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Empirically Assessing Hadley v. Baxendale

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EMPIRICALLY ASSESSING *HADLEY V. BAXENDALE*

George S. Geis

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GEORGE S. GEIS*

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I. INTRODUCTION

Hadley v. Baxendale,¹ one of the most celebrated cases in contract law,² sets forth the default rule that unforeseeable consequential

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1. *Hadley v. Baxendale*, 156 Eng. Rep. 145 (Ex. 1854).

2. See, e.g., GRANT GILMORE, *THE DEATH OF CONTRACT* 92 (Ronald K.L. Collins ed., 2d ed. 1995) (“*Hadley v. Baxendale* is still, and presumably always will be, a fixed star in

damages are unrecoverable.³ The case has come to represent an important limit to the general rule awarding full expectation damages for breach.⁴ And over time, *Hadley* has taken on even greater significance as an archetype for contract default rules that efficiently expose asymmetric information.⁵

A sophisticated line of literature examines the *Hadley* rule from an economic point of view,⁶ building theoretical models to determine whether it is efficient.⁷ While many variables matter, one key con-

the jurisprudential firmament.”); Ian Ayres & Robert Gertner, *Strategic Contractual Inefficiency and the Optimal Choice of Legal Rules*, 101 YALE L.J. 729, 734-35 (1992) (“*Hadley* continues to be one of the most analyzed contract cases in law and economics literature.”); Russell Korobkin, *The Status Quo Bias and Contract Default Rules*, 83 CORNELL L. REV. 608, 616 n.21 (1998) (“Perhaps the most famous case in all of contract law, *Hadley* has become the example that default rule theorists most often employ to illustrate their conceptual arguments.”).

3. See 3 E. ALLAN FARNSWORTH, FARNSWORTH ON CONTRACTS § 12.14 (3d ed., Aspen Publishers 2004); JOHN EDWARD MURRAY, JR., MURRAY ON CONTRACTS § 120 (4th ed., LexisNexis 2001); JOSEPH M. PERILLO, CALAMARI AND PERILLO ON CONTRACTS § 14.5 (5th ed. 2003).

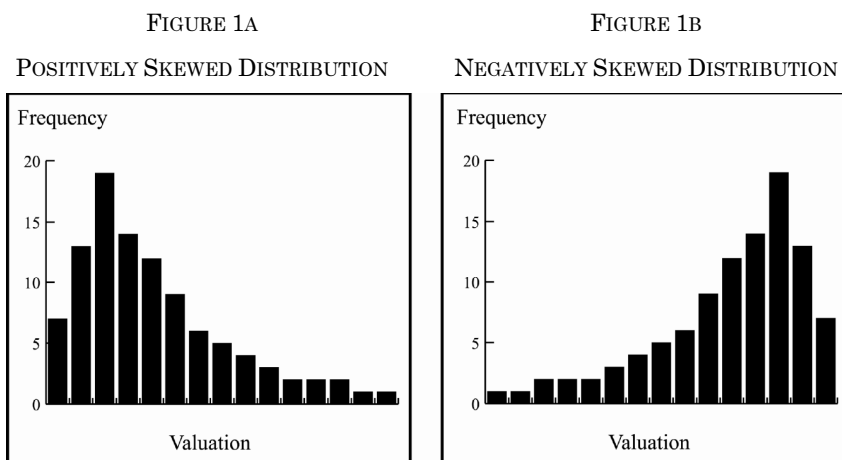
4. See FARNSWORTH, *supra* note 3; MURRAY, *supra* note 3; PERILLO, *supra* note 3.

5. See Ian Ayres & Robert Gertner, *Filling Gaps in Incomplete Contracts: An Economic Theory of Default Rules*, 99 YALE L.J. 87 (1989); Lucian Arye Bebchuk & Steven Shavell, *Information and the Scope of Liability for Breach of Contract: The Rule of Hadley v. Baxendale*, 7 J.L. ECON. & ORG. 284 (1991); Eric A. Posner, *Contract Remedies: Foreseeability, Precaution, Causation and Mitigation*, in 3 ENCYCLOPEDIA OF LAW AND ECONOMICS 162, 163-69 (Boudewijn Bouckaert & Gerrit De Geest eds., 2000).

6. The economic approach to contracts permeates modern literature. See ROBERT COOTER & THOMAS ULEN, LAW AND ECONOMICS 188-306 (4th ed., Pearson Addison Wesley 2004); 3 ENCYCLOPEDIA OF LAW AND ECONOMICS, *supra* note 5, at 1-72, 78-222 (publishing various articles on this subject); RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW § 4.1-.15 (6th ed. 2003); STEVEN SHAVELL, FOUNDATIONS OF ECONOMIC ANALYSIS OF LAW 291-385 (2004); 1 THE NEW PALGRAVE DICTIONARY OF ECONOMICS AND THE LAW 174, 425, 436 (Peter Newman ed., 1998). Of course, economic analysis is not the only way to understand contract law, and other approaches yield valuable insights. Economic analysis of contract law—along with the broader use of economics in the law—also receives its share of external criticisms. For an overview of these criticisms, see BRIAN BIX, JURISPRUDENCE: THEORY AND CONTEXT 210-13 (3d ed., Carolina Academic Press 2004); and Richard Craswell, *Incommensurability, Welfare Economics, and the Law*, 146 U. PA. L. REV. 1419 (1998). For representative critiques, see ELIZABETH ANDERSON, VALUE IN ETHICS AND ECONOMICS (1993); AMARTYA SEN, DEVELOPMENT AS FREEDOM (1999); Martha C. Nussbaum, *Flawed Foundations: The Philosophical Critique of (a Particular Type of) Economics*, 64 U. CHI. L. REV. 1197 (1997); Margaret Jane Radin, *Market-Inalienability*, 100 HARV. L. REV. 1849 (1987); and Cass R. Sunstein, *Incommensurability and Valuation in Law*, 92 MICH. L. REV. 779 (1994). This Article does not address these concerns. Instead, it takes the position that economic analysis is one way to shape contract law and that empirical analysis remains relevant even when a noneconomic approach to contract law is preferred.

7. See Ayres & Gertner, *supra* note 5 (establishing a model for contract penalty defaults based on consequential damages); Bebchuk & Shavell, *supra* note 5 (developing a formal model of the *Hadley* rule); Jason Scott Johnston, *Strategic Bargaining and the Economic Theory of Contract Default Rules*, 100 YALE L.J. 615, 636-39 (1990) (analyzing *Hadley* when sellers enjoy market power); Ayres & Gertner, *supra* note 2 (extending Johnston’s analysis); Barry E. Adler, *The Questionable Ascent of Hadley v. Baxendale*, 51 STAN. L. REV. 1547 (1999) (refining the *Hadley* model further to reflect the uncertainty of incurring consequential damages in breach).

cern is the distribution of buyer valuations for contract performance.⁸ Economic theory suggests that if many buyers place a low value on performance while few buyers place a high value on performance (see Figure 1a)—and if a buyer's valuation is private, unobservable information—then the *Hadley* rule may be preferable to a rule that awards full expectation damages.⁹ Under these circumstances, a *Hadley* default may force private information to be revealed in a way that encourages efficient precautions against breach and minimizes transaction costs from bargaining around the default.¹⁰ If the valuation distributions are reversed (Figure 1b), the *Hadley* rule may be inefficient, and a full-damages default might be better.



Eric Posner, as part of a broader challenge to the economic analysis of contract law, has recently called to question the merits of this *Hadley* model.¹¹ He makes two arguments. First, it is simply too difficult to gather data needed to test *Hadley*.¹² For instance, Posner

8. Ayres & Gertner, *supra* note 5, at 108; Lucian Arye Bebchuk & Steven Shavell, *Reconsidering Contractual Liability and the Incentive to Reveal Information*, 51 STAN. L. REV. 1615, 1625 (1999) (“[I]t seems that the *Hadley* rule is clearly desirable for cases . . . in which a minority of buyers has valuations of performance that are substantially higher than the valuations of ordinary buyers.”).

9. See Ayres & Gertner, *supra* note 5, at 108-18; Bebchuk & Shavell, *supra* note 5, at 285-86.

10. See Ayres & Gertner, *supra* note 5, at 108-11. A comprehensive analysis of the optimal default rule needs to consider additional variables, including transaction costs incurred by high-value and low-value buyers to contract around the default rule, efficiency gains from tailored precautions, the probability of incurring consequential damages, and several other factors. See *id.*; Adler, *supra* note 7, at 1551-53. An extended discussion of the *Hadley* solutions is found *infra* Part II.B.

11. Eric A. Posner, *Economic Analysis of Contract Law After Three Decades: Success or Failure?*, 112 YALE L.J. 829, 830 (2003) (“[T]he economic approach does not explain the current system of contract law, nor does it provide a solid basis for criticizing and reforming contract law.”).

12. *Id.* at 837-38.

doubts that buyer valuations can ever be determined empirically.¹³ Second, it is too hard to sum the impact of multiple variables in the model.¹⁴ Even if lawmakers can estimate buyer valuations, they may find it impossible to pick an optimal default rule because other variables—such as the transaction costs of contracting around a default, the efficiency gains from information revelation, and the probability of incurring consequential damages in breach—need to be added into the mix.¹⁵ In short, armchair economic theorizing is not a fruitful endeavor.

