AN OPTION THEORY OF LEGAL ENTITLEMENTS

by

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To Jennifer Gerarda Brown

thou shalt remain

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CHAPTER 1: OPTIONAL RIGHTS

I. *The Option Revolution*

The object of this book is to use option theory to illuminate the structure of legal rights. The project is a natural one. Law and economic analysis tends to absorb (with a lag) the most important discoveries of economics. And the advances in option theory certainly count as one of the most important and pragmatic developments in economic thought in the last 28 years.[1] The Nobel prize in 1997 for Myron Scholes and Robert Merton was richly deserved and suggests the impact of option theory on the field of economics. But the option theory developed in and since the 1970s has had a tremendous impact on the non-academic world as well.[2] The Black-Scholes formula for pricing options quickly traveled from the pages of academic journals to the floors of the option exchanges. This formula is as close as economics has ever come to an $E = MC^2$ expression. Option theory has given rise to a host of new financial products both by identifying missing markets and by giving traders a powerful new way of pricing the new products. The trading of financial derivatives on option, futures and swap exchanges has developed into massive markets.[3]

The collapse of Long Term Capital Management (LTCM) suggests to many the failure of option theory to predict and control risk. After all, at its worst, LTCM was hemorrhaging more than $100 million a day in losses (on one occasion, $500 million). Just as Einstein's relativity theory gave us the H-bomb and nuclear reactor, Scholes' option theory gave us the financial equivalent of nuclear meltdown.[4] For some, LTCM was the *Jurassic Park* of financial arrogance -- teaching us that it's not nice to fool with mother nature. But I believe the real lesson is just the opposite. With 5 billion dollars in equity, LTCM was able to borrow and invest over 150 billion dollars. As with the Wright brothers, what is remarkable is not that this first plane crashed, but that it stayed up in

the air so long. The ability to hedge huge risks has made dramatic headway. It's amazing that LTCM was able to manage a 30 to 1 leverage ratio (of debt to equity) for as long as they did.[5] And the second generation of hedge funds are already back in business creating the kinds of stratospheric leverage that would have been hardly imaginable in the days before option theory.

Option theory has also let finance economists discover options that are implicitly embedded in a wide variety of financial and non-financial phenomena. The analysis of "real" (non-financial) options is a burgeoning new field of scholarship.[6] Seeing these options around us is not merely a redundant recharacterization of existing theories. If that were the case, there would be little payoff to learning the tools of option theory. But, as soon as one discovers a hidden option, it is immediately possible to use pricing theory to evaluate the implicit value of the option -- by focusing on the five fundamental determinants of option value (value of the underlying asset, time to maturity, (risk-free) interest rate, exercise price, and volatility of the underlying asset).

For example, option theory lets us reinterpret shareholders in a firm that has issued debt as having a call option to buy back the underlying assets of the firm from the debtholders (by paying the debtholders the amount of the debt due on the date of maturity).[7] When the debt comes due, if the underlying assets are worth less than the outstanding debt, the shareholders will choose not to exercise their call option (and the assets will belong to the debtholders in bankruptcy). If the underlying assets are worth more than the outstanding debt as it comes due, the shareholders will exercise their call option by paying off the debt, effectively buying back the underlying assets of the firm. Option theory thus makes clear why shares in firm with 100 million in debt due in one year and only 90 million in underlying assets might still trade at a positive value (because the option to

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buy back the underlying assets for $100 million after a year is valuable even though the option is currently "out of the money"). It also illuminates why firms near bankruptcy have incentives to engage in risky behavior.

One of the most important contributions of option theory to our understanding of asset value is that options become more valuable as the volatility in the underlying asset increases. Even though we normally think of risk-averse investors eschewing volatility, it turns out that volatility in the underlying asset unambiguously increases the value of the option itself. The call option interpretation of shares in a leveraged firm thus suggests that shares will be more valuable if the firm's underlying assets are invested in riskier projects.[8]

The analysis of "real" options is also revolutionizing the way businesses analyze investment opportunities. The first impact of corporate finance on MBAs and derivatively on corporate America was in the use of net present value analysis. Instead of comparing the "internal rate of return" to some under theorized "hurdle" rate, MBAs were endlessly taught that it is more appropriate to discount all cash flows to their present value and to invest in projects that had a net present value. The Net Present Value (NPV) revolution was a substantial improvement over the prior technology. The only problem was that NPV analysis ignored the option values that are almost always embedded in real investments. Firms often have (i) the option of discontinuing an investment in mid-stream, (ii) the option of expanding the investment, or (iii) the sometimes valuable option of delaying the beginning of an investment. Even investments that have a negative net present value may be profitable if the option components are properly valued. And in choosing between two alternative investments, the one with the lower expected NPV may actually be superior

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if its option values are systematically superior.[9] The current revolution (which is slowly percolating through to the MBA curriculum) is to modify the standard NPV approach to take account (and price the value) of these real options.

