where it has been argued both that governmental takings of private property are not justified, since negotiations would have bought about that result if it was wealth-enhancing, and that government taking power is an efficient response to the reality of transaction costs.[237] But as a number of recent commentators have emphasized, there are any number of rights in the U.S. Constitution that could be or have been subject to Coasean bargains, including the sovereign immunity provision of the 11th Amendment (Farber 1996), the separation of powers (Sidak 1991a; 1991b) and (Koh 1991), and freedoms of religion (Mueller 1997) and speech. On the speech front, Brietzke (1996) uses the theorem to justify legal prohibitions on racist speech, while Rasmusen (1998) draws on it to justify legal sanctions for the desecration of symbols, such as a national flag.

The lesson here is that constitutional provisions can sometimes be bargained around, either because they are not inalienable or because people can simply work around them. For example, a decision to find a constitutional right to a parental veto of underage abortion, or a finding that parents have no such right, may well be irrelevant, as parents and daughters can strike bargains in return for their preferred outcome—e.g., parents agreeing to pay expenses associated with the baby and its care, fund college tuition, etc. or the daughter offering parents something that they value, such as getting her college degree, in return for their permission. These examples are admittedly not typical applications of the Coase Theorem, but they do "aptly illustrate the startling insights which the Coase Theorem can prompt" (1997, 403).[238]

6.1.7 *The Coase Theorem in Judicial Opinions*

For all of its prominence in the legal and economic analysis of law literatures, the Coase theorem has played a very small (overt) role in judicial decision making. Its reasoning has been invoked in only 30 judicial opinions in U.S. Federal and State Courts,[239] with the theorem mentioned by name six

[235] It has been suggested, for example, that both the Magna Carta and the U.S. Constitution can be viewed as the outcome of Coasean bargains (Glaeser and Shleifer 2002; Djankov et al. 2003).

[236] The takings clause of the Fifth Amendment to the U.S. Constitution ("… nor shall private property be taken for public use, without just compensation") limits the authority of government to seize private property.

[237] The two earliest references here are Michelman (1967) and Sax (1971). For more recent discussions, see Fischel (1985) Miceli and Segerson (2006).

[238] It hardly needs stating that Farber's sentiments are very much in keeping with the theorem's benchmark function as "a heuristic generator of insight" (Bergstrom 1989, 1157-58),

[239] The data comes from searches conducted by the author on "Coase theorem," "Coase," and "Problem of Social Cost" in the WestLaw and LexisNexis databases of U.S. Federal and State Court cases. The results were then examined for the use of Coase theorem-type arguments. We define Coase theorem reasoning rather strictly here. For example, the several references to Coase that simply invoke least-cost avoider arguments (a form of the "normative

times.[240] The cases in question come from a variety of areas of law—e.g., property, torts, contract, bankruptcy, labor, taxation, securities—and numerous jurisdictions. That said more than 40 percent of the invocations of the theorem come from Judges Posner (9) and Easterbrook (4) though, curiously, neither is among the judges using the term, "Coase theorem" in their opinions.[241]

It is not clear that the decisions in any of the cases in question turn on the theorem. The discussions of it tend to be very brief and constitute just one piece of the court's reasoning. Fourteen, or nearly half, of these opinions involve a judicial assessment that the parties can and perhaps should be expected to make adjustments via negotiation, occasionally with qualifications. A representative opinion comes from Judge Posner, writing on a dispute between Chrysler and one of its automobile dealers, who points out that though "The parties … have divergent interests, … they can be expected to negotiate to the solution that maximizes the net benefits of their relationship."[242] In a similar vein, Judge Kram, writing in a bankruptcy case, holds that "When a distressed or nearly bankrupt firm seeks to reorganize its financial structure, the incentives among those financially interested in the firm would generally be to contract to the efficient solution and avoid the transaction costs of a bankruptcy proceeding."[243]

The invariance principle is referenced in roughly half of the cases, sometimes in tandem with the discussion of negotiated solutions or a competitive markets version of the theorem,[244] but also as a stand-alone claim. Judge Posner, for example, writes, "We should recognize initially that, when those affected by a chosen default rule can easily bargain around it to agree to a mutually beneficial course, the rule choice will generally make little difference to the parties' actual agreement."[245] Judge Easterbrook, who invokes invariance on multiple occasions, sounded a similar note when suggesting

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Coase theorem") do not qualify. Harrison (2012, 24-25), for one, takes a more expansive view. It should also be noted that judges may have invoked Coase theorem reasoning without referencing or mentioning Coase, as a result of which our data would understate the true citation count. Landes and Lahr-Pastor (2011, S397) provide data on Federal Court opinion citations to Coase as compared to Arrow, Becker, Samuelson, and Stigler.

[240] A search of the term, "Coase theorem" in WestLaw or LexisNexis turns up more than six cases, but several of the citations are to journal articles using the term in the title (e.g., Kelman 1979), with the opinion making no reference to Coase's result. It should be noted that there are more than 100 opinions referencing Coase, 52 of which cite "The Problem of Social Cost" and another six of which cite "The Federal Communications Commission." However, many of these citations are not attached to Coase theorem-type arguments. There are also a small number of opinions that mention the "Coase theorem" without an accompanying article citation.

[241] Posner and Easterbrook both sit on the U.S. Court of Appeals for the Seventh Circuit.

[242] *Chrysler Corp. v. Kolosso Auto Sales, Inc.*, 148 F.3d 892 (1998). Here and elsewhere, however, Posner qualifies his position by noting that the the possibility that bargaining will not take place justifies the court's use of a specific (efficient) remedy.

[243] *UPIC & Co. v. Kinder-Care Learning Centers, Inc.*, 793 F.Supp. 448 (1992).

[244] In these competitive markets Coase theorem opinions, of which there are six, the judges invoke a version of the theorem that has prices adjusting appropriately to account for alterations in legal circumstances—such as for wage rates due to changes in liability for workplace accidents.