Posner's critique echoes a broader cry for empirical analysis¹⁶ throughout legal scholarship.¹⁷ A wide range of academics, practitio-

13. *Id.*

14. *Id.* Using a choice-of-remedies example, Richard Craswell synthesizes Posner's claim as follows:

[W]e cannot decide which remedy is "best" in any overall sense . . . unless we have some way of measuring the relevant effects, both good and bad, and then summing them to come up with a combined score for each of the possible remedies. But if we lack empirical data to measure the magnitudes of the various effects, any such sum will be difficult—or even impossible—to construct, so we will never know which remedy is truly the most efficient.

Richard Craswell, *In That Case, What Is the Question? Economics and the Demands of Contract Theory*, 112 YALE L.J. 903, 908 (2003).

15. Posner, *supra* note 11, at 836-39.

16. It is important to distinguish between quantitative empirical analysis and qualitative empirical analysis. Broadly speaking, empirical research uses evidence about the world based on observation or experience. Lee Epstein & Gary King, *The Rules of Inference*, 69 U. CHI. L. REV. 1, 2 (2002). In the legal literature, the term "empirical analysis" often refers more narrowly to quantitative data and statistical techniques. *Id.* But empirical analysis can also be qualitative (nonnumerical). *Id.* Many legal studies, of course, draw upon qualitative worldly observations to support a hypothesis or contention and can thus be considered empirical in nature. *Id.* at 2-3. In this sense, legal scholarship is often empirical. But consistent with other legal literature, all references to empirical analysis in this Article, unless specified otherwise, refer to quantitative empirical analysis.

17. The Winter 2002 edition of *The University of Chicago Law Review*, for example, explicitly raised the topic of empirical research in the law. Exchange, *Empirical Research and the Goals of Legal Scholarship*, 69 U. CHI. L. REV. 1 (2002). The provocative exchange debated whether the current state of empirical legal scholarship was deeply flawed and whether it even comported with the rules of inference that guide empirical research in the social and natural sciences. *Id.* A subtheme of the exchange was a greater need for rigorous empirical analysis in the law. See Epstein & King, *supra* note 16, at 1 ("[Law professors] appear to have been proceeding with little awareness of, much less compliance with, many of the rules of inference, and without paying heed to the key lessons of the revolution in empirical analysis that has been taking place over the last century in other disciplines."); Frank Cross et al., *Above the Rules: A Response to Epstein and King*, 69 U. CHI. L. REV. 135, 135 (2002) (opining that Epstein and King "miss the targets they seek" as "their assault on legal scholarship violates many of their own rules of inference"); Jack Goldsmith & Adrian Vermeule, *Empirical Methodology and Legal Scholarship*, 69 U. CHI. L. REV. 153, 153-54 (2002) ("Epstein and King overlook that legal scholarship frequently pursues doctrinal, interpretive, and normative purposes [G]iven constraints on time, information, expertise, and research funds, academics face inevitable tradeoffs between rigor and accuracy, on the one hand, and timeliness, relevance, and utility, on the other."); Richard L. Revesz, *A Defense of Empirical Legal Scholarship*, 69 U. CHI. L. REV. 169, 171 (2002) ("[I]n their haste to show that legal academics have failed, Epstein and King miss an important opportunity to explore the ways in which [legal scholarship and the social sciences] can

ners, and judges believe that contract law—along with other legal disciplines—needs greater empirical analysis to test and support scholarly claims.¹⁸ The shortage of quantitative empirical scholarship in the law is attributed to many factors: lack of training among professors, lower prestige for empirical work, greater expense burdens, and a longer research process incompatible with the law’s need for timely insights.¹⁹ For whatever reasons, empirical analysis of con-

contribute to [each] other.”). Around this same time, the *University of Illinois Law Review* sponsored a symposium on empirical legal research, focusing less on the quality of historical scholarship and more on the potential of future scholarship. Symposium, *Empirical and Experimental Methods in Law*, 2002 U. ILL. L. REV. 791.

18. See RICHARD A. POSNER, OVERCOMING LAW 210-11 (1995); Derek C. Bok, *A Flawed System of Law Practice and Training*, 33 J. LEGAL EDUC. 570, 581-82 (1983); Epstein & King, *supra* note 16, at 4-6; Michael Heise, *The Importance of Being Empirical*, 26 PEPP. L. REV. 807, 834 (1999) (“Our legal literature would be enriched if more academics, particularly law professors, became more engaged in empirical legal research and produced more of it.”); William M. Landes, *The Empirical Side of Law & Economics*, 70 U. CHI. L. REV. 167, 168-70 (2003) (inferring from data analysis of three journals—*The Journal of Law and Economics*, *The Journal of Legal Studies*, and the *American Law and Economics Review*—that empirical articles appear more frequently in economic journals than in law journals); Russell J. Weintraub, *A Survey of Contract Practice and Policy*, 1992 WIS. L. REV. 1, 2-4. The call for more empirical research comes from all ends of the legal realm. See, e.g., Vicki Been & Joel C. Beauvais, *The Global Fifth Amendment? NAFTA’s Investment Protections and the Misguided Quest for an International “Regulatory Takings” Doctrine*, 78 N.Y.U. L. REV. 30, 134 (2003) (calling for more empirical data to determine whether NAFTA will chill efficient environmental regulation); Joseph A. Guzinski, *Government’s Emerging Role as a Source of Empirical Information in Bankruptcy Cases*, AM. BANKR. INST. J., Oct. 1998, at 8 (arguing that a lack of empirical information has hindered efforts to reform the bankruptcy code); Michael Korybut, *Searching for Commercial Reasonableness Under the Revised Article 9*, 87 IOWA L. REV. 1383, 1405-06, 1457 (2002) (calling for empirical data to understand the treatment of commercial unreasonableness in foreclosure under the revised Article 9 of the Uniform Commercial Code); Michael A. Livingston, *Reinventing Tax Scholarship: Lawyers, Economists, and the Role of the Legal Academy*, 83 CORNELL L. REV. 365, 397 (1998) (raising a need for more empirical analysis in tax scholarship); Kevin R. Reitz, *Sentencing Guideline Systems and Sentence Appeals: A Comparison of Federal and State Experiences*, 91 NW. U. L. REV. 1441, 1489 (1997) (raising a need for greater quantitative empirical work in the context of guideline sentence appeals).

19. See Heise, *supra* note 18, at 815-24 (arguing that professors’ lack of formal, nonlegal graduate education, lack of resources, high risk, lack of prestige, and lack of internal and external institutional incentives are to blame); Landes, *supra* note 18, at 178-80 (analyzing the effect and, at times, interplay of training, prestige, cost, and time); Julius G. Getman, *Contributions of Empirical Data to Legal Research*, 35 J. LEGAL EDUC. 489, 493 (1985) (explaining why intellectual prestige, funding, and time, among other things, are factors); Goldsmith & Vermeule, *supra* note 17, at 164-65 (arguing that, in addition to other factors, the need for legal scholarship to provide timely guidance to the courts requires information to be occasionally offered under “conditions of empirical uncertainty”); Epstein & King, *supra* note 16, at 9-10 (identifying the lack of training as one source of the problem). *But see* Epstein & King, *supra* note 16, at 118 (“[Legal scholars] can conduct first-rate [empirical] research that they can create and disseminate rapidly.”). Recent literature focuses on mitigating these shortcomings by building the institutional infrastructure needed to support empirical research in the law. See Lee Epstein & Gary King, *Building an Infrastructure for Empirical Research in the Law*, 53 J. LEGAL EDUC. 311 (2003); Howell E. Jackson, *Analytical Methods for Lawyers*, 53 J. LEGAL EDUC. 321 (2003); Matthew Spitzer, *Evaluating Valuing Empiricism (at Law Schools)*, 53 J. LEGAL EDUC. 328 (2003); David E. Van Zandt, *Discipline-Based Faculty*, 53 J. LEGAL EDUC. 332 (2003). It

tract law is in its infancy.²⁰ And few have studied the *Hadley* rule empirically.²¹

This Article takes up the task of empirically assessing *Hadley* in three simple markets. Drawing upon willingness-to-pay research in the field of marketing, this Article first estimates the distribution of buyer valuations for a can of Coca-Cola, a piece of pound cake, and an ergonomic pen.²² Monte Carlo simulation, a technique developed by Manhattan Project scientists, is then used to model complex interactions between multiple variables and the overall impact of alternative default rules on social welfare.²³ Ultimately, this combina-

should be noted, however, that the number of empirical legal articles may be on the rise. A search for the term *empirical* in the title of all American law reviews published between 1990 and 2000 revealed 231 results. Epstein & King, *supra* note 16, at 15-16 & 16 n.37. An updated search for all such articles published from 2001 to 2004 yields 216 results. This search was conducted in Westlaw's Journals and Law Reviews (JLR) database on March 9, 2005, for the term *empirical* in the title field.