II. *Legal Options*

So it should not be surprising that these powerful ideas might provide some useful analysis for legal issues as well. Legal scholars of corporate law have already been putting the theory to good use in analyzing issues of corporate governance and bankruptcy – for example, finding the real options component in convertible bonds.[10]

But the law creates options in many other contexts as well. The Holmesian notion that a promise is the duty to perform or pay damages, can be reconceived as a promissor's option. Option theory can be used to price this breach option.[11] The importance of option theory in private contracting is dramatically illustrated in recent litigation involving Rent-a-Center.[12] Rent-A-Center (RAC) is one of several companies in the "rent-to-own" industry that rents appliances, furniture and a variety of other chattel predominately to the working poor in contracts that allow the renter to gain ownership if she rents for a sufficiently long duration.[13] The industry has been charged with implicitly charging excessively high interest in these agreements. But rent-to-own agreements are different than traditional consumer credit sales in that the consumer has more flexibility. In a traditional credit sale, the consumer makes an unconditional promise to pay back the amount lent -- and failure to do so amounts to a breach of contract (which in turn may affect the consumer's credit history). In a rent-to-own agreement, by contrast, the consumer does not promise to pay until it owns the chattel, but may return the chattel at any point without breaching its agreement. From an

option perspective, the rent-to-own contract is equivalent to a traditional credit sale but where the consumer also purchases a put option -- the option at any time to sell the chattel back to RAC in return for its future payment obligations. An appreciation of options once again allows us not only to see the implicit option but to price it. This is important, because to assess realistically whether RAC is charging excessive implicit interest, it is necessary to price the implicit put that the consumers are purchasing (on credit) as well.[14]

In Hohfeldian terms, every "privilege" is an option to do some act and every "power" is the option to change some legal relation.[15] Indeed, the "Bill of Rights" might be aptly relabeled as the "Bill of Options." One has the right to speak or not, the right to practice religion or not, the right to trial (or not). Just as Hohfeldian analysis lets us disaggregate constituent parts of a particular regime, the option perspective allows us in context after context to disentangle option and non-option components of particular entitlement regimes. This dissaggregation lets us not only to more clearly interrogate whether constituent parts of a particular bundle of rights are properly allocated, but also to "price" the constituent parts. Applying option theory to the takings clause naturally leads one to ask whether the government should having "givings" rights (via put options) as well as the more traditional takings call option.[16] Or an option perspective also leads one to ask whether the federal government should have an eminent domain (call) option to take states' 11th amendment rights. Even accepting that the states have newfound entitlements against federal legislation does not by itself tell us whether feds should be able take this entitlement and pay damages. Just as feds can exercise an eminent domain power over state land, one might wonder whether the feds could take a state's monopoly policy power interest in protecting (or failing to protect) its female citizenry

and pay the states damages.[17] Option theory again lets us not only see this as a possibility, but might aid us in pricing such a takings option.

This book uses option theory to illuminate different ways that policymakers can protect legal entitlements. The notion of a "legal entitlement" is an expansive one, encompassing such diverse rights as the right to bodily security, the right to a pollution-free atmosphere, the right to build a house that blocks another's view, or the right to damage another's reputation by false accusation.[18] More than twenty-five years ago Guido Calabresi and Douglas Melamed noticed that legal entitlements tend to be protected in two distinctly different ways.[19] Property rules protect entitlements by deterring non-consensual takings, while liability rules protect entitlements by compensating the entitlement holder if such takings do occur.

The crucial jumping off point is to see that liability rules give potential takers a call option to take. A liability rule gives at least one party an option to take an entitlement nonconsensually and pay the entitlement owner some exercise price. Thus, if the right against pollution is protected by a liability rule, a polluter may pollute if she is willing to pay damages.[20]

From this option perspective, the only difference between liability and property rules lies in the price of exercising the option--the damages to be paid for the nonconsensual taking.[21] Property rules set the exercise price so high that no one is likely to exercise the option to take nonconsensually, while the lower exercise prices of liability rules presuppose that some people will take nonconsensually.[22]

The option analysis deconstructs the original distinction between property rules and liability rules. Whereas Calabresi and Melamed assumed that property rules involve consensual agreements

and liability rules involve nonconsensual takings, the options analysis shows that both property and liability rules involve options for nonconsensual taking. In other words, property rules are actually a special case of liability rules: Property rules are liability rules with an exercise price so high that the option is (almost) never taken.