[245] *Bidlack v. Wheelabrator Corp*., 993 F.2d 603 (1993).

in a labor law case that "the rule of liability won't matter when the number of parties is small and no one is judgment-proof."[246]

Transaction cost-related qualifications, including structural impediments to bargaining, are frequently cited as a possible barrier to Coase theorem-type solutions, and with various degrees of concern. Judge Williams, in a case involving emissions trading, emphasized that "transaction costs notoriously are not zero,"[247] while Judge Kram pointed to aspects of the law that create hold-up incentives in certain contexts.[248] In light of our discussion of divorce law in section 5.2.3, above, it is interesting to note the divergent judicial perspectives on the matter. Judge Shadur expresses no qualms about efficient and invariant negotiated solutions in this context, asserting that the parties "can negotiate … their financial arrangements during the unpleasantness of the pre-divorce-decree period, with full knowledge as to whether they are dealing in pre-tax or post-tax dollars," calling this "a classic illustration of the Coase Theorem."[249] Judge Holmes, however, provides a very different perspective in his discussion of rights to dependent tax exemptions: "It is one of the great theorems of law that if all sides are rational actors with perfect knowledge and zero transaction costs, the allocation of resources—even including exemptions, child tax credits, and the like—would be the same regardless of the rules we choose. … *But in our fallen world, there are few stages on which rational actors are more outpeopled by the children of wrath than in domestic-relations law*."[250]

All in all, given the paucity of references to the theorem in the case literature it is difficult to avoid the conclusion that the theorem plays a far more significant role in legal scholarship than in judicial decision making, but this is also true for the economic analysis of law generally.

6.2 *Environmental Economics*

The Coase theorem's legacy in environmental economics extends back farther than that in any other applied field of economics,[251] and "The Problem of Social Cost" remains one of the most cited articles in both the environmental and ecological economics literatures (Ma and Stern 2006).[252] Though much of the attention given to the theorem within environmental economics during the

[246] *Reyes v. Remington Hybrid Seed Co., Inc.*, 495 F.3d 403 (2007).

[247] *Michigan v. U.S. E.P.A.*, 213 F3d 663 (2000).

[248] *UPIC & Co. v. Kinder-Care Learning Centers, Inc.*, 793 F.Supp. 448 (1992).

[249] *Coltman v. C.I.R.*, 980 F.2d 1134 (1992).

[250] *Armstrong v. C.I.R.*, 139 T.C. No. 18 (2012).

[251] See, e.g., Milliman (1962) and Kneese (1964), as well as Medema's (2014c) analysis of the uses of the theorem in the environmental economics literature of the 1960s and 1970s.

[252] There is very little overlap among the most cited articles in these fields because of their rather different concerns and approaches.

1970s was wrapped up in the controversy over it and defenses of Pigovian remedies,[253] subsequent decades have seen more practical use made of the theorem as well as the extension of its logic into positive transaction cost situations. And while Harstad (2012, 81) can claim with some justice that, beyond emissions trading, "the influence of the Coase theorem on environmental policy has been limited," Shogren (2012, 351) predicts that "a Coasean-style collaboration and negotiation is [its] future."

One of several lessons taken from the Coase theorem is the idea that externalities are the result of an absence of property rights over the relevant resources.[254] Such is the influence of this view that both the OECD (1977) and the World Bank (1992) have pointed to the need to establish or clarify property rights as a necessary first step in dealing with environmental issues. The pairing of this insight with the theorem's suggestion that the exchange of these rights will lead to efficient resource use has contributed to several important insights for environmental policy. Though the analysis is often grounded in the Coase theorem, proponents of property-rights approaches recognize that transaction costs are not zero. But with well-defined property rights, they argue, the transaction costs associated with the exchange process are likely to be lower than the costs associated with centralized solutions and the accompanying bureaucratic oversight.[255]

6.2.1 *Emissions Trading*

It has become somewhat standard to attribute the insight behind markets in pollution rights, including the cap-and-trade variant, to Coase,[256] but the history is more nuanced. It was Crocker (1966) who first proposed the exchange of pollution rights, and though he does not deny that Coase's article had some influence on his thinking, he found his inspiration in Hirshleifer et al. (1960) and Gaffney's (1961) discussions of efficiency-impeding barriers to the exchange of water resources (Crocker 2011, 4, 15). The other pioneers of this approach, Dales (1968b; 1968a) and Montgomery (1972), also found their fundamental inspiration elsewhere. Over the years, however, the Coase theorem and

[253] Krutilla (2011, 298) provides a recent analysis of the theoretical symmetry between Coasean and Pigovian instruments in the idealized world of zero transaction costs. See also Pezzey (1992; 2003).

[254] The earlier work of Gordon (1954) is also important here.

[255] The property rights approach is sometimes referred to as "free market environmentalism" (Anderson and Leal 1991), an unfortunate moniker conjuring up images of the Grand Canyon being offered for sale to the highest bidder. See, e.g., the reactions to this approach in Blumm (1992) and Hahnel and Sheeran (2009).

[256] As Campbell et al. (2010, 5) have aptly noted, "almost every work of theoretical substance, or pretension on carbon trading, makes reference to Coase's 'The Problem of Social Cost', which is identified as the *fons et origo* of market-mimicking as a fundamental improvement upon command and control as the basic form of regulatory technique." For a representative sample, see, e.g., Stavins (1997, 298), Ellerman (2005, 123), Tietenberg (2010, 360), Crane and Landis (2010, 399n.7), Harstad (2012), and Hahn (2013, 449). This is also true of the textbook literature. See, e.g., Goolsbee, et al. (2016, 675-76).

emissions trading have developed something of a symbiotic relationship. Indeed, a case can be made that the acceptance of the possibilities of emissions trading played a role in the gradual acceptance of the Coase theorem, and there can be little question that the theorem—particularly the competitive markets formulations of it—played a role in the increased attention given to emissions trading in its formative years.

It is certainly true that emissions trading has a Coasean flavor. Yet, as several commentators have pointed out, these systems are at least as Pigovian as Coasean, with government setting quantities rather than tax prices (Masur and Posner 2015, 102-103). Efficiency (as opposed to simple cost-minimization for a given q) then depends crucially on the government correctly setting the initial number of permits. Emissions trading was more tightly aligned with the Coase theorem, in a conceptual sense, through Montgomery's (1972) demonstration that the initial distribution of permits has no effect on the resultant equilibrium.[257] However, the reality of transaction costs, as well as the potential for monopoly power (Maeda 2003) and other forces, suggests both that the extent of permit trading may be lower than the theorem predicts and that market outcomes may not be invariant across alternative initial allocation schemes.[258] Simulations by Rose and Stevens (1993) provide evidence that outcomes are not greatly affected by the criterion used to make initial permit assignments. And while more recent work by Abrell et al. (2011), using data from the European Union's Emission Trading System, find that initial permit allocation and ex-post carbon emissions are correlated, implying that these markets "deviate from the idealised market conditions assumed in the Coase theorem" (2011, 15), Hahn and Stavins's (2011) analysis of data from seven emissions trading systems, including the EU's, finds "modest" but encouraging levels of support for the invariance claim.