20. Russell Korobkin, *Empirical Scholarship in Contract Law: Possibilities and Pitfalls*, 2002 U. ILL. L. REV. 1033, 1036. A recent review of empirical contracts scholarship in over 500 law journals from 1985 to 2000 yields just twenty-seven articles. *Id.* at 1036-37 & app. By comparison, a search in just fifteen top law journals during the years 1980-2001 uncovers seventy-one economics-oriented articles and fifty-two noneconomics-oriented articles on contracts. Gregory Scott Crespi, *The Influence of Two Decades of Contract Law Scholarship on Judicial Rulings: An Empirical Analysis*, 57 SMU L. REV. 105, 107 (2004) (analyzing the incidences of judicial citations of economic, noneconomic, and empirical contract scholarship). Several commentators bemoan the low level of empirical contracts research. *E.g.*, Korobkin, *supra*, at 1037 (“[T]he empirical study of contract law is a very underdeveloped genre of legal scholarship.”); Weintraub, *supra* note 18, at 4 (“Despite this need for data, however, to date there have been only a handful of empirical studies focusing on particular contract problems and relationships . . .”). More broadly, a recent study estimates that just 20.9% of all articles on common law subjects (mainly contracts, torts, and property) published in *The Journal of Legal Studies* from 1972 to 2002 were empirical. Landes, *supra* note 18, at 170 & tbl.1. By comparison, during this same time period, 55% of articles on crime, 52.3% of articles on procedure, and 50% of articles on public choice in the journal were empirical. *Id.* Landes also shows that empirical analysis enjoys an even greater use among economists outside the legal academy. For instance, 72.4% of all articles published in *The Journal of Law and Economics* (a publication largely edited by business professors and largely focused on scholarship outside the legal academy) during the same thirty-year period were empirical in nature. *Id.* at 168-70 & 170 tbl.1.

21. For existing empirical work on the *Hadley* doctrine, see Richard Danzig, *Hadley v. Baxendale: A Study in the Industrialization of the Law*, 4 J. LEGAL STUD. 249 (1975); Richard A. Epstein, *Beyond Foreseeability: Consequential Damages in the Law of Contract*, 18 J. LEGAL STUD. 105 (1989); Johnston, *supra* note 7, at 639-48; and Janet T. Landa, *Hadley v. Baxendale and the Expansion of the Middleman Economy*, 16 J. LEGAL STUD. 455 (1987).

22. The buyer valuation estimations for these products are developed from marketing research by Klaus Wertenbroch and Bernd Skiera in *Measuring Consumers' Willingness to Pay at the Point of Purchase*, 39 J. MARKETING RES. 228 (2002). For additional research on the willingness-to-pay methodology, see Gerald E. Smith & Thomas T. Nagle, *How Much Are Customers Willing to Pay?*, MARKETING RES., Winter 2002, at 20; and HENRIK SATTLER & FRANZISKA VÖLCKNER, METHODS FOR MEASURING CONSUMERS' WILLINGNESS TO PAY (Inst. of Mktg., Retailing & Mgmt. Sci. at the Univ. of Hamburg, Research Papers on Marketing and Retailing No. 009, 2002), available at http://www.henriksattler.de/publikationen/HS_FV_WillingnesstoPay.pdf.

23. On the links between Monte Carlo simulation and the Manhattan Project, see Roger Eckhardt, *Stan Ulam, John Von Neuman, and the Monte Carlo Method*, 15 LOS ALAMOS SCI. 131 (1987). For general background regarding Monte Carlo simulation, see

tion of empirical and assumption-based analysis yields several important insights.

The primary claim of this Article is that a *Hadley* default rule is more efficient than a full-damages default rule in the simple markets studied. The extended claim is that markets with similar conditions might also benefit from the *Hadley* rule. However, these findings are subject to four important qualifications. First, the *Hadley* rule is not preferable when high-value buyers systematically have a much greater chance of incurring consequential damages. Second, a full-damages default outperforms *Hadley* when most of the efficiency gains from information revelation go to low-value buyers. Third, the *Hadley* rule is not optimal when the transaction costs of contracting around the default rule are much greater for high-value buyers than low-value buyers. Finally, the analysis assumes perfect competition, and introducing seller power into the empirical model might change the results.

The discussion is organized as follows. Part II reviews the *Hadley* literature, including the concern that economic models of *Hadley* are indeterminate. Part III launches an empirical case study of the *Hadley* rule. More specifically, Part III.A develops a working model of *Hadley* from the existing economic literature, and Part III.B uses willingness-to-pay data to empirically estimate buyer valuations for three simple markets. Part III.C combines this work with other variables to arrive at preliminary conclusions for each market. Part III.D qualifies the findings by conducting sensitivity analysis. Part IV proposes additional research to test the *Hadley* rule in more complicated markets. Finally, Part V suggests that the field of marketing may be a ready-made source of data for contract law scholars. If so, it might be premature to abandon empirical testing of economic theories, at least for the question of consequential damage defaults. A brief conclusion summarizes the results.

II. THE *HADLEY* PROBLEM

A. *The Significance of a British Miller*

The classic contracts case *Hadley v. Baxendale*²⁴ denies recovery for unforeseeable consequential damages, that is, nonstandard damages beyond contemplation of the promisor at the time of contracting.²⁵ Hadley, a British mill operator, contracted with Baxendale to

JAMES E. GENTLE, *RANDOM NUMBER GENERATION AND MONTE CARLO METHODS* (2d ed. 2003); PETER JÄCKEL, *MONTE CARLO METHODS IN FINANCE* (2002); and ISTVÁN MANNO, *INTRODUCTION TO THE MONTE-CARLO METHOD* (1999).

24. 156 Eng. Rep. 145 (Ex. 1854).

25. 3 FARNSWORTH, *supra* note 3, § 12.14, at 255-57; MURRAY, *supra* note 3, § 120, at 783-85; PERILLO, *supra* note 3, § 14.5, at 569.

deliver a broken shaft to a manufacturer, who needed the shaft as a model to make the replacement.²⁶ Unfortunately, Baxendale was delayed, and the mill shut down for five days.²⁷ The court denied Hadley compensation for profits lost during this time period because they were unforeseeable consequential damages.²⁸

The case has come to represent an important limit to the general rule awarding full expectation damages for breach.²⁹ Damages are divided into two types, general and consequential. General damages, arising naturally in the usual course of breach, are routinely recoverable.³⁰ Consequential damages, such as Hadley's lost profits, are not recoverable unless the loss is foreseeable at the time of contracting or the parties make alternative arrangements.³¹ In other words, *Hadley* is a default rule that takes effect only when a contract is silent on the issue of consequential damages. Parties can contract around it if they wish.³²

Much of contract theory deals with this concept of selecting appropriate default rules to govern incomplete contracts.³³ Parties cannot possibly anticipate everything that might happen over the course of a contract. Even if they could, the costs of negotiating every con-

26. *Hadley*, 156 Eng. Rep. at 146.

27. *Id.*

28. 3 FARNSWORTH, *supra* note 3, § 12.14.

29. The *Hadley* rule receives widespread acceptance. The *Restatement (Second) of Contracts* adopts the rule as follows: "Damages are not recoverable for loss that the party in breach did not have reason to foresee as a probable result of the breach when the contract was made." RESTATEMENT (SECOND) OF CONTRACTS § 351 (1979). Article 2 of the Uniform Commercial Code (UCC) codifies *Hadley*. U.C.C. § 2-715(2)(a) (2003). The United Nations Convention on Contracts for the International Sale of Goods limits damages to losses that the breaching party "foresaw or ought to have foreseen . . . as a possible consequence of the breach of contract." United Nations Convention on Contracts for the International Sale of Goods, Apr. 11, 1980, art. 74, 52 Fed. Reg. 6262, 1489 U.N.T.S. 3.

30. See 3 FARNSWORTH, *supra* note 3, § 12.14, at 256.

31. *Id.* at 257, 259, 268.

32. In fact, many commercial contracts apparently modify this default rule to disclaim liability for *all* consequential damages, whether foreseeable or not. See DOUGLAS G. BAIRD ET AL., *GAME THEORY AND THE LAW* 281 n.16 (1994); 3 FARNSWORTH, *supra* note 3, § 12.14, at 268. Richard Epstein puts it this way:

All in all, the optimal contracting strategy does not appear to call for the high consequential damages, subject to defense rules, that courts have tended to adopt. . . . [W]ithin the class of fixed damage awards, there is reason to expect these damages to be kept relatively limited, which is what the express contracts have typically provided.

Epstein, *supra* note 21, at 118. See also *infra* note 49 (exploring UCC drafting committee discussions to abandon the *Hadley* default rule for this reason).

33. See, e.g., Adler, *supra* note 7, at 1547 ("At the center of contract theory is the role of default rules."); Randy E. Barnett, *The Sound of Silence: Default Rules and Contractual Consent*, 78 VA. L. REV. 821 (1992); Richard Craswell, *Contract Law: General Theories*, in 3 ENCYCLOPEDIA OF LAW AND ECONOMICS, *supra* note 5, at 1; Charles J. Goetz & Robert E. Scott, *The Limits of Expanded Choice: An Analysis of the Interactions Between Express and Implied Contract Terms*, 73 CAL. L. REV. 261 (1985).

tingency may outweigh the benefits of planning for small-probability events. As a result, no one drafts a complete contract.³⁴

The law faces a choice, then, when parties to a contract come across a contingency not addressed by the initial agreement. One option is to dismiss the contract entirely, expunging all contractual liability because the parties have not sufficiently stated a binding agreement.³⁵ A second option is to fill these contractual gaps somehow and enforce the enhanced contract instead.³⁶ Economic analysis claims to offer a basis for choosing efficient default rules to govern incomplete contracts.