The next chapter will more formally define options and introduce the details of option theory, but for now it is sufficient to see that options are crucially defined by identifying (1) who has the option; (2) whether the option is to buy (a call) or to sell (a put); and (3) the price of exercising the option. While the very names -- "puts" and "calls" -- can be initially confusing (and therefore offputting),[23] I will try to show that an option interpretation both simplifies our understanding of how entitlements are structured and illuminates how entitlements should be structured. One way that option theory simplifies is by providing a single model or frame in which to assess both property and liability rules. From an option perspective, property and liability rules can be viewed as lying on a single spectrum: Property rules confront defendants with a high ("out-of-the-money") exercise price while liability rules confront defendants with a lower exercise price.[24]

Conceptually, this book asks how a court might want to allocate entitlements among individuals when the court is imperfectly informed about the individuals' values. Many of the following pages will analyze a seemingly straightforward math problem. Imagine that a court is trying to decide which of two disputants should control a particular entitlement. Each disputant knows her own value for the entitlement, but the court sees only an unbiased probability function of each disputant's value. The court, among other things, wants the entitlement controlled by the higher-valuing disputant.

How should the court structure the parties' legal entitlements? A first intuition is that the court should simply give the entitlement to the individual with the higher expected value. This "mean" allocation rule would make a great deal of sense if the court were merely choosing among property rules; but we will see -- through the lens of option theory -- that giving the initial entitlement to the disputant who is, on average, *lower-valuing* can at times produce higher allocative efficiency. This result is ,of course, counter intuitive. But, as we shall see, so are others.

III. *The Central (Counter-Intuitive) Results*

An important test of a theory's usefulness is the extent to which it can produce counter-intuitive results.[25] Theoretical results that merely confirm what we already know via other theories or common sense add little value. An option perspective on legal rights would be a rather arid, aesthetic exercise, if it merely recharacterized what we already knew. So it is appropriate at the outset to summarize some of the counter-intuitive results introduced in the book – in part as an unabashed advertisement to induce further reading. Here are six take-home lessons:

- *Where there are calls, there must be puts.* Once traditional liability rules are seen as "call" options, it is natural to ask whether "put" options are or should be used by the law. Calabresi and Melamed saw that defendant polluters might pay for the right to pollute or that plaintiff pollutees might pay for the right to stop pollution, but they did not focus on who gets to decide whether payment would be made. Traditional liability rules are more like call options because they give the payor the option of forcing a sale. But it is also possible to give payees the put-like option of forcing a purchase. The next chapter will show that instead of giving a polluter the option to pay for the right to pollute, the law might give a pollutee the

option to be paid for giving up her entitlement to clean air. Put-like protections for pollutees seem startling,[26] but they in fact are the normal "election of remedies" granted to a plaintiff whose property rights have been infringed upon. For example, if the polluter instead builds an encroaching fence on the pollutee's land, it would be normal to give the pollutee the choice of injunction or permanent damages for the encroachment.[27]

- *Courts can decouple distributive and allocative concerns.* Appreciating the possibility of put options is the first-step in expanding a courts' choice set. Allowing a defendant to pollute if she chooses to pay a million dollars should produce the same allocative equilibrium as giving the defendant a put option to sell her pollution right for a million dollars,[28] but very different wealth distributions. Indeed, there are an infinite number of option implementations that produce the same allocative equilibrium, but merely divide the expected payoffs differently between the disputants. For example, asking the defendant to choose between paying $800,000 to pollute and receiving $200,000 to forego polluting should produce an identical allocation as the foregoing call and put implementation but provides an intermediate distribution of payoffs. Enlightened courts are thus free to maximize allocative efficiency (by delegating the allocative choice to the more efficient litigant) without sacrificing concerns of equity or ex ante investment incentives.

- *Variance matters.* The option perspective also illuminates how liability rules allow imperfectly-informed courts to delegate the allocative decision to disputants with private information. A liability rule literally lets the plaintiff or the defendant decide who will ultimately control the entitlement (by deciding whether or not to exercise her option).