6.2.2 *Small-Scale Property Rights Solutions*

A more direct line of inspiration runs from the Coase theorem to smaller-scale applications of the property rights approach *cum* exchange approach to managing environmental and natural resources (Anderson and Libecap 2014).[259] Conservation easements, land trusts, individual transferable quotas (ITQs) in fisheries and water-trading projects, all increasingly prominent over the last thirty years, have an underlying logic that has been linked to the Coase theorem. And because of the small numbers and potential for relatively low costs of transacting, property rights solution are considered germane to issues ranging from localized water pollution (Söllner 1994) to salinity management

[257] Montgomery makes no mention of Coase in his 1972 analysis.

[258] See Hahn and Stavins (2011), as well as Maeda (2003), Krutilla (1999), and the references cited therein.

[259] Other broad-based discussions of this approach can be found in, e.g., Anderson and Leal (1991) and Meiners and Yandle (1998; 1998).

(Greiner and Cacho 2001) to common pool problems associated with wind farms (Kaffine and Worley 2010).[260]

Although the literature is not replete with illustrations of true Coasean bargaining over environmental problems, the rapid growth of land trusts in recent decades is considered by some an illustration of the Coasean bargaining process at work, despite the fact that these trusts are often attended by governmental subsidies (Anderson 2004, 363).[261] More common are Payment for Environmental (or Ecosystem) Services (PES) systems, which are, as Engel et al. put it, an "attempt to put into practice the Coase Theorem" (2008, 665). Under a PES system, an environmental services buyer offers to pay an environmental services seller to undertake an activity that benefits the buyer—e.g., watershed management or reforestation of deforested land. The buyers may be users of the service—the form of PES program that closely approximates the Coasean environment—or the project may be government-financed, the latter being particularly relevant when the requisite conditions for Coasean bargains are not present.[262]

There is wide agreement that the conditions necessary for user-financed (Coasean) systems are absent in the vast majority of cases. And while examples of user-financed PES schemes do not abound, they can be found for watershed services and carbon sequestration in Ecuador (Wunder and Albán 2008), watershed and biodiversity services in Bolivia (Asquith, Vargas and Wunder 2008), watershed services in Nicaragua and Guatemala (Corbera, Kosoy and Tuna 2007), and wildlife conservation in Cambodia (Clements et al. 2010) and Africa (Nelson et al. 2010). The difficulties that can attend the Coasean schemes are on full display in Abildtrup et al.'s (2012) study of attempts by Danish waterworks to set up voluntary agreements on pesticide use with nearby farmers.[263] Abildtrup et al. found that these negotiations failed in the majority of cases, typically due to disagreements over compensation and, in keeping with Ellickson's findings, a feeling that the "polluter pays" principle was being violated. Information problems also prevented objective calculation of damages, giving framers an incentive to overcharge, and negotiations were lengthy, with farmers sometimes refusing to enter into negotiations at all. This led Abildtrup et al. to question the theorem's robustness and to conclude that policies which encourage such negotiations are likely to yield disappointing results.

[260] Anderson and Libecap (2014, 134-72) provide an overview and illustrations.

[261] See also Beckmann and Wesseler (2007) on farming and Depres et al. (2008) on water pollution. An attempt to make water policy in Chile on Coasean lines, however, has not come without criticism (Bauer 1998).

[262] Wunder (2005, 3) provides a formal definition. Such systems are sometimes referred to as a hybrid of Pigovian and Coasean solutions, though it is reasonable to question whether they are effectively different from Pigovian subsidies.

[263] These farmers have the right to use fertilizers and pesticides even though they may pollute the drinking-water supply.

The relatively limited extent of Coasean bargaining over environmental issues and the propensity for direct governmental involvement in many PES programs provides evidence for the significant role that transaction costs play in these situations.[264] The informational asymmetries, problems of property rights specification and enforcement, and non-participation/free-rider issues loom large here, and these effects are only exacerbated by the trans-jurisdictional (and especially international) nature of many of these spillovers.[265] Matsumoto's (2011) finding, using Japanese data on environmental disputes, that the duration of negotiations increases, and the likelihood of negotiated solutions decreases, with the number of participants only adds to the concerns. Harstad (2012) contends that some of these problems can be avoided by assigning rights in the relevant *input* (e.g., fossil fuel) *deposits*, while Kleindorfer and Orts (1998) and Cohen and Santhakumar (2007) suggest that greater government-mandated information disclosure may increase the likelihood of Coasean bargaining.[266]

While Brown et al. (2007) conclude that transaction cost concerns weigh in favor of direct state action, Krutilla (1999, 258-59) cautions that these solutions, too, are attended by significant (and sometimes under-appreciated) transaction costs, including those associated with administration, monitoring, and enforcement of centralized remedies, as well as the costs of rent-seeking over environmental tax revenues, and cautions that these must be carefully balanced against those resulting from market-oriented options.

6.2.3 *Smoking Bans*

One of the more interesting practical applications of the Coase theorem has been its deployment in arguments against smoking bans in bars and restaurants. The idea that the theorem could be applied to second-hand smoke has been called "the height of absurdity" (Phelps 1992, 430; Hofmann and Nell 2012, 238-39) because of the transaction costs involved in having smokers and non-smokers negotiate with each other.[267] Despite the soundness of this position, that is not what the Coase theorem-based arguments utilized in this context suggest. Instead, they involve a version of the single-owner argument.

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[264] See, e.g., Hackl et al. (2007), Engel et al. (2008), Gong et al. (2010), Vatn (2010), and Tacconi (2012). A recent overview is provided by Schomers and Matzdorf (2013).

[265] See, e.g., Huber and Wirl (1998), Anderson and Grewell (1999), Barrett (1999), Helland and Whitford (2003), Congleton (2004), Graves (2009) and Harstad (2012).

[266] Bui and Mayer (2003), however, provide evidence questioning the impact of disclosure rules.

[267] Bulow and Klemperer (1998, 358) and Bulow (2003, 738) contend, though, that the negotiation approach likely operates for second-hand smoke between spouses.

While transaction costs between smokers and non-smokers are likely to be prohibitive, ban opponents contend that the interests of restaurant owners render those costs irrelevant because the owners' profit-maximization calculus internalizes all relevant externalities.[268] Outcomes then are efficient on an individual restaurant basis, with some choosing smoking, some non-smoking, and some a mix (along with smoke mitigation technologies and related arrangements). The implication, then, is that smoking bans allocate inefficiently large amounts of space to non-smokers and inefficiently small amounts of space smokers.[269] The empirical evidence here, though, is mixed. If the Coase theorem applies, we would expect a smoking ban to negatively affect restaurant and bar profits. Boyes and Marlow (1996) and Dunham and Marlow (2003) provide some evidence to support this conclusion. Alamar and Giantz (2004), in contrast, find that smoking bans have increased profitability, while Adams and Cotti (2007) find that these bans reduce bar employment but have neutral or even slightly positive impacts on employment in restaurants.