One way to select a default rule is to simply choose the term that most parties would prefer at the time of contracting.³⁷ This majoritarian approach to default rules allows the law to economize on transaction costs by supplying standard contract terms that parties

34. See COOTER & ULEN, *supra* note 6, at 211-17; SHAVELL, *supra* note 6, at 299-301; Craswell, *supra* note 33. Alan Schwartz and Robert Scott recently put it this way: “[C]ontracts will inevitably be incomplete. There is an infinite number of possible future states and a very large set of possible partner types. When the sum of possible states and partner types is infinite and contracting is costly, contracts must contain gaps. Parties cannot write contracts about everything.” Alan Schwartz & Robert E. Scott, *Contract Theory and the Limits of Contract Law*, 113 YALE L.J. 541, 594-95 (2003). Parties may also remain silent for a number of strategic reasons. See Ayres & Gertner, *supra* note 5, at 94; Ayres & Gertner, *supra* note 2, at 760; Johnston, *supra* note 7.

35. Such is the approach taken in a number of classic common law cases. See, e.g., *Varney v. Ditmars*, 111 N.E. 822, 823 (N.Y. 1916) (holding a promise to give a “fair share of [the] profits” sufficiently vague to render the contract unenforceable). The *Restatement (Second) of Contracts* offers some support for this approach. See RESTATEMENT (SECOND) OF CONTRACTS § 33(1) (1979) (“Even though a manifestation of intention is intended to be understood as an offer, it cannot be accepted so as to form a contract unless the terms of the contract are reasonably certain.”); *id.* § 33 cmt. b (“Contracts should be made by the parties, not by the courts, and hence . . . remedies for breach of contract must have a basis in the agreement of the parties.”); see also Robert E. Scott, *A Theory of Self-Enforcing Indefinite Agreements*, 103 COLUM. L. REV. 1641, 1643-61 (2003) (exploring situations where courts refuse to enforce incomplete contracts).

36. This approach receives support from the Uniform Commercial Code, which often seeks to supplement incomplete contracts with fair or reasonable terms, especially when parties fail to specify less important terms. See, e.g., U.C.C. § 2-305(1) (2003) (inserting a reasonable price when none is specified). For more general discussion, see Richard E. Speidel, *Restatement Second: Omitted Terms and Contract Method*, 67 CORNELL L. REV. 785 (1982). Other compromise approaches to enforcing incomplete contracts have also been suggested. See, e.g., Omri Ben-Shahar, “Agreeing to Disagree”: *Filling Gaps in Deliberately Incomplete Contracts*, 2004 WIS. L. REV. 389 (suggesting an intermediate solution, in some circumstances, which holds parties partially accountable to honor incomplete contracts).

37. Craswell, *supra* note 33, at 2-5; Charles J. Goetz & Robert E. Scott, *The Mitigation Principle: Toward a General Theory of Contractual Obligation*, 69 VA. L. REV. 967, 971 (1983). The *Restatement (Second) of Contracts* suggests that lawmakers should supply an essential missing term with one “which is reasonable in the circumstances.” RESTATEMENT (SECOND) OF CONTRACTS § 204 (1979). It has been suggested that this leads to the use of majoritarian defaults. See Speidel, *supra* note 36; see also U.C.C. § 2-204(3) (2003) (“[A] contract for sale does not fail for indefiniteness if the parties have intended to make a contract and there is a reasonably certain basis for giving an appropriate remedy.”).

would otherwise have to adopt by express agreement.³⁸ While it may be fiction to retroactively divine the parties' intentions, economists can often reason that one term would have been selected over alternatives. Perhaps one party can better manage the risk, for example, or avoid costs easier.³⁹ By generalizing the preferences of many contracting parties in this manner—or even by looking historically at a large number of executed contracts—lawmakers could conceivably judge which default rules will minimize transaction costs.⁴⁰

But, unfortunately, selecting default rules by majority preference may not always lead to the most efficient outcome. A second strain of economic theory suggests that lawmakers should, instead, sometimes choose default rules preferred by a minority of parties.⁴¹ The reason is this: minority defaults can, at times, lead to information sharing that increases the overall welfare of an economic system.⁴² Selecting the right default can prevent better-informed parties from taking advantage of less-informed parties by compelling information to come forward that results in a greater social welfare.⁴³

From an economic point of view, then, one key challenge is knowing whether to choose majoritarian defaults that save on transaction costs or to choose penalty defaults that force information to be shared. This tension plays out most directly in the economic literature evaluating *Hadley*.⁴⁴ In fact, over time, the *Hadley* rule has

38. POSNER, *supra* note 6, § 4.1, at 96-97; cf. Frank H. Easterbrook & Daniel R. Fischel, *Limited Liability and the Corporation*, 52 U. CHI. L. REV. 89, 93 (1985) ("The legal rule [of limited liability] enables firms to obtain . . . benefits . . . at lower cost.").

39. See ROBERT A. HILLMAN, *PRINCIPLES OF CONTRACT LAW* 254-56 (2004); Goetz & Scott, *supra* note 37, at 971-76. For an example of this in practice, see *National Distillers & Chemical Corp. v. First National Bank of Highland Park*, 804 F.2d 978, 982 (7th Cir. 1986), reasoning that "[a]mbiguities and gaps in contracts should be resolved by finding what the parties would have bargained for had they addressed the matter explicitly at the time."

40. *But see* Russell Korobkin, *The Endowment Effect and Legal Analysis*, 97 NW. U. L. REV. 1227, 1272 (2003) (suggesting that behavioral economic effects may cause contract default rules to be "sticky," preventing parties from efficiently contracting around the rules in some cases); Korobkin, *supra* note 2, *passim* (suggesting that default rule preferences of contracting parties may be influenced by the existing default rule).

41. See Ayres & Gertner, *supra* note 5, at 93-95; Craswell, *supra* note 33, at 5-9.

42. The intuition behind these penalty defaults, or "information-forcing defaults," is to keep better-informed parties from strategically hiding socially valuable information during contract formation. Ayres & Gertner, *supra* note 5, at 94. To get the information out, "it may be efficient to choose a rule that a majority of people actually disfavor." *Id.* at 95; see also Gwyn D. Quillen, Note, *Contract Damages and Cross-Subsidization*, 61 S. CAL. L. REV. 1125 (1988) (discussing cross-subsidization problems that result when better informed parties keep information private).

43. Ayres & Gertner, *supra* note 5, at 94, 99. This point is developed further *infra* Parts II.B.1-2.

44. See, e.g., Ayres & Gertner, *supra* note 5, at 101-04; Bebchuk & Shavell, *supra* note 5, at 284-87.

taken on much greater significance as an archetype for the power of contract default rules to efficiently expose asymmetric information.⁴⁵

B. Theoretical “Solutions” to Hadley

The *Hadley* situation is usually modeled by dividing a population of buyers into two classes: those with a low valuation of contract performance and those with a high valuation.⁴⁶ For example, purchasers of FedEx delivery services might be divided between buyers valuing delivery greatly (perhaps they need to deliver important documents to buy a house or apply for a job) and buyers with a low valuation of performance (perhaps they need to send a newsletter or another routine document). Each buyer is risk-neutral and knows his valuation type. The selling party has no way to distinguish one type of buyer from the other and must rely instead on the buyer to reveal this private information. From a social point of view, it is desirable for sellers to know this information so they can take efficient precautions.⁴⁷ For example, using the facts of *Hadley*, the carrier could hire another employee to ensure timely delivery for the highest-value buyers.⁴⁸ While many default rules might govern the issue of consequential damages,⁴⁹ two alternative rules are proposed: (1) a *Hadley* default limiting unforeseeable consequential damages unless high-value buyers reveal their type and (2) a full-damages default allowing high-value buyers to recover everything without revealing any informa-

45. See Adler, *supra* note 7, at 1548-53; Ayres & Gertner, *supra* note 5, at 101-04; Bebchuk & Shavell, *supra* note 5, at 286. More generally, contracting under asymmetrical information receives extensive treatment in the literature on game theory and the law. See, e.g., BAIRD ET AL., *supra* note 32, at 79-158.

46. A more realistic approach might be to model the value of performance by the two classes of buyers as two continuous distributions with different means. Such an approach is suggested by Adler, *supra* note 7, at 1561 n.38. This Article extends the analysis in this manner. See *infra* Part III.

47. The model thus assumes that spending more on precautions will reduce the risk of breach and therefore the expected damages suffered by each buyer for nonperformance. Said another way, if the low-value and high-value buyers were conducting these activities themselves, they would each take different levels of care, which would reflect the optimal investments to reduce the risk of nonperformance. Other things being equal, one would prefer a default rule that leads to identical results. See BAIRD ET AL., *supra* note 32, at 150-51; Ayres & Gertner, *supra* note 5, at 97-104; Bebchuk & Shavell, *supra* note 5, at 287-92.

48. This might make sense if the costs of hiring the extra employee were more than offset by the benefits of a greater chance of timely delivery to Hadley. One can also imagine an inefficient investment in precautions—for example, hiring ten police to fend off an unlikely attempt at highway robbery. Such an investment might result in a price greater than what Hadley is willing to pay and is unlikely to occur once full negotiations have taken place.

49. For example, some members of the drafting committee for the 2003 amendments to Article 2 of the Uniform Commercial Code considered imposing a default rule denying recovery of *all* consequential damages from breach. Interview with William Henning, Former Chair, Drafting Committee to Revise UCC Article 2, in Tuscaloosa, Ala. (June 16, 2004). This discussion did not lead to a formal draft proposal, and amended Article 2 leaves the *Hadley* rule in place. *Id.*

tion.⁵⁰ Which default rule will allow sellers to distinguish between buyer types, thus enabling them to take efficient precautions that maximize social welfare?⁵¹

1. *The Majoritarian Solution*

A lawmaker might argue that the *Hadley* default is preferable because it forces high-value buyers to reveal their type by negotiating protection for unforeseeable consequential damages.⁵² Of course, high-value buyers may initially resist disclosing this information to avoid a price increase. But as long as sellers are best situated to in-

50. *E.g.*, Adler, *supra* note 7, at 1554-59; Ayres & Gertner, *supra* note 5, at 108; Bebchuk & Shavell, *supra* note 5, at 289-92.