Option theory can guide courts in determining which party is likely to be the more efficient chooser.[29] A basic principal of option pricing is that underlying volatility makes options more valuable. As applied to liability rules, this suggests that the litigant who, from the courts' perspective, has the more speculative valuation is likely to be the more efficient chooser. Until now, courts have focused too much on the mean of the litigants' valuations. Option theory suggests that the variance is more important to allocative efficiency.

• *Two heads can be better than one.* While traditional liability rules delegate the allocation choice to a single-chooser (either the plaintiff or the defendant), it turns out that it is also possible for courts to create an option that delegates the allocational choice to both parties – by allowing either disputant to veto a particular allocation. For example, a court might grant an initial entitlement to the plaintiff but allow the entitlement to be transferred to the defendant for a judicially determined amount ($X) unless either side objects. "Dual chooser" rules of this kind can produce, under certain conditions, systematically higher expected payoffs than more traditional single-chooser rules. And as with put option rules, it turns out that dual chooser rules are already being used in the common law.

• *Liability rules can mimic auctions.* Prior scholars have seen how liability rules can "mimic markets" by allowing defendants, when transaction costs are high, to take entitlements nonconsensually that they would have purchased were transaction costs low. But higher-order liability rules can also be structured to "mimic auctions" with the analogous efficiency benefits. Traditional liability rules economize on the private information of the single chooser – who allocates the entitlement to herself when her value exceeds the non-choosers

mean valuation. But traditional liability rules do nothing to economize on the private information of the non-chooser. A defendant might find it advantageous to exercise an initial call option, but the plaintiff may know that it has an unexpected high valuation so that such taking is in fact inefficient. Granting plaintiffs take-back options can economize on both sides' private information. As with ascending auction bids, it is crucial that the exercise price of each additional taking increase so that the parties successively signal their higher valuations. Higher-order liability rules again seem esoteric, but Chapter Five will argue that, once again, they can already be found in the common law. Moreover, I will show that the results of higher-order regime can be replicated by an instantaneous auction mechanism in which each party simply reports her valuation to the court.

- *Liability rules allow bargainers to reveal information credibly.* Finally, while much of the book is concerned with the effect of liability rules on parties' behavior in the absence of bargaining, I will also show in Part II that liability rules have an information-forcing effect that property rules lack. Liability rules divide the legal claims to an entitlement between the option and non-option holders. This Solomonic entitlement division means that there are two distinct types of Coasean bargains that might be struck to improve allocative efficiency. Chapter Nine will show that a non-option holder can credibly reveal whether her value is above or below the exercise price merely by indicating an interest in one type of trade or the other. For example, a plaintiff who indicates an interest in bribing a defendant not to take (thus effectively purchasing the defendant's call option) credibly reveals that she values the entitlement more than the exercise price.

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Stepping back, we see that this book uncovers a dizzying variety of seemingly new and unanalyzed liability rules from among which judges might choose: put option rules, "pay or be paid" rules, "pay or pay" rules, "dual chooser" rules, and "higher order" liability rules. In each case, the book provides a theory for when a particular type of rule is likely to be allocatively efficient in harnessing the disputants' private information. In each case, the book will suggest criteria for setting optimal damages and will discuss possible analogs between the theory and current remedial practice. Unlike Calabresi and Melamed, who discovered a new rule that had heretofore gone unused, my repeated goal here is to discover a theory for rules that have been used without sufficient comment.

Finally, the option perspective, by producing a better understanding of how to structure liability rules, provides deeper insights into when entitlements should be protected by property rules. The expanded choice set of liability rules offered by the option perspective will tend to undermine a variety of pre-existing theories. This book will ultimately reject the prior conjectures that property rules will tend to be more efficient than liability rules when (i) transaction costs are low; (ii) the entitlement is tangible; (iii) the disputants' valuations are correlated; or (iv) when ex ante investment incentives are important. My thesis is not that liability rules always dominate. Only that several of the theories put forward as explanations for the prevalence of property do not wash. Instead, I will suggest that the prevalence of property protections may turn instead upon a more prosaic concern with the costs of implementing an optimal liability rule regime.