* * *

The Coase theorem-inspired approaches to environmental issues are, perhaps understandably, not without their critics. Concerns over intergenerational spillovers (John and Pecchenino 1997; Gerlagh and Keyzer 2001), the morality of ostensibly commodifying the environment (Reibstein 2010; Gómez-Baggethun et al. 2010; Vatn 2010), and the pursuit of efficiency at the expense of sustainability (Gowdy and McDaniel 1995) feature regularly in the literature today, as they did during the Coase theorem controversies of the 1970s. These concerns, along with social norms of fairness, may be as significant as transaction costs in explaining why conflict—as in Cooter's Hobbes theorem—appears to be more common than Coasean bargaining when it comes to dealing with environmental issues (Van den Bergh 2007).

6.3 *Finance*

If Becker's "Rotten Kid Theorem," is, as Bergstrom (1989, 1138) has labeled it, the Coase theorem's younger sibling, then the Modigliani-Miller theorem (Modigliani and Miller 1958) is it's slightly older brother. Hirshleifer (1973, 129) and Alchian and Demsetz (1973, 26) seem to have been the first to point up the similarity between the Coase theorem and the Modigliani-Miller claim that a firm's financing decisions are without consequence for firm value in a perfect capital market, and

[268] Tollison and Wagner (1988, 74) argue that parents internalize these smoke externality issues for their children in similar fashion.

[269] See, e.g., Tollison and Wagner (1988), Boyes and Marlow (1996, 58-59), Dunham and Marlow (2003), and Craven and Marlow (2008). Alamar and Giantz's (2004, 524) argument that the Coase theorem fails here because it does not take into account the preferences of restaurant staff ignores related conclusion that smoking-related implications for labor supply and wages, too, would enter into the owner's calculus.

Monissen (1976, 412) soon made this explicit, saying that Modigliani-Miller "can be interpreted as a special case of the more general Coase Theorem."[270] Not long thereafter, Fama (1978, 282) drew on the Coase theorem in defense of Modigliani-Miller to show that the maximization of the wealth of stockholders and bondholders is the only rule consistent with a stable capital market equilibrium.[271] Like the Coase theorem, Modigliani-Miller has been controversial, suggesting that "chief financial officers (and their highly compensated investment banker consultants)," as with the Coase theorem's judges, are essentially irrelevant (Gilson and Kraakman 2002, 719). It, too, has been used both as an argument against regulation and as a baseline against which to analyze the relaxation of its assumptions to capture important aspects of real-world activity. And, as in the case of the Coase theorem, the empirical evidence is not definitive.[272]

But the applications of the Coase theorem in the financial realm go well beyond Modigliani-Miller per se. Regulations pertaining to information disclosure,[273] insider trading,[274] and bankruptcy[275] have been criticized in light of the possibilities suggested by the Coase theorem and supported based on the impediments created by transaction costs. For those disposed to favor the Coase theorem as a tool for financial markets analysis, the sophistication of agents and the plethora of available contracting forms create a presumption in favor of the efficiency of contract—or at least its superiority over regulatory approaches (Easterbrook and Fischel 1991). As Whitman (1993, 880) put it, "Doubtless some bargaining failures do and will occur, but since the Coasian model reflects reality with sufficient regularity, it provides a fully acceptable working assumption for further analysis." And evidence such as that from La Porta et al. (2006) that public enforcement, beyond providing a

[270] See also Alchian (1979, 247) and Krause (1998).

[271] Bernholz's (1997; 1999; 2012) demonstration that the Coase theorem generalizes to the larger set of collective action problems in a cooperative game setting with binding contracts is germane here, as this setting includes joint stock companies. Though Fama and Miller (1972) do not mention the Coase theorem, their discussion of capital markets is very instructive as to the commonalities here.

[272] See, e.g., Grossman (1995); Acheson and Turner (2006), and Weinstein (2003) finding in favor of invariance, and Esty (1998), Grossman (2001), and Grossman and Imai (2013) providing results that are at odds with it. For further discussions of aspects of Modigliani-Miller in a Coase theorem context, see, e.g., Meiners et al. (1978), Easterbrook and Fischer (1991) and Presser (1992) on limited liability, Aivazian and Callen (1980a) on the effects of non-callable debt, Macey (1995) on whether banks should be allowed to participate in governance of their corporate borrowers, and Mayers and Smith (1982) on mechanisms of accounting for risk.

[273] See, e.g., Easterbrook and Fischel (1991), Greenwood et al. (2006), La Porta et al. (2006), and Leuz (2007).

[274] See, e.g., Carlton and Fischel (1983) and Haddock and Macey (1985).

[275] See, e.g., Webb (1987; 1991), Asquith et al. (1994), Shleifer and Vishney (2011) and Zimmer (2012), as well as the opinion of Judge Kram cited in section 6.1.7, above. Zimmer's case study of a situation in which the theorem's prediction was borne out is particularly interesting.

framework to encourage contracting, tends not to affect the growth of stock markets, provides support for those who favor the Coase theorem-inspired contracting approach.[276]

That said, there is no shortage of criticism of those who would view financial markets through the lens of the Coase theorem,[277] nor of empirical findings that support the critics. Predictably, the criticisms tend to be grounded in the prevalence and magnitude of transaction costs, which, in turn are said to provide a rationale for governmental supervision of banks and for a regulatory structure to organize financial transactions, as well as for regulations protecting minority shareholders, creditors, and the like. Even so, some critics acknowledge that the argument for assuming low transaction costs in securities markets, which "render[s] most laws and regulations unnecessary" and perhaps even damaging, is "powerful" (Glaeser, Simon and Shleifer 2001, 853-54). The lesson, following Miller (1996), is that case for regulation, is situation-dependent, requiring careful exploration of the costs of transacting.