51. The concept of greater social efficiency through more tailored precautions can be illustrated with a simple numerical example. Take a population of 100 buyers with a positively skewed distribution of performance valuations as follows (Figure 1a, *supra* p. 899, displays this data visually):

VALUE PLACED ON PERFORMANCE	NUMBER OF BUYERS
1	7
2	13
3	19
4	14
5	12
6	9
7	6
8	5
9	4
10	3
11	2
12	2
13	2
14	1
15	1
TOTAL	100
MEAN	5.1

If sellers cannot distinguish among the types of buyers, they will take precautions reflecting the mean performance valuation of 5.1. However, if they can divide the buyers into just two groups—those above the mean and those below the mean—then they can take precautions reflecting a mean value of 3.2 for the 65 low-value buyers and precautions reflecting a mean value of 8.7 for the 35 high-value buyers. More granular knowledge of the performance valuations for different buyer classes results in two main benefits. First, sellers can avoid wasting precautions on the 65 low-value buyers who would prefer a lower price and higher chance of breach. Second, sellers can take additional precautions—greater than the average levels taken when all buyers are pooled together—to increase the probability of successful performance for the 35 high-value buyers. Social gains will continue to accrue with increasing levels of granularity (for example, subdividing the two groups of buyers into groups of four, eight, or ultimately down to groups of fifteen). Of course, these gains may be offset by the increased transaction costs needed to obtain this granularity.

52. *See* Posner, *supra* note 11, at 836-37.

vest in extra precautions,⁵³ high-value buyers will realize that they are better off paying the higher price and enjoying greater certainty of performance.

But what happens if a full-damages default rule is adopted instead? Now, high-value buyers will be compensated fully and need not reveal their special circumstances.⁵⁴ Low-value buyers, however, will prefer that sellers take fewer precautions in exchange for a cheaper price.⁵⁵ They will step forward to reveal this preference, allowing sellers to again distinguish between buyer types and take more granular precautions.⁵⁶ Thus, in theory, either the *Hadley* or the full-damages default rule will expose private information and lead to efficient precautions.

Under a majoritarian approach, then, the optimal default rule is simply a function of the underlying valuation distribution for the market. The most efficient rule seeks only to minimize transaction costs by putting in place a default that most buyers need not contract around.⁵⁷ Lawmakers should estimate the buyer valuation distribution for the market and select the default rule accordingly: if buyer valuations skew positively (Figure 1a⁵⁸), then a *Hadley* rule is best; if they skew negatively (Figure 1b⁵⁹), then a full-damages default should be chosen. And if buyer valuations are normally distributed, the consequential damages default rule may not matter.⁶⁰

2. *The Penalty Default Solution*

In some cases, however, a *Hadley* default can be better even when most buyers would not select this rule in advance. The logic is subtle: majority defaults may not lead buyers to reveal their type, while a penalty default rule—reflecting the preferences of fewer buyers—may expose this information.⁶¹

This can happen because the majoritarian model of *Hadley* assumes away important variables. For instance, the optimal default rule may depend on the magnitude of transaction costs—the costs of contracting around a disliked default rule.⁶² Or the best rule may change if low-value and high-value

53. One would expect this to be true in many cases. However, independent insurance markets, allowing buyers to self-insure if they wish, might exist for some types of contracts. This is ultimately another issue subject to empirical investigation.

54. See Craswell, *supra* note 33, at 7-8; Posner, *supra* note 11, at 836-37.

55. See Craswell, *supra* note 33, at 7-8; Posner, *supra* note 11, at 837.

56. See Craswell, *supra* note 33, at 7-8; Posner, *supra* note 11, at 837.

57. This analysis follows from Coasean contractual theory. See R.H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960); Johnston, *supra* note 7, at 623-25.

58. See *supra* p. 899 fig.1a.

59. See *supra* p. 899 fig.1b.

60. Posner, *supra* note 11, at 854.

61. Adler, *supra* note 7, at 1549-50; Ayres & Gertner, *supra* note 5, at 97-98; Bebchuk & Shavell, *supra* note 5, at 290.

62. A majoritarian default might be appropriate if transaction costs are so small that everyone contracts around inefficient defaults or so large that no one does so. See Ayres &

buyers face different transaction costs.⁶³ The optimal default might also turn on which buyers benefit the most from tailored precautions.⁶⁴

Consider a situation where the majoritarian default leads to a poor outcome. Assume that a legal system selects a full-damages default to govern the negatively skewed market shown in Figure 1b.⁶⁵ This default is majoritarian because there are 65 high-value buyers who prefer a full-damages rule and just 35 low-value buyers. But the transaction costs incurred by low-value buyers to contract around the full-damages default may outweigh the gains that they receive from the seller taking fewer precautions. If so, low-value buyers will not reveal their type, and sellers will take average precautions for the entire buyer pool rather than more efficient tailored precautions. By contrast, this problem may not occur if lawmakers select a *Hadley* default. If the gains from high-value buyers contracting around the *Hadley* default rule sufficiently outweigh the transaction costs incurred, then they will reveal their type. Under these circumstances, a default rule preferred by a minority of buyers leads to greater social welfare, while a default rule preferred by the majority is less efficient.

A stylized numerical example may help illustrate this point.⁶⁶ Under this example, simplify the market in Figure 1b⁶⁷ even further so that there are 35 identical low-value buyers and 65 identical high-value buyers, and make the assumptions of Table 1.

TABLE 1
BUYER ASSUMPTIONS IN A NEGATIVELY SKEWED MARKET

BUYER TYPE	NUMBER	VALUATION (\$)	COST TO CONTRACT AROUND DEFAULT (\$)
Low	35	50	15
High	65	500	10
Average		342.5 ⁶⁸	

Gertner, *supra* note 5, at 114-15. But this need not be the case, and robust models will explicitly take transaction cost variables into account. *Id.* at 117-18; see also Alan Schwartz & Joel Watson, *The Law and Economics of Costly Contracting*, 20 J.L. ECON. & ORG. 2, 3 (2004) (noting that “contracting and renegotiation costs are treated as exogenous parameters, commonly assumed to be either *very high* or *very low*” and then “explor[ing] the middle ground”).

63. Korobkin also explores this point. See Korobkin, *supra* note 20, at 1058.

64. Ayres & Gertner, *supra* note 5, at 116-18.

65. See *supra* p. 899 fig.1b. The distribution of buyer valuations for this market is the inverse of the one described *supra* note 51.

66. This example is adapted from the framework established by Bebchuk and Shavell. See Bebchuk & Shavell, *supra* note 5, at 287-90 nn.9-17. Perfect competition is assumed, and all seller costs except precautions are excluded for simplicity.

67. See *supra* p. 899 fig.1b.

68. This value is the weighted average of the low-value and high-value buyer valuations: $(.35 * 50) + (.65 * 500) = 342.5$.

Assume further that sellers in a perfectly competitive market can choose from three different levels of precautions, as indicated in Table 2. Taking greater precautions increases the chances that sellers will successfully perform the contract, but doing so also costs more. For example, sellers taking medium precautions incur \$25 in costs—which they pass on to buyers in perfect competition—and these precautions lead to successful contract performance 60% of the time.

TABLE 2
SELLER PRECAUTIONS ASSUMPTIONS

SELLER PRECAUTION LEVEL	PROBABILITY OF PERFORMING CONTRACT (%)	COST OF TAKING PRECAUTION (\$)
Low	40	5
Medium	60	25
High	80	100

With these assumptions, low-value buyers prefer contracts where sellers take low precautions:⁶⁹

$$\text{Utility}_{\text{low}} = 50 (40\%) - 5 = 15$$

$$\text{Utility}_{\text{med}} = 50 (60\%) - 25 = 5$$

$$\text{Utility}_{\text{high}} = 50 (80\%) - 100 = -60$$

Conversely, high-value buyers prefer contracts where sellers take high precautions:

$$\text{Utility}_{\text{low}} = 500 (40\%) - 5 = 195$$

$$\text{Utility}_{\text{med}} = 500 (60\%) - 25 = 275$$

$$\text{Utility}_{\text{high}} = 500 (80\%) - 100 = 300$$

And if sellers cannot distinguish buyer types, they will take medium precautions, reflecting average expected preferences:

$$\text{Utility}_{\text{low}} = 342.5 (40\%) - 5 = 132$$

$$\text{Utility}_{\text{med}} = 342.5 (60\%) - 25 = 180.5$$

$$\text{Utility}_{\text{high}} = 342.5 (80\%) - 100 = 174$$

Now imagine that this legal system selects the majoritarian default rule of full damages. High-value buyers have no need to contract around this rule because they will be fully compensated under the default.⁷⁰ But low-value buyers may choose to reveal their type for a cheaper price.⁷¹ Will the economic system benefit if they

69. Buyer utility = [(valuation of successful performance) * (probability of successful performance)] - cost of precautions.

70. See Posner, *supra* note 11, at 836-37.

71. *Id.* at 837.

do so? Consider the social welfare in each possible outcome (Table 3).