IV. *Plan of Action*

Part I focuses on highly stylized, bilateral disputes. I assume that each disputant knows her own valuation of the disputed entitlement, but that the court (and the other disputant) only observes

an unbiased probability distribution of potential valuations. This part crucially assumes that the disputants cannot bargain for consensual transfer of the entitlement. An analysis of "autarky" (the absence of trade or bargaining) is interesting in and of itself both because enmity, temporal exigencies and more generically "high transaction costs" may in some contexts preclude bargaining, and because the autarkic takings strategies (and related payoffs) are themselves the legal shadow in which any bargaining would occur. The simplifying assumptions of Part I aid in showing how various new-fangled liability rules can succeed in harnessing litigants' private information. It is here that I explicate the full array of judicial choice -- introducing readers to put option rules, dual chooser rules, higher-order rules and the like.

Part II systematically relaxes each of Part I's simplifying assumptions. Succeeding chapters show how liability rules can be structured to adapt to problems of correlated valuation and multiple takings. Most importantly, Chapter 9 analyzes how liability rules should be structured when bargaining is possible. And Chapter 10 presents experimental evidence that – contrary to Calabresi and Melamed – liability rules can produce greater allocative efficiency than property rules when disputants bargain in low transaction cost settings. The book concludes with an assessment of when property rules are likely to be most efficient.

V. *Acknowledgments*

My greatest debt in writing this book is to Jack Balkin, Paul Goldbart and Eric Talley. This book grows out of a series of articles that I published with these coauthors analyzing liability rules from an option perspective.[30] Balkin saw the large implications of what we called "higher order" liability rules; Goldbart solved mathematical problems that I could only begin to imagine; and Talley

uncovered the core "information-forcing" quality of liability rule bargaining. Each of these three is a but-for cause of this book. Goldbart's ideas can be found as well in chapters 3, 4, 5, 6 and 7. Goldbart in fact might easily be considered a co-author of the book. Talley is a coauthor of chapter 9, but his contribution is particularly important. Talley was the first person to lead me into thinking about the cathedral in this new option-oriented way. My head number crunchers over the past few years, Nasser Zakariya and Fred Vars, have made the types of contributions to Chapter 10 (in both collecting and analyzing the data) that in other circumstances would often merit co-authorship.

I have also been deeply influenced by the work of a not-so-small coterie of scholars -- chiefly Richard Epstein, Louis Kaplow, James Krier, Saul Levmore, Carol Rose, Stewart Schwab and Steve Shavell -- who have contributed to this modern option reinterpretation of liability rules.[31] With the likes of these scholars adding to the dialogue, what started as whimsical modeling might yet blossom into a movement.

This book is an attempt not only to distill and synthesize the previous literature, but to probe further in the option approach. What I understand about the optimal design of liability rules has changed dramatically since Talley and I wrote our first article about bargaining in the shadow of liability rules. And I only had the crudest inklings about the possibility of dual chooser rules when I drafted my first put option article. The theory presented here is accordingly more extensive and more internally consistent than what could be found by merely reading a concatenation of the preexisting literature. For those readers who grow impatient with ungrounded theorizing I have also included the results of an experiment on how disputants with private information bargain in the shadow of liability and property rules.

Endnotes

1.In the past, legal scholars have tended to incorporate into their analysis the social science skills they had been taught as undergraduates. This slowed the rate of diffusion across disciplines because a new development in economics would need first to diffuse into the undergraduate curriculum and then undergraduates would have to ripen into law professors before the advance appeared in law reviews. Now, however, with the increased numbers of J.D./Ph.D.'s, the diffusion rate can be much faster. See, e.g., Eric L. Talley, *Property Rights, Liability Rules, and Coasean Bargaining under Incomplete Information* 17-26 (John M. Olin Program in Law and Econ., Stan. Law School. Working Paper No. 114, 1994) (applying mechanism design to legal issue). But the option theory used in this book existed (and, to some degree, was taught) when I was an undergraduate – so it might be seen as an example of the earlier, slower method of diffusion.

2. "The question of how a call option should be priced had been the subject of a long intellectual chase, commencing from the early sixties. Many economists, including Paul Samuelson of MIT, had attacked the problem, from both theoretical and empirical points of view. The team of Black and Myron Scholes intensely worked on this problem from 1968 to 1971, in a friendly competition with a brilliant student of Samuelson's named Robert Merton." www.mayin.org/ajayshah/MEDIA/1995/black.html

3.The total volume of trading on the Chicago Board of Trade in 2000 was 233,528,558 (contracts). The total in 1973 was 13,222,989. *CBOT Volume -- Historical: 1921-00* (2001) at http://www.cbot.com/cbot/docs/7416.xls.