6.4 *The Firm and the Organization of Industry*

Much has been made of the possible relationship between Coase's two most influential articles, "The Nature of the Firm" (1937) and "The Problem of Social Cost" (1960). Coase himself made this connection in 1960 when he raised the prospect of a single firm efficiently internalizing externalities between two producing agents, and a number of more recent commentators have emphasized the important role that transaction costs play in these two articles. But there are also those who see a very bright line between them—the former focusing on a world in which transaction costs are pervasive and the latter a world in which they are zero[278]—with very straightforward implications for the bargaining process. Hart (2008, 406), for example, has called "The Problem of Social Cost" "problematic for followers of Coase (1937)" because, "in a world of Coasian bargaining, it is hard to see why important aspects of organizational form such as authority, hierarchy and delegation matter. Why would the parties not simply bargain about everything all the time, using monetary side-payments?"[279] What we find at the intersection of Coase (1937) on the one hand and Coase (1960) and the Coase theorem on the other is a call to examine the effects of transaction costs and property rights on the contracting process—whether to theorize about contractual forms that can mitigate the

[276] In addition to the theorem-friendly findings cited earlier in this section, see also Glaeser et al. (2001) and Ryngaert and Scholten (2010). For an alternative perspective on Ryngaert and Scholten's findings, see Listokin (2009).

[277] See, e.g., Presser (1992), Miller (1996), Beck et al. (2006), and Beck and Levine (2008).

[278] It is important to reiterate that, contrary to common perceptions, "The Problem of Social Cost" emphasizes the reality of transaction costs.

[279] Thus, Hart says, "in order to make progress on the Coasian agenda, we must move away from Coase (1960) and back in the direction of Coase (1937). We need to bring back haggling costs!" (2008, 406).

effects of transaction costs, better understand (and develop theories to explain) contracts as written, or to assess implications for the organization of production.

It is sometimes suggested that firms *would not exist* in a world of zero transaction costs, but this is not strictly correct. Instead, there is no transaction cost-related *rationale* for the existence of the firm in this world; firms and markets are equally efficient here, just as are Pigovian taxes and negotiated solutions in the presence of externalities. It nevertheless is reasonable to conceive of a firm as an optimal response to departures from a Coase theorem world.[280] The transaction-cost approaches pioneered by Williamson (1971; 1975) and Alchian and Demsetz (1972), and the nexus of contracts approach that developed out of the work of Jensen and Meckling (1976) can be thought of as explanations for outcomes when the Coase theorem's zero transaction costs assumption does not apply, giving rise to, e.g., monitoring problems and opportunistic behavior.

The property rights approach to the firm, developed particularly in the work of Grossman, Hart, and Moore,[281] builds on the work of Williamson et al. but emphasizes the property rights side of the Coase theorem. We have already noted that the reality of transaction costs precludes complete contracts. In the hands of Grossman-Hart-Moore, organizational structure turns on the implications of property rights—residual rights of control, or ownership rights—for resolving conflicts under contractual incompleteness, particularly via the influence of these control rights on the parties' bargaining positions. The first wave of this scholarship largely eschewed complications introduced by transaction costs in allowing agents to bargain costlessly ex post. More recent work, however, has brought these costs squarely into the picture, in the form of "aggrievement costs" and their influence on contractual performance, to offer explanations for the form and structure of contracts (Hart and Moore 2008; Hart 2009) and the scope of the firm (Hart and Holmstrom 2010).[282]

6.5 *Politics*

No small amount of the support for the Coase theorem lies in the possibilities it is said to offer for taking politics out of the policy picture. But the view that politics is fundamentally exchange

[280] A similar explanation has been offered to explain two-sided markets, which have been depicted as instances of network externalities to which the Coase theorem does not apply (Rochet and Tirole 2006). Here, the platform can be thought of as a transaction-cost reducing institution (Spulber 2010). In a Coase theorem world, all markets are one-sided, which casts some doubt on regulatory concerns based on the presence of network externalities (Rochet and Tirole 2006; Niman 2002).

[281] See, e.g., Grossman and Hart (1986), Hart (1989), Hart and Moore (2005; 2008), and Hart and Holmstrom (2010).

[282] Aggrievement arises when contractual performance falls below expectations, and it gives rise to costs in the form of retaliation and shading on performance. One finds some experimental support for the idea that perceptions of one-sidedness in contracts may promote non-cooperation in the experiments discussed in Thaler (1991; 1992). See also Ulen (1994, 516).

suggests that the theorem lends itself nicely to theorizing about political processes. And, in fact, the theorem has been employed to analyze issues across the spectrum of political jurisdictions—from local land use to international conflict.

6.5.1 *The Political Coase Theorem*

The "political Coase theorem" tells us that, under appropriate conditions, the outcomes of the political process will be efficient and that the political decision rules and other institutions in force will have no bearing on the ultimate outcomes, whether that be public good provision or growth rates.[283] One version of this story builds on Becker's (1983) analysis of political competition and its efficiency-promoting properties.[284] The Acemoglu-Parisi strand, however, relies on the possibility of Coasean bargains among political agents and, in doing so, calls to mind the commonalities between Buchanan and Tullock's analysis in *The Calculus of Consent* (1962) and Coase (1960). Wittman's (1995) extensive defense of the efficiency of democratic processes, which, he argues, tend to serve a transaction-cost-reducing function, draws on both literatures.

The first formal demonstration of what is now referred to as the political Coase theorem comes from Bernholz (1997; 1999; 2012), who showed that the Coase theorem generalizes to the larger set of collective action problems in a cooperative game setting with binding contracts, obviating difficulties with empty cores and free riders. Further reinforcement for an efficient and stable political Coase theorem equilibrium has been provided by Parisi (2003) and Luppi and Parisi (2012).

In a political Coase theorem environment, the need for public choice analysis and much of public finance disappears. Arrovian intransitivities are not a problem (Parisi 1997); logrolling is always efficiency enhancing (Parisi 2003); public goods provision, regulations, and the tax code are efficient (Cooter 2000; Sproule-Jones and Richards 1984; Hammond 1990); rent seeking is eliminated (Aidt 1997; Epstein and Nitzan 2002); welfare-reducing distributional effects of legal rules would immediately be remedied through the political tax-and-transfer system (Fennell and McAdams 2015); and Tiebout and federalism would both be irrelevant (Migué 1997). In short, there is no government failure.

The problem, of course, is that actual political conditions are unlikely to resemble the stringent conditions required by the theorem. Transaction costs are the source of a multitude of

[283] See Vira (1997), Acemoglu (2003) and Parisi (2003), as well as Cooter (2000) and Klick and Parisi (2003). It was Vira who first used the term "political Coase theorem" in print.