TABLE 3
SOCIAL WELFARE UNDER FULL-DAMAGES DEFAULT RULE

	SOCIAL WELFARE		
	LOW-VALUE BUYERS	HIGH-VALUE BUYERS	TOTAL
Low-value buyers contract around default (separating ⁷²)	0 ⁷³	19,500 ⁷⁴	19,500
Low-value buyers do not contract around default (pooling ⁷⁵)	175 ⁷⁶	17,875 ⁷⁷	18,050*
* Equilibrium result			

If low-value buyers incur the costs of contracting around the rule, the buyer population separates by type. Low-value buyers receive low precautions and high-value buyers receive high precautions (without incurring transaction costs). Conversely, if low-value buyers do not reveal their type, the population pools and everyone receives medium precautions. Society is better off when low-value buyers contract around the default rule (19,500 > 18,050), but they will not do so. Each low-value buyer faces a cost of \$15 to contract around the rule yet only benefits by \$10—the difference between utility with low precautions and utility with medium precautions. The equilibrium is a pooling one where no one reveals information.

In this example, however, the results change when the *Hadley* default is selected, even though fewer buyers prefer this rule. Now the 65 high-value buyers must decide whether to reveal their type. Con-

72. A separating equilibrium occurs when one group of buyers offers information about their type, thus allowing the seller to distinguish between the groups of buyers and take tailored precautions. See Adler, *supra* note 7, at 1557-58; Ayres & Gertner, *supra* note 5, at 111-23.

73. This social welfare value is calculated as follows: (number of low-value buyers) * (utility to low-value buyer with low precautions – cost to low-value buyer of contracting around default) = (35) * (15 - 15) = 0. Thus, in this context, social welfare is the sum of participant utility and excludes third-party effects.

74. This social welfare value is calculated as follows: (number of high-value buyers) * (utility to high-value buyer with high precautions) = (65) * (300) = 19,500.

75. A pooling equilibrium occurs when no buyer group offers information about their type, thus forcing the seller to take the same level of precautions for the entire buyer “pool.” See Adler, *supra* note 7, at 1556; Ayres & Gertner, *supra* note 5, at 111-13.

76. This social welfare is calculated as follows: (number of low-value buyers) * (utility to low-value buyer with medium precautions) = (35) * (5) = 175.

77. This social welfare is calculated as follows: (number of high-value buyers) * (utility to high-value buyer with medium precautions) = (65) * (275) = 17,875.

sider the resulting social welfare under both outcomes as shown in Table 4.

TABLE 4
SOCIAL WELFARE UNDER *HADLEY* DEFAULT RULE

	SOCIAL WELFARE		
	LOW-VALUE BUYERS	HIGH-VALUE BUYERS	TOTAL
High-value buyers contract around default (separating)	525 ⁷⁸	18,850 ⁷⁹	19,375*
High-value buyers do not contract around default (pooling)	175 ⁸⁰	17,875 ⁸¹	18,050
* Equilibrium result			

Social welfare is greater when high-value buyers contract around the *Hadley* default rule (19,375 > 18,050), and they will do so. The increase in utility when they move from medium precautions to high precautions, a net gain of \$25, outweighs the transaction costs of \$10. While the greatest social welfare comes when low-value buyers contract around a full-damages default,⁸² this outcome never occurs. *Hadley* thus offers the best obtainable outcome.

This example illustrates how self-interested buyer behavior sometimes prevents majoritarian defaults from exposing socially valuable information. Different assumptions, of course, might support majoritarian defaults.⁸³ The penalty-default solution to *Hadley* argues that limited consequential damages should sometimes be imposed to force efficient precautions, even though the rule may be preferred by few contracting parties. This means that lawmakers considering the

78. This social welfare is calculated as follows: (number of low-value buyers) * (utility to low-value buyer with low precautions) = (35) * (15) = 525.

79. This social welfare is calculated as follows: (number of high-value buyers) * (utility to high-value buyer with high precautions – cost to high-value buyer of contracting around default) = (65) * (300 – 10) = 18,850.

80. Calculated as in *supra* note 76.

81. Calculated as in *supra* note 77.

82. This is true because total transaction costs incurred when low-value buyers contract around the default (35 * 15 = 525) are less than the total transaction costs incurred when high-value buyers do so (65 * 10 = 650). *Cf.* Bebchuk & Shavell, *supra* note 5, at 288-89, 295 (discussing socially optimal behavior of buyers and sellers where, in contrast to this model, contracting high-buyers have lower transaction costs because they are in the minority). This need not always be the case. If, for example, transaction costs of high-value buyers are reduced to \$5, the resulting welfare when they contract around the *Hadley* default is 19,700—which exceeds the social welfare when low-value buyers contract around the full-damages default.

83. For example, reducing transaction costs for low-value buyers to \$5 would cause them to separate in a full-damages regime. A majoritarian default thus results in the most efficient outcome.

Hadley rule ought to analyze more than just the number of high-value and low-value buyers in a market. Additional buyer data—including the magnitude of performance valuations, costs incurred when contracting for other rules, and efficiency gains from tailored precautions—are needed to select the better default rule.

3. *Introducing Stochastic Damages*

The solution gets more complicated, however, when consequential damages are stochastic (occurring with some probability) instead of certain.⁸⁴ Using the facts of *Hadley*, imagine, for example, that there was only some chance that the miller would lose profits from a delayed delivery—maybe he was searching neighboring mills for a spare shaft.⁸⁵ Barry Adler recently modeled this nuance,⁸⁶ finding that the change narrows the circumstances where penalty defaults lead to the optimal outcome.⁸⁷ A few changes to the previous example are reflected in Table 5, which will illustrate this point.

TABLE 5
REVISED BUYER ASSUMPTIONS

BUYER TYPE	NUMBER	VALUATION: GENERAL DAMAGES (\$)	VALUATION: CONSEQUENTIAL DAMAGES (\$)	PROBABILITY OF INCURRING CONSEQUENTIAL DAMAGES ⁸⁸ (%)	COST TO CONTRACT AROUND DEFAULT (\$)
Low	35	25	75	60	15
High	65	25	475	90	10
Average		25	335 ⁸⁹	79.5	

Buyer valuation is now split between general damages and consequential damages, and the *Hadley* rule is modeled differently. Consequential damages incurred by low-value buyers are considered foreseeable and, thus, recoverable under *Hadley*.⁹⁰ Consequential damages beyond this amount are unforeseeable. High- and low-value buyers

84. See Adler, *supra* note 7, at 1560.

85. Or, to borrow from Adler, imagine that Hadley hired a mechanic who had a chance to fix the mill without the missing mill shaft. *Id.*

86. *Id.*

87. *Id.* at 1561-70.

88. For simplicity, this probability of incurring consequential damages is modeled with certainty. *Cf. id.* at 1561 n.38 (using a simplified presentation to convey the general idea). The working model used *infra* Part III.A models this variable stochastically.

89. This value is the weighted average of the low-value and high-value buyer consequential damages: $(.35 * 75) + (.65 * 475) = 335$. Similarly, the average probability of incurring consequential damages is the weighted probability of low- and high-value buyers.

90. See Adler, *supra* note 7, at 1562.

also have different chances of suffering consequential damages.

In this stylized example, then, the first \$75 in consequential damages is foreseeable, while the incremental \$400 incurred by high-value buyers is not. High-value buyers also suffer damages with greater probability. Assumptions for seller precautions remain the same.

With this modeling refinement, high-value buyers are more likely to conceal their type inefficiently, even under a *Hadley* default. As before, low-value buyers prefer contracts where sellers take low precautions,⁹¹ high-value buyers prefer contracts where sellers take high precautions,⁹² and sellers take medium precautions when they are unable to distinguish buyer type.⁹³ Under a full-damages regime, the outcome mirrors the earlier example. Table 6 illustrates this point.

TABLE 6
REVISED SOCIAL WELFARE UNDER FULL-DAMAGES DEFAULT RULE

	SOCIAL WELFARE		
	LOW-VALUE BUYERS	HIGH-VALUE BUYERS	TOTAL
Low-value buyers contract around default (separating)	280 ⁹⁴	17,030 ⁹⁵	17,310
Low-value buyers do not contract around default (pooling)	595 ⁹⁶	16,023 ⁹⁷	16,618*
* Equilibrium result			

91. The calculation here is slightly more complicated, as buyer utility under each precaution level now depends on the probability of consequential damages occurring. Thus, the equation for buyer utility is as follows: [probability of no consequential damages * ((general damages * the probability of successful performance) – the cost of precautions)] + [probability of consequential damages * (((general damages + consequential damages) * the probability of successful performance) – the cost of precautions)]. Using this formula for low-value buyers,

$$Utility_{low} = [40\% * ((25 * 40\%) - 5)] + [60\% * (((25 + 75) * 40\%) - 5)] = 23$$

$$Utility_{med} = 17$$

$$Utility_{high} = -44$$

92. For high-value buyers,

$$Utility_{low} = [10\% * ((25 * 40\%) - 5)] + [90\% * ((25 + 475) * 40\%) - 5] = 176$$

$$Utility_{med} = 246.5$$

$$Utility_{high} = 262$$

93. For average buyers,

$$Utility_{low} = [20.5\% * ((25 * 40\%) - 5)] + [79.5\% * (((25 + 335) * 40\%) - 5)] = 111.5$$

$$Utility_{med} = 149.8$$

$$Utility_{high} = 133.1$$

94. This social welfare value is calculated as follows: (number of low-value buyers) * (value to low-value buyer with low precautions – cost to low-value buyer of contracting around default) = (35) * (23 - 15) = 280.