4.Scholes was a principal in Long Term Capital Management (LTCM). *Nova #2704: Trillion Dollar Bet* (PBS television broadcast, Feb. 8, 2000).

5.*Id.* See also www.derivativesstrategy.com/magazine/archive/1999/0499fea1.asp.

6.Gordon Sick, *Real Options* (New Haven: Yale School of Organization and Finance, 1994); Lenos Trigeorgis, *Real Options: Managerial Flexibility and Strategy in Resource Allocation* (Cambridge and London: MIT Press, 1996); George Pinches, *Real Options: Developments and Applications*, 38:0 QUARTERLY REVIEW OF ECONOMICS AND FINANCE 533 (1998), as part of special issue on real options; Martha Amram & Walin Kulatilaka, *Real Options: Managing Strategic Investment in an Uncertain World* (Boston: Harvard Business School Press, 1999); Angelien G.Z. Kemna, *Case Studies on Real Options* 22:3 FINANCIAL MANAGEMENT 259 (August 1993).

7.This is a standard example. See Richard A. Brealey and Stewart C. Myers, *Principles of Corporate Finance, 5th Ed.* (New York: McGraw-Hill, 1996), at 558. From an option perspective, the issuance of debt by an all equity firm is equivalent to a transaction in which the shareholders simultaneously (i) sell the firm's assets to the debtholders and (ii) buy a call option from the

debtholders. The net difference in cash paid by debtholders and shareholders respectively in these two transactions represents the amount transferred by the debtholders to the shareholders. Because of "put call parity" (to be discussed *infra* at ?) there is also an equivalent put option interpretation of the transaction in which the shareholders simultaneously (i) buy a put option from the debtholders and (ii) sell an unconditional promise to pay money in the future.

8.If the firm is near bankruptcy, the option holders will reap all the upside returns and receive the same fixed payoff (of zero dollars) if the investment fails either modestly or spectacularly. The option to declare bankruptcy (or not) allows shareholders to play with other people's money.

9.Martin L. Weitzman, *Optimal search for the best alternative*, 47 ECONOMETRICA 641 (1979) M. Rothschild, *A two-armed bandit theory of market pricing*, 9 JOURNAL OF ECONOMIC THEORY 185 (1974).

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10.The leading textbook on corporate finance discusses convertible bonds as bonds combined with call options on stock, where the exercise price is equal to the bond value. R. Brealey & S Myers, *supra* note 7, at 624. Vimal Kulatika & Alan Marcus, *General Formulation of Corporate Real Options*, 7 RESEARCH IN FINANCE 183 (1988); Lucran Arye Bebchuk, *A New Approach to Corporate Reorganizations*, 101 HARVARD L. REV. 775 (1988); G. Mitu Gulati et al, *Connected Contracts* 47 UCLA L. REV. 887 (April 2000); Peter A. Huang, *Teaching Corporate Law from an Option Perspective*, 34 GEORGIA L. REV. 571 (Winter 2000); John D. Ayer, *The Role of Finance Theory in Shaping Bankruptcy Policy*, 3 American Banker Institute L. Rev. 53 (Spring 1995); Philip Aghion, Oliver Hart & John Moore, *The Economics of Bankruptcy Reform*, 8 JOURNAL OF LAW, ECONOMICS AND ORGANIZATION 523 (1992); Thomas A. Smith, *A Capital Markets Approach to Mass Tort Bankruptcy*, 104 YALE L. J. 367 (November 1994).

11.See Paul G. Mahoney, *Contract Remedies and Options Pricing*, 24 Journal of Legal Studies 139 (1995); Alexander Triantis & George Triantis, *Timing Problems in Contract Breach Decisions*, 41 JOURNAL OF LAW AND ECONOMICS 163 (April 1998). For other non-corporate applications of options theory see Peter H. Huang, *A New Options Theory for Risk Multipliers of Attorneys' Fees in Federal Civil Rights Litigation*, 73 NEW YORK UNIVERSITY L. REV. 1943 (1998); Bradford Cornell, *The Incentive to Sue: An Option-Pricing Approach*, 19 JOURNAL OF LEGAL STUDIES 173 (1990); William Blanton, *Reducing the Value of Plaintiffs' Litigation Option in Federal Court: Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 2 GEORGE MASON UNIVERSITY L. REV. 159 (Spring 1995).

12.Readers should be advised that I have been retained as an expert witness for plaintiffs in several of these suits. Burney v. Thorn Americas, Inc. 970 F. Supp. 668 (E.D. Wis. 1997), rescinding earlier order in part; Burney v. Thorn Americas, Inc. 944 F. Supp 762. (E.D. Wis. 1996), granting summary judgment.