[284] See also Stigler (1992). Becker did not link his own theory of political competition to the Coase theorem, but others have. See, e.g. Munger (1990, 296).

problems—particularly for bargaining over multi-dimensional policy issues (Luppi and Parisi 2011). At the heart of the problems for the theorem, though, is the inability of agents to make enforceable political commitments given the incentives to renege on intertemporal contracts.[285] An experimental test of the political Coase theorem by Galiani et al. (2014) provides some support for the relationship between commitment possibilities and social welfare, though neither low nor high commitment opportunities generate the extreme non-cooperative and cooperative results (respectively) that the theory predicts.

These realities have led Acemoglu (2003, 622) to conclude that while the political Coase theorem theorem may be a "useful benchmark," a conflict model, *à la* Cooter's "Hobbes theorem," provides the best approach to analyzing political differences—a sentiment echoed by Vermeule (2010). But the literature suggests a more extensive benchmark role for the political Coase theorem, just as for its traditional counterpart. Douglas North (1990, 109) tells us that the institutional policy problem is to "make the political market approximate the zero transaction cost model for efficient economic exchange" and, as Parisi (2003) emphasizes, the analysis of a frictionless political world provides insights into rule-related reforms that could enhance the efficiency of the political decision-making process. The breakdown of the political Coase theorem, owing to transaction-cost and commitment problems, provides a window into topics including bargaining over multi-dimensional policy issues (Luppi and Parisi 2012), the evolution of transaction-cost-reducing rules of procedure (Shepsle and Weingast 1984), the design of optimal monetary institutions (King 2004), the question of whether distributional goals are best pursued through the legislative or the judicial branch (Fennell and McAdams 2015),[286] and even transition by coup (Acemoglu and Robinson 2001).

6.5.2 *Federalism*

The Coase theorem has also provided the basis for a theory of federalism, originally developed by Inman and Rubinfeld (1996; 1997b; 1997a), which suggests that negotiation between political jurisdictions—e.g., between the federal government and the states, between states, or between a state

[285] See, e.g., Besley and Coate (1998), Acemoglu (2003), and Parisi (2003). Guzzini and Palestrini (2010) compare the relative efficiency of temporary and permanent binding contracts in a Coase theorem setting, demonstrating the potential inefficiencies introduced by the former. Interestingly, Jehiel and Moldovanu (1999) show that where transaction costs, save for the ability to commit to future actions (i.e., fully enforceable contracts), are zero, efficiency may not hold but invariance to the initial assignment of property rights does. Mueller (2003, 33) provides an informative summary of some of these issues. As Levinson (2011) points out, however, constitutional commitments offer the prospect of overcoming some of the problems associated with political commitments.

[286] Fennell and McAdams contend that the transaction costs associated with the political process may render the judicial branch the superior venue for the pursuit of distributional goals—a view that contrasts with Posner's (1990, 360) contention that efficiency is best pursued through the judicial branch and distributional goals though the legislature.

and its municipalities—can resolve inter-jurisdictional externalities. Based on this, Cooter (2010, 139) has posited a "Federal Coase Theorem," which states that, "assuming zero transaction costs, the supply of public goods and the control of externalities are efficient regard less of the allocation of powers to different levels of government." A further implication is that the *form* of government—whether a single national government or a confederation of states—has no bearing on the outcome (Inman and Rubinfeld 1997a, 80).[287] The point, of course, is not to insist that the allocation of powers across different levels of government does not matter, but to identify the reasons, often related to transaction costs, why it does and the implications for efficient governance structures.

One of the several interesting insights to emerge from this literature goes to the limitations of direct democracy (Merrill 2010, 284-85). If the decisions of jurisdiction *A* have impacts on jurisdiction *B*, bargaining between government officials in those two jurisdictions allows the spillovers to be taken into account in a way that local voting cannot. Consider the NIMBY problem. If *B* is the best place to put a landfill, then officials in *A*, *C*, *D*, … can negotiate compensation with officials in *B* to approve the locating of the landfill there. Under democratic voting, the transaction costs associated with negotiating compensation with each voter effectively preclude negotiation, meaning that voters in *B* likely would reject the proposal.[288] This, then, has important implications for the allocation of political decision-making authority at the state and local levels.

The complications of inter-jurisdictional bargaining, of course, can be severe, as we have already seen.[289] On the theoretical level, the frequency of incomplete contracts in inter-jurisdictional agreements has led Lülfesmann (2002) to suggest that the Grossman-Hart-Moore approach (discussed in section 6.4, above) provides the more suitable vehicle for analysis. And in a practical vein, some, and perhaps many situations undoubtedly require that the national government institute policies to deal with inter-jurisdictional spillovers. Yet, there is reason to believe that the practical effect of these limitations in small-numbers bargaining situations may not be overly restrictive (Feiock 2007; Feiock, Steinacker and Park 2009), and Inman and Rubinfeld (1996, 1289-97) are sufficiently optimistic about the possibilities to recommend that national policies be designed with a view to facilitating Coasean bargains.

[287] The connection of this insight to the relationship between Coase (1937) and the Coase theorem should be obvious.

[288] Sobel (1997, 473-74) and Wildasin (2007) provide applications of the theorem to the allocation of taxation authority across governmental jurisdictions.

[289] In the present context, see also Rubinfeld (1997), Jéhiel (1997), and Lülfesmann (2002).

6.5.3 *Zoning*

The property rights approach to zoning, too, was inspired by the Coase theorem, with Fischel's (1978) realization that zoning works as a de facto property right, vested in the community. The theorem tells us that it does not matter whether the the property right "belongs" to the community or the individual landowners; one party will purchased more highly valued use rights from the other regardless of how the rights are initially assigned (Fischel 1985, 232). As such, any zoning restrictions that persist will be efficient in a Coase theorem world.

Some, in what Hovenkamp (2002, 528) has called "exuberant displays of enthusiasm over the Coase Theorem," have used the theorem to infer that zoning is not necessary because agents can privately contract over land-use controls to maximize joint wealth (e.g., Siegan 1972; Ellickson 1973). A somewhat less exuberant approach views *the zoning process* as an efficient response to transaction costs. Assume, following Fischel (1980; 2015) that planners are subject to the will of political majorities in the jurisdictions in which they operate. In bargains between the citizens and developers over land use, the planners, as representatives of the people, turn a large numbers situation into a small-numbers situation (1980, 74-75),[290] providing a transaction cost-reducing institutional response to prohibitive political transaction costs at the local level. Moreover, if local governments are responsive to the median voter, then any land-use rules that emerge, including zoning, can be seen as the efficient outcome a Coasean bargain between the citizens/goverment and developers (Fischel 2015, 242ff). If this view of the zoning process is accurate, the effects of zoning restrictions are purely distributional—e.g., transferring wealth from private developers and owners of undeveloped land and the general public. Berry (2001) and Groves and Helland (2002) provide some evidence supporting this position.[291]

6.5.4 *Trans-National Agreements*

Suggestions that the Coase theorem can be applied to international conflicts (e.g., Friedman 1977) have met with significant resistance. Breakdowns of the theorem in situations as diverse as pollution control (Cooper 1995, 37; Barrett 1999), the US-Soviet arms race (Anderton 1990), and the Middle East conflict (Cowen 2004b; 2004a; Plaut 2004; Rowley and Taylor 2006; Rowley and Webb 2007) have been cited to counter the theorem's applicability, with responsibility ascribed to factors ranging

[290] In this sense, planners perform the same function as the class action lawsuit serves in the legal realm—aggregating many agents into a single bargaining unit. See section 6.1.4, above.