95. This social welfare value is calculated as follows: (number of high-value buyers) * (value to high-value buyer with high precautions) = (65) * (262) = 17,030.

96. This social welfare value is calculated as follows: (number of low-value buyers) * (value to low-value buyer with medium precautions) = (35) * (17) = 595.

97. This social welfare value is calculated as follows: (number of high-value buyers) * (value to high-value buyer with medium precautions) = (65) * (246.5) = 16,023.

Social welfare is greater if low-value buyers separate (17,310 > 16,618), but instead they will pool. Transaction costs of \$15 exceed the net benefit of \$6 that accrues to low-value buyers moving from medium to low precautions.⁹⁸

In the earlier example, instituting a *Hadley* default resulted in a switch from a pooling equilibrium to a separating one. But this time, changing the default rule will not cause separation. Clearly, social welfare is again greater with buyer separation, as Table 7 illustrates. Furthermore, the gains to high-value buyers moving from medium to high precautions (\$15.5) exceed the transaction costs of contracting around the default rule (\$10).⁹⁹ But high-value buyers must now pay an additional cost if they identify their type: sellers will charge them for the higher probability of incurring the initial \$75 in consequential damages.¹⁰⁰ In this example, high-value buyers pay an extra \$7.88 when identifying their type.¹⁰¹ Facing this calculus, high-value buyers keep quiet;¹⁰² this results in a pooling equilibrium—even with the *Hadley* rule.

TABLE 7
REVISED SOCIAL WELFARE UNDER *HADLEY* DEFAULT RULE

	SOCIAL WELFARE		
	LOW-VALUE BUYERS	HIGH-VALUE BUYERS	TOTAL
High-value buyers contract around default (separating)	805 ¹⁰³	16,380 ¹⁰⁴	17,185
High-value buyers do not contract around default (pooling)	595 ¹⁰⁵	16,023 ¹⁰⁶	16,618*
* Equilibrium result			

This does not mean that penalty defaults never work.¹⁰⁷ It means only that they may work less frequently than otherwise believed.¹⁰⁸ A

98. See *supra* p. 914 tbl.5 and note 91.

99. See *supra* p. 914 tbl.5 and note 92.

100. See Adler, *supra* note 7, at 1565-66 (describing a similar scenario between shippers and carriers).

101. This additional cost is calculated as follows: (probability of consequential damages for high-value buyers – probability of consequential damages for average buyers) * foreseeable consequential damages = (90% - 79.5%) * 75 = 7.88.

102. \$15.50 in benefits < \$17.88 in total costs.

103. This social welfare value is calculated as follows: (number of low-value buyers) * (value to low-value buyer with low precautions) = (35) * (23) = 805.

104. This social welfare value is calculated as follows: (number of high-value buyers) * (value to high-value buyer with high precautions – cost to high-value buyers of contracting around default) = (65) * (262 - 10) = 16,380.

105. This social welfare value is calculated as in *supra* note 96.

106. This social welfare value is calculated as in *supra* note 97.

nanced model of *Hadley*, then, needs to add variables for the chances that high-value and low-value buyers will incur consequential damages.

In summary, the choice of a default rule to govern consequential damages depends on several variables, including (1) the magnitude and distribution of valuations that buyers place on contract performance;¹⁰⁹ (2) the transaction costs incurred when high-value buyers bargain around a *Hadley* default or when low-value buyers bargain around a full-damages default;¹¹⁰ (3) the social efficiency gains when high- or low-value buyers disclose private information, thus enabling more tailored precautions against breach;¹¹¹ and (4) the probability that high-value or low-value buyers will incur consequential damages in breach.¹¹² Given this complexity, it may be difficult for law-makers to unpack these variables and determine which default rule should apply in any given context. One commentator has remarked that “accurate evaluation of a penalty-default rule’s efficacy in the *Hadley* setting could be a heroic task.”¹¹³

C. *The Indeterminacy Concern with Economic Contracts Scholarship*

Eric Posner takes the argument further, suggesting that complex economic models of contract law—including the *Hadley* model for consequential damages—are indeterminate.¹¹⁴ In his view, economic analysis of contract law has become so complicated that the theories do not lead to observable implications or concrete normative suggestions. The argument is twofold. First, key variables in the economic

107. To see this in the example, change low-value buyer consequential damages from \$75 to \$25. With this modified assumption, the gains to high-value buyers from identifying themselves outweigh the costs of doing so, and buyers separate under the *Hadley* rule.

108. See Adler, *supra* note 7, at 1551-54. Responses to Adler’s article echo this belief. See Ayres & Gertner, *supra* note 5, at 92-93; Bebchuk & Shavell, *supra* note 8, at 1618-19.

109. See Ayres & Gertner, *supra* note 5, at 101-02.

110. See *id.* at 97-100.

111. See Bebchuk & Shavell, *supra* note 5, at 287-89.

112. See Adler, *supra* note 7, at 1560. Other refinements to the model are possible. Most notably, Jason Scott Johnston has introduced a game theoretical model of the *Hadley* rule where he relaxes assumptions of perfectly competitive markets. See Johnston, *supra* note 7, at 626-39. In other words, sellers are no longer “identical price-taking firms.” *Id.* at 625. This introduces an incentive for sellers to learn about buyer valuations, not for the purpose of taking efficient precautions but rather to increase their individual profits. *Id.* at 625-26. It also introduces another dimension of information revelation, as buyers would now like to learn whether different sellers have different probabilities of breach. See *id.* at 625-26. Other commentators emphasize the complications of crafting defaults in markets with seller power. See Ayres & Gertner, *supra* note 2, at 732-33; Alan Schwartz, *The Default Rule Paradigm and the Limits of Contract Law*, 3 S. CAL. INTERDISC. L.J. 389, 397-99 (1993).

113. Adler, *supra* note 7, at 1552.

114. See Posner, *supra* note 11, at 830.

models cannot be estimated with any degree of confidence.¹¹⁵ Second, even if one variable can be measured in isolation, there is no way to aggregate all of a model's variables to obtain meaningful outcomes.¹¹⁶ Take each argument in turn.

The first claim is that key variables are too hard to measure. In other words, "we [do not] have enough empirical data to be able to guess which rule is based on assumptions that are closer to reality."¹¹⁷ For *Hadley*, an example of an indeterminate variable might be the distribution of buyer valuations. How could lawmakers ever estimate the range of values for a given contract? What is the relevant population? How would they gather a sample? Why would participants ever feel compelled to reveal their actual valuation?¹¹⁸ If there is truly no way to estimate this variable empirically, then it may be impossible to state an optimal default rule for consequential damages.

More generally, if most economic models of contract law contain unverifiable terms, then economic analysis may be of little use. Models lacking a basis for empirical testing will ultimately fail to provide guidance to lawmakers. Even if more sophisticated models refine the variables and circumstances under which different default rules are preferable, they will remain indeterminate. Other approaches are needed to fill contract gaps at a more granular level.¹¹⁹

115. *Id.* at 864-65.

116. *Id.* at 865.

117. *Id.* at 837.

118. Posner concludes that "[n]o one has tried to determine the shape of this distribution through empirical research, and indeed it is hard to imagine how this could be done." *Id.* at 854. Barry Adler puts it this way: "A determination [of the optimal default rule] depends on perhaps unobtainable information about the full range of each type's [(high-value and low-value buyers)] expected damages from breach." Adler, *supra* note 7, at 1552.

119. Or maybe contract gaps should not be filled at all. Alan Schwartz and Robert Scott suggest that lawmakers should dismiss contracts that run into contingencies not spelled out explicitly, at least for contracts between sophisticated parties. See Schwartz & Scott, *supra* note 34, at 594-609. They support this approach by arguing that most state-imposed default rules are inefficient and do not address the myriad of situations that occur in contract law. See *id.* at 598-601. Instead of lowering transaction costs, these rules may force parties to contract around the defaults and raise the overall costs of contracting. See *id.* at 608; Robert E. Scott, *Rethinking the Default Rule Project*, 6 VA. J. 84, 85 (2003) (stating that if parties do not like a legislatively enacted term, they will "expend resources drafting their own term[s]"). The buyer and seller would then be free to renegotiate terms or abandon the deal entirely. Schwartz & Scott, *supra* note 34, at 594-609. Ultimately, the parties might come to understand the consequences of this approach and adjust their contracting strategies accordingly. *Id.* Of course, this refusal to set default rules would itself be a type of default rule. Richard Craswell puts it this way:

The law could, of course, simply refuse to enforce any contract . . . that fell short of absolute completeness. But such a rule would itself be a 'default rule': it would be a legal rule defining the obligations (or lack of obligations) that result when a contract does not itself specify what rules should govern. As long as actual contracts fall short of full completeness, then, the existence of default rules is not so much a choice as a logical necessity.