13.See Alix M. Freedman, *A Marketing Giant Uses its Sales Prowess to Profit on Poverty*, WALL STREET JOURNAL A2 (Sept. 22, 1993); and James M. Lacko, Signe-Mary McKernan, & Manoj Hastak, *Survey of Rent-to-Own Customers*, FEDERAL TRADE COMMISION BUREAU OF ECONOMICS STAFF REPORT (April 2000).

14.The implicit price of the put option is added to the implicit principal borrowed and thus reduces the implicit interest rate for any given periodic rental payment.

15.For example, an offeree's power to form a contract is a classic option to buy or sell. Indeed, firm offers are synonymous with option contract. Similarly, the easement holder's "privilege" to cross a piece of land is an option to do so as opposed to a duty. The option perspective is quite consistent with the Hohfeldian notion of jural correlatives. For if some one has an option, the person against whom that option to buy or sell runs is subject to that option. *See infra* Chapter 2 (discussing conservation of claims against a particular entitlement). If an offeree has the "power" to create a contract, this necessarily implies that the offeror has the Hohfeldian "disability" of being subject to the offeree's unilaterally changing their legal relationship. If an easement holder has the "privilege" of crossing a particular piece of property, the owner of that land has the Hohfeldian "no right" of noninterference. But as Hohfeld and Corbin both emphasized, being subject to another's power or privilege does not necessarily imply disutility. See Wesley N. Hohfeld, *Fundamental Legal Conceptions as Applied in Judicial Reasoning*, 26 YALE L. J. 710 (1917) [hereinafter Hohfeld, *Fundamental Legal Conceptions*]; *Some Fundamental Legal Conceptions as Applied in Judicial Reasoning*, 23 YALE L. J.16 (1913); Arthur L. Corbin, *Legal Analysis and Terminology*, 29 YALE L. J. 163 (1919); Corbin, *Offer and Acceptance, and Some of the Resulting Legal Relations*, 26 YALE L. J. 169 (1917). The holders of a disability or a no-right might tend to enrich the holder if the holder of the correlative right exercises her option to their advantage. This result is also reproduced in the option models. *See infra* Chapter 3; Ian Ayres & J.M. Balkin, *Legal Entitlements as Auctions: Property Rules, Liability Rules and Beyond*, YALE L. J. 703 (1996).

16.Abraham Bell & Gideon Parchomovsky, *Givings*, 111 Yale. L. J. 547 (2001). A special assessment can be interpreted as the price exacted by local government in the exercise of a put option. Forcing the "sale" of special benefits to property owners situated near public improvements played a prominent role in the financing of public infrastructure in the early part of the twentieth century. Tax Foundation, Inc., *Special Assessments and Service Charges in Municipal Finance* (1970) cited in Robert C. Ellickson & Vicki L. Been, *Land Use Controls: Cases and Materials* (New York: Aspen Law & Business, 2000) at 749.

17.Richard A. Epstein, *Takings: Private Property and the Power of Eminent Domain* (Cambridge: Harvard University Press, 1985).

18.The first two examples are interests in security (Hohfeldian rights proper); the second two are interests in liberty (Hohfeldian privileges). Hohfeld, *supra* note 15. The classification of the entitlement depends on who holds it. If the entitlement is placed in the hands of a polluter, it is a privilege to pollute; if the entitlement rests in the hands of the neighboring landowner, it is a right

to be free from pollution.

19. Guido Calabresi & Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral* 85 Harvard L. Rev. 1089 (1972)-.

20. *See, e.g.*, Boomer v. Atlantic Cement Co., 257 N.E.2d 870 (N.Y. 1970) (requiring factory owners to pay permanent damages in compensation for right to pollute).

    In many business situations, options are the result of a prior bargain, where the option to take at a given price is purchased for some premium. However, in the case of liability rules, the option is the result of preexisting legal rules; the law simply gives parties the right to take in exchange for damages.

    Both the bargained-for option and the liability rule are examples of what Hohfeld termed a "liability." Hohfeld, *supra* note 15. A party has a Hohfeldian liability when another party has the right to alter the first party's rights unilaterally. The second party has what Hohfeld called a "power." The person who owns an option alters rights by exercising the option, creating a duty to pay the purchase price. The person who takes under a liability rule alters rights by interfering with the entitlement, creating a duty to pay damages.