[291] Viewed from the perspective of property law, zoning regulations may also function as a solution to fragmented property rights, the transaction costs associated with which can preclude efficiency Coasean bargains (McMillen and McDonald 1993).

from transaction costs (including the ubiquitous enforcement problems) and the absence of property rights to the complete failure of the theorem's behavioral premises to apply to these conflicts.[292]

On the other hand, the theorem *has* been used to provide the underpinnings for free trade arguments (Findlay and Wellisz 1982; Cooper 1995), as well as for the fact that trade rivalries seldom give rise to full-scale trade wars as the Hobbes theorem and the prisoner's dilemma might predict (Conybeare 1984). Here, transaction costs become the explanation for the existence of tariffs, for pessimism regarding the optimality of such trade agreements as are reached (Cooper 1995; Dudley 1998), and for the role of larger political complications in the (non-)settlement of trade disputes at the WTO (Guzman and Simmons 2002).

The goal, then, is to identify institutional structures that will facilitate negotiated solutions. Sykes (1999, 32-33) draws on the theorem to argue for forcing bargaining to resolve disputes over regulations that, while not instituted for protectionist purposes, have protectionist effects. Because the involved governments have a range of chips (perhaps not even related to trade) to bring into the bargaining process, he says, negotiated settlements offer better prospects for efficient outcomes than rigid rules imposed by organizations such as the WTO. Keohane (1982; 1984), meanwhile, invokes a version of the single-owner argument in suggesting that the transaction costs associated with international conflicts create demand for trans-national regimes, such as the European Union. These regimes, he argues, reduce transaction costs and so facilitate international agreements. The logic of this position notwithstanding, the EU's violation of the "Linguistic Coase theorem" (Portuese 2010) and the resulting costs imposed by its lack of a common language function as a cautionary tale, illustrating that the ability of these institutions to efficiently reduce transaction costs poses a significant challenge for institutional design.

6.6 *Development and Transition*

There are strong incentives for Coasean bargains that would replace inefficient institutions with those that are growth-promoting and poverty-alleviating (Olson 1996, 23). For example, their is scope for a Coasean bargain between rich and poor nations that would have labor migrate from the low-productivity to high-productivity countries, generating gains well in excess of the associated transaction costs (Olson 1996, 9. But the reality is that such bargains typically are not made. At the national level, the prescription to simply "assign private property rights," which will then flow to their highest valued uses, has been blamed—and the Coase theorem with it—for the problems with

[292] The argument here is that moral, religious, ethnic, and other considerations may be at least as important as material considerations and often are not amenable to Coasean bargaining.

transition to market systems in Eastern Europe.[293] Why are these bargains not made? The answer, obviously, lies in the importance of transaction costs and institutions—toward which the benchmark reading of the theorem points us.[294]

Corruption, which Hodgson and Jiang (2007, 1056) have called "the nemesis of the Coasean solution," poses a significant impediment to the enforcement of Coasean bargains in many developing and transitional areas (Sutter 1995; La Porta et al. 2000). But the Coase theorem reveals that political corruption may be efficiency-enhancing, with bribery improving on allocation practices otherwise used by public sector agents. These bribes internalize to political agents the full cost of inefficient decisions. This, in turn, works as a low-cost method of redistributing wealth and prevents self-interested political agents from expropriating wealth in less efficient ways.[295] Of course, these efficiency claims turn on the desire of agents to maximize social wealth, the ability to enforce corrupt contracts, and the wider effects of corruption of which this bribe scheme is a symptom.[296] But the lesson is that the welfare effects of corruption may well be situation specific and, in some instances, rooting it out may do more harm than good.

Fractionation of coercive authority also can be a particularly serious problem in many developing and transitional areas. While a monopoly of coercive force and attendant minimization of expropriation is likely efficiency-enhancing (per Olson) and could be achieved via Coasean bargains among competing power groups, the reality is that such agreements tend to break down, leading to instability that is damaging to the growth process (Besley and Ghatak 2010). One consequence of dispersed coercive authority is poorly defined property and contract rights: It is neither clear who has the authority to define those rights nor that they ultimately will be protected (Rubin 1994, 33; Rapaczynski 1996, 87). This, in turn, may mitigate the efficiency-promoting effects of corruption pointed to by Sheifer et al.

6.7 *Labor*

Donohue's (1989) application of the Coase theorem to the data from the Illinois unemployment experiment, discussed above, provides some insight into the alternative perspective that the theorem provides on labor market institutions. Hiring, separation, and job reassignment decisions will be

[293] See, e.g., Deakin and Hamilton (2015), Stiglitz (1994), Sunstein (1992), and Milanovic (2016). Brue and MacPhee (1995, 192-93) found the invocation of terms such as "Coase theorem" by Russian economists in the early 1990s as evidence that some had been keeping up with Western economics.

[294] For two very different views of the utility of the Coase theorem proper as a tool for thinking about development issues, see Erlich and Lui (1991) and Field (1991).

[295] See Shleifer and Vishny (1994), Shleifer (1994), and Boycko, Shleifer and Vishny (1996).

[296] See Aidt (2003, F634-35) for a brief overview of criticisms of this bribery approach.

efficient and independent of the underlying employment law, including, for example, the presence or absence of at-will employment laws (Krueger 1991; Miles 2000), mandatory retirement (Siegfried 1997), and, if workers are able to adjust effort, minimum wage laws (Ippolito 2003). Unions, too, are without purpose or effect in a Coase-theorem world, providing a different justification for the union neutrality position long associated with one segment of the "Chicago school."[297] Employers can negotiate individually with all prospective employees at zero cost, and unions offer no prospect of improving on these contractual terms (Hylton 1992). Unions here also have no impact on prices and employment levels, one implication of the latter being that any gains to union members come at the expense of employers rather than consumers (Dau-Schmidt 1992).