The second claim is that the overall effects of multiple variables cannot be summed.¹²⁰ In the *Hadley* context, even if lawmakers can estimate buyer valuation distributions with confidence, they would still need to estimate all of the other variables for the same population and aggregate the impact. How significant are the transaction costs? What are the efficiency gains from more tailored precautions? And what are the interactions between each of these variables? The optimal default rule could only be selected upon completion of this arduous analytic work.¹²¹

In fact, there may be further concerns. Suppose lawmakers can measure, with some confidence, all relevant variables in a single experiment, thus solving the “vague variable” and “summing-up” problems. And imagine that they do this over several different markets. It is entirely possible that the optimal default rule in one market is empirically different than the optimal rule in another. Maybe the valuation distribution curves of home construction, for example, skew negatively, indicating a preference for a full-damages default, while valuations of delivery contracts skew positively, advocating a *Hadley* rule. In this case, should lawmakers prefer customized default rules—where each market gets its optimal default—or, in the interests of contracting certainty, should they select just one global default for the issue of consequential damages?¹²² A parallel problem exists for heterogeneous contractors within a single market.¹²³ Should lawmakers use *Hadley* for one set of home builders and full damages for another? These choices raise fundamental jurisprudential issues of rules versus standards that permeate many areas of the law.¹²⁴

At its heart, though, Posner’s challenge to economic contracts scholarship highlights a need for empiricism. If key variables are truly immeasurable, then the economic approach to contract default rules may be futile. But if there are ways to get at the variables—or at least at some of the variables—empirically, then economic models may offer a tangible foundation for reforming contract law. Posner

Craswell, *supra* note 33, at 2.

120. Posner, *supra* note 11, at 838, 880.

121. *Id.* at 836-37.

122. This tension is raised in Ayres & Gertner, *supra* note 5, at 125-27.

123. *Id.*; see also Craswell, *supra* note 33, at 4-5.

124. For greater discussion of rules versus standards in the contracts context, see Craswell, *supra* note 14, at 908-09; and Avery Wiener Katz, *The Economics of Form and Substance in Contract Interpretation*, 104 COLUM. L. REV. 496 (2004). On the rules versus standards issue more generally, see Colin S. Diver, *The Optimal Precision of Administrative Rules*, 93 YALE L.J. 65 (1983); Louis Kaplow, *Rules Versus Standards: An Economic Analysis*, 42 DUKE L.J. 557 (1992); Duncan Kennedy, *Form and Substance in Private Law Adjudication*, 89 HARV. L. REV. 1685, 1687-1713 (1976); and Pierre Schlag, *Rules and Standards*, 33 UCLA L. REV. 379 (1985).

acknowledges that empirical analysis could conceivably spark a “renaissance” in the economic study of contract doctrine:

[Economic] models enjoy some intellectual advantages . . . for they would enable us to make complex and interesting predictions about contract law if we had sufficient information about empirical conditions. But because we do not have such information, and it is—in my view, though others might disagree—unlikely that we ever would, the complex economic theories do not get us much closer to an understanding of contract law¹²⁵

And so far, empirical scholarship in contract law is indeed rare. A recent review of contracts scholarship in over 500 law journals from 1985 to 2000 yields just twenty-seven empirical articles, a surprisingly small body of work.¹²⁶ In actuality, economists—largely outside the legal academy—have compiled a substantial body of empirical work on contracts, examining the contract terms selected in specific markets or situations.¹²⁷ But this work rarely considers explicit doctrinal implications for contract law.¹²⁸ Said differently, the models of contract default rules developed by legal scholars have been subjected to little empirical testing. This is true even though scholars often call for empirical study.¹²⁹

An empirical analysis of *Hadley*, then, might take on a greater significance. If key variables can be measured empirically, a growing body of scholarship could test and refine economic models of contract

125. Posner, *supra* note 11, at 864-65.

126. See Korobkin, *supra* note 20, at 1036-37. Korobkin explains his results as follows: Despite the fact that . . . contract law is a relatively rich area for legal scholarship, I was able to identify fewer than thirty articles relevant to this review, and many of these either only arguably meet the definition of “empirical” or provide a tenuous link between the data gathered and any contract doctrine.

Id. (footnotes omitted). Also see *supra* note 20 for other sources of evidence that nonempirical approaches to contract doctrine are much more prevalent.

127. See, e.g., Douglas Allen & Dean Lueck, *Contract Choice in Modern Agriculture: Cash Rent Versus Cropshare*, 35 J.L. & ECON. 397 (1992); Victor P. Goldberg & John R. Erickson, *Quantity and Price Adjustment in Long-Term Contracts: A Case Study of Petroleum Coke*, 30 J.L. & ECON. 369 (1987). For a survey of this work, see Pierre-Andre Chiappori & Bernard Salanié, *Testing Contract Theory: A Recent Survey of Some Work*, in 1 ADVANCES IN ECONOMICS AND ECONOMETRICS: THEORY AND APPLICATIONS 115 (Mathias Dewatripont et al. eds., 2003). While this literature dates back to the 1980s, much of the work has occurred in the past five years. *Id.* at 142. And even here, “the empirical validation of the theory has long lagged behind the theoretical work.” *Id.* at 115.

128. See Korobkin, *supra* note 20, at 1036 (“[A]lthough there is a very large body of empirical studies of contracting, there is extremely little empirical contract law scholarship being produced in the legal academy today.”).

129. See, e.g., Ian Ayres, *Valuing Modern Contract Scholarship*, 112 YALE L.J. 881, 900 (2003) (“I join [Eric] Posner in welcoming and predicting a shift from the theoretical to the empirical.”); Korobkin, *supra* note 20, at 1061 (“[T]he surprising dearth of empirical research in contract law scholarship . . . presents a sizeable opportunity for scholars to help to define an emerging field.”); Schwartz & Watson, *supra* note 62, at 23 (“That so little data exist relating contract costs to contract form implies the need for serious empirical research.”).

law. The next Part turns to this possibility through a case study assessing the *Hadley* rule.

III. AN EMPIRICAL CASE STUDY OF *HADLEY V. BAXENDALE*

This Part launches an empirical case study of the *Hadley* rule. Part III.A describes the model used for the test.¹³⁰ Part III.B presents data from several marketing studies and uses this data to empirically estimate buyer valuation distributions in three simple markets. Part III.C runs Monte Carlo simulations to incorporate the effects of multiple variables. These simulations indicate that a *Hadley* default typically generates more welfare than a full-damages default in each market studied. Finally, Part III.D qualifies these findings by conducting sensitivity analysis on other variables in the model.

A. *Developing a Working Model of Hadley*

Under the empirical model of *Hadley*, one hundred buyers must first decide whether to contract with a seller. Each buyer has a different valuation of contract performance (VALUE) chosen randomly from a predetermined probability distribution.¹³¹ This valuation is split between general damages (GD) and consequential damages (CD). Specifically, the first portion of damages is deemed general—up to a constant assumption for GD—and the balance of VALUE is CD.¹³² General damages always occur with breach, but buyers may not incur consequential damages.¹³³ The probability of suffering consequential damages (PROBCD) is determined randomly for each buyer, again from a known distribution of values.¹³⁴

The seller may take low, medium, or high precautions for each buyer. Greater levels of precautions increase the probability of successful contract performance (PROBLOW, PROBMED, PROBHIGH) but also cost more (COSTLOW, COSTMED, COSTHIGH). Without

130. The model is also available, upon request, from the author, at ggeis@law.ua.edu. The model is built in Microsoft Excel, and users will also need to download and install Crystal Ball, an Excel add-in simulation program available from Decisioneering at <http://crystalball.com> (last visited Mar. 3, 2005).

131. The shape and parameters of the probability distribution differ for each market and are derived empirically. *See infra* Part III.B.

132. If the random VALUE for any buyer is less than the constant assumption for GD, then all damages are considered general. For example, if general damages are assumed to be \$0.20 and buyer number 26 values contract performance at just \$0.15, then all of that buyer's damages are deemed general (GD = \$0.15), and no damages are consequential (CD = \$0.00).

133. *Cf.* Adler, *supra* note 7, at 1560 (modeling consequential damages stochastically).

134. Initial values are selected from a normal probability distribution with a mean of 90%, a standard deviation of 5%, a minimum value of 0%, and a maximum value of 100% (the tails of the normal distribution below 0% and above 100% are distributed proportionately along the rest of the curve). Changes to this distribution are discussed *infra* Part III.D.1.

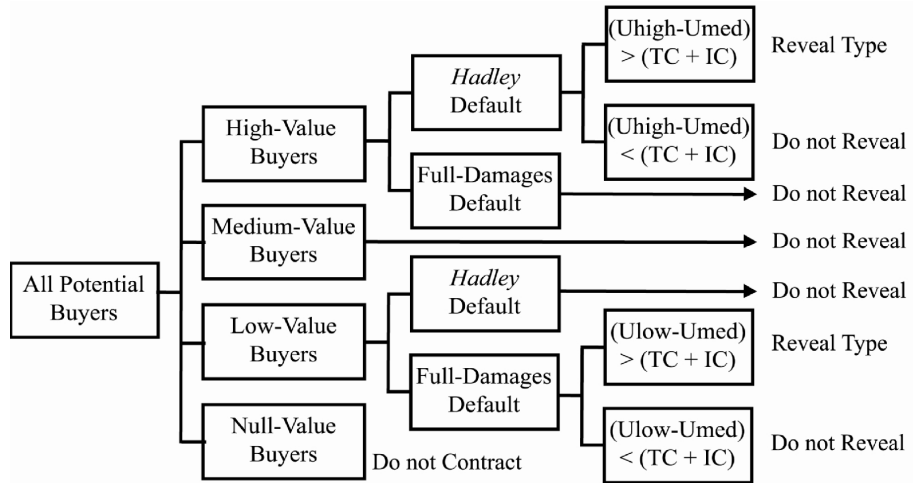
knowing a buyer’s specific valuation, the seller will take precautions reflecting the