    Hohfeld was careful to point out that having a liability to others (in his sense) is not always a bad thing; sometimes it is to our benefit that others can change our rights unilaterally. *See supra note* 15, at 742. For example, whenever a person makes an offer to us, she changes our bundle of rights, because we now have the right to accept the offer. And when a party destroys a chattel we do not value highly, we may benefit because we have the right to receive damages at the market price, which may be higher than our private valuation.

    In a world with perfect information and costless bargaining, it is not advantageous to give others unilateral options to purchase, no matter how high the exercise price. It is more efficient to offer to sell the property to the highest bidder. That is one reason why parties normally demand premiums to grant options. But where transaction costs are high, an entitlement holder may prefer to grant options to potential buyers without receiving any premium in return. Such options help ensure that one can reap some profits from the exchange even when one may not be able to transfer consensually to a higher valuing buyer. The analogous insight is that where transaction costs are high, the law can increase efficiency by creating options in the form of liability rules.

21. *But see* Jules L. Coleman & Jody Kraus, *Rethinking the Theory of Legal Rights*, 95 YALE L. J., 1335 (1986) (arguing that change in degree of protection from nonconsensual taking changes content of entitlement).

22. The options framework seems particularly well-suited for some nuisance contexts where the taking party intentionally takes the right of another, and hence seems to be consciously choosing, say, to pollute or not pollute. By contrast, negligent tortfeasors do not intentionally take the interest of other parties, and might not seem to be affirmatively exercising an option. However, even a negligent tortfeasor chooses a level of care and thus can be said to choose intentionally a certain probability of taking that comports with the options framework.

23.Even now I sometimes revert to the mental pictures of shotputting an asset away (to help remember that a put is an option to sell) and calling an asset to you (to remember that a call is an option to buy).

24.See Louis Kaplow & Steven Shavell, *Property Rules Versus Liability Rules: An Economic Analysis*, 109 Harvard L. Rev. 713 (1996). ("[O]ne can conceive of the two property rules and the liability rule that we studied as all being, in fact, liability rules with different levels of damages: the property rule protecting injurers corresponds to a liability rule with zero damages; the conventional liability rule that we emphasized is the rule with damages equal to courts' best estimate of harm; and the property rule protecting victims mirrors a liability rule with extremely high, or infinite, damages.").

25.Richard Posner, SEX AND REASON 5-6 (1992).

26.Saul Levmore, *Unifying Remedies, Liability Rules and Inalienability: A Twenty-Five Year Retrospective*, 106 YALE L. J. 2149 (May 1997).

27.Pile v. Pedrick, 167 Pa. 296, 300 (1895).

28.In each case, (putting aside differences in the willingness to pay vs. the willingness to accept discussed *infra in* Chapter 8), the defendant will only choose to pollute if her value of polluting is greater than one million.

29.James E. Krier & Stewart J. Schwab, *Property Rules and Liability Rules: The Cathedral in Another Light*, 70 N.Y.U. L. R.440 (May 1995).

30.Ian Ayres & Eric Talley, *Solomonic Bargaining: Dividing a Legal Entitlement to Facilitate Coasean Trade*, 104 YALE L. J. 1027 (1995) [hereinafter Ayres & Talley I]; Ayres & Talley, *Distinguishing Between Consensual and Nonconsensual Advantages of Liability Rules*, 105 YALE L. J. 235 (1995) [hereinafter Ayres & Talley II]; Ian Ayres & Paul M. Goldbart, *An Option Theory of Liability Rules*, 100 Michigan L. Rev. 1 (2001) [hereinafter Ayres & Goldbart I]; Ayres & Goldbart, *Correlated Values in the Theory of Property and Liability Rules*, Journal of Legal Studies (forthcoming 2003) [hereinafter Ayres & Goldbart II]; Ayres & Balkin, *supra* note 15. Uncharacteristically, I have even managed to publish one sole authored article on an option interpretation of liability rules. Ayres, *The 1998 Monsanto Lecture: Protecting Property with Puts*, 32 VALPARAISO UNIVERSITY L. REV. 793 (1998).

31.Richard Epstein, *A Clear View of the Cathedral: The Dominance of Property Rules*, 106 YALE L. REV. 2091(1997); Kaplow & Shavell, *supra* note 24; Krier & Schwab, *supra* note 29; Levmore, *supra* note 26; Carol M. Rose, *The Shadow of the Cathedral*, 106 YALE L. J. 2175 (1997).