‘ The vast majority of this literature cited here allows that transaction costs are positive in reality and thus that these labor market institutions do matter. Viewing these questions through the lens of the Coase theorem's suggestion that they should not, though, offers new possibilities for explaining the consequences of labor market institutions, and perhaps improving them. But the theorem also cautions us against *presumptive judgments*. Freeman (2001), for example, provides evidence that while labor market institutions have significant distributional effects, their efficiency effects are only minimal. The explanation, he says, may lie in the Coase theorem—that labor and capital reach efficient negotiated solutions regardless of how rents are appropriated.[298] Additional support for this position comes from Hall (2009), who finds that cyclical impacts on labor markets are efficiently resolved in existing bilateral relationships between employers and workers, even though inefficient levels of overall unemployment may remain.

6.8 *The Coase Theorem and "Coasean Bargaining"*

We see in some quarters an implicit assumption that if the Coase theorem can be dispensed with—whether by "disproving" it or by invoking the reality of transaction costs—we can move on to "real" solutions, typically centralized ones. But this "throw-out-the-baby-with-the-bath-water" approach misses out on one of the most important insights to be drawn from the Coase theorem and, indeed, from Coase's larger body of work—including "The Nature of the Firm": The possibilities of bargaining and the associated potential of private ordering.[299] The extent to which we can rely on "Coasean bargaining" is germane both for those who (wrongly we have argued) subscribe to positive transaction costs versions of the Coase theorem and for those who see the theorem as a benchmark,

[297] See, e.g., Friedman (1951) and Rees (1951) .

[298] Caballero and Hammour (2001) provide an alternative perspective on Freeman's findings.

[299] See Farrell (1987), Katz (1996), and Kidd (2014). Farrell (1987, 125-26) put it this way: "People can be ingenious in seeking to improve their lot, and even when markets fail some hope remains for cooperation and efficiency. … [E]conomists should not forget that people can be creative and can bypass unsatisfactory institutions."

suggestive of the possibilities of efficiency-enhancing negotiated solutions under conditions not too far removed from the frictionless world contemplated by the theorem.

Coasean bargaining, in its more narrow form, refers to the process of bargaining around inefficient institutions. More broadly conceived, it refers to bargaining to a joint-maximizing (but not necessarily efficient in a general-equilibrium sense) outcome and so is indistinguishable from Edgeworth processes. Yet, its distinctive naming suggests that there was something new here—a need to look for bargaining possibilities where economists and others had not looked for them before. Perhaps the potential for Coasean bargains are hard for people to notice.[300] But the fact that bargaining is costly does not make it, or efficient outcomes, impossible;[301] in fact, transaction costs can facilitate bargains.[302] Likewise, the reality that there is scope for strategic behavior does not tell us that people typically exploit those opportunities. Even Cooter (1982, 19) for all of his pessimism about the Coase theorem, allows that "gains from trade in bargaining situations are realized more often than not." The question, then, is that of the extent to which extant institutions facilitate, or can be rearranged to facilitate, these private agreements. Ironically, after several decades of focus on the Coase theorem proper, this literature takes us back to some of the very comparative institutional questions that Coase was pointing to in "The Problem of Social Cost."[303]

7. Conclusion

When Adam Smith wrote that the individual pursuit of self-interest, channeled through the competitive marketplace, is the best vehicle for increasing the wealth of a nation, he offered no formal proof. That proof, of something rather more restrictive than Smith had postulated, had to wait nearly two centuries. But this did not prevent his idea from attracting legions of supporters, some of whom saw in Smith's *deus ex machina*, the "invisible hand," a prescription for extreme laissez-faire. Of course, Smith's idea also spawned numerous detractors, who expended no small amount of effort attempting to demonstrate that his theory was erroneous, morally bankrupt, or some combination of these. No small amount of the controversy over Smith's theory owes to its vagueness—particularly regarding the "invisible hand" that would guide the translation from private vices to public

[300] See, e.g., Farber (1986), Donohue (1991), Farnsworth (1999), and Hylton (2000).

[301] Myerson (2008) illustrates how, given transaction costs, mechanism design can provides a framework to assess how the initial assignment of rights affects the probability of reaching an efficient outcome.

[302] See, e.g., Hovenkamp (2011) and Robson (2013).

[303] It is this comparative institutional emphasis in Coase that led McCloskey to formulate—and, in Stiglerian fashion, present in her price theory textbook—her own unique version of Coase theorem: "in the presence of transaction costs the location of a pollution tax or of other liability for damages does matter for efficiency" (McCloskey 1982, 354).

benefits—leaving it to subsequent generations of scholars to fill in the blanks. And so they did, and in a variety of ways.

The Coase theorem's history, like that of Smith's "invisible hand" proposition, is defined at once by ambiguity, controversy, and an ever-expanding domain—to say nothing of resilience. "Like malaria," Cooter tells us, "attacks on the Coase Theorem just seem to make it stronger" (1993, 422).[304] But this resilience, it appears, has brought us to an (unstable) equilibrium in which there are several competing versions of the theorem and a variety of meanings attributed to its central assumptions. Because of this, we have a signifiant segment of the profession which believes the theorem is correct—even if not agreeing on what it is—and a significant segment (game theorists in particular) convinced that it is rubbish. Such ideas are hardly the stuff of textbook microeconomic theory. Yet, the Coase theorem is, and has for decades been, a staple of the microeconomics textbooks from the principles level on up.[305]

There is good reason to doubt that Coase, when originally laying out his negotiation result, had a full understanding of the conditions necessary for it to be true. The same can undoubtedly be said of Smith. An understanding of those conditions has come only as the result of its probing by subsequent generations of scholars. Viewed from this perspective, the Coase theorem controversy is anything but an illustration of "more heat than light." Instead, supporters and critics alike have moved us toward a valid theorem. Having arrived there, we find that the Coase theorem is neither prediction nor testable hypothesis nor descriptor nor policy prescription. It is, and can be nothing more than, a benchmark—a generator of predictive, testable, descriptive, and policy insights. And as with the First Fundamental Theorem that eventually emerged from Smith's insight, it demands that we examine the consequences, for economic theory and for the world in which we live, of the many deviations from the rigid conditions that it imposes.

[304] See also Parisi (1995, 149).

[305] The textbook literature exhibits no more agreement on the specifics of the theorem than does the scholarly literature, as a little casual empiricism will reveal. See also Butler and Garnett (2003) and Medema (2015c).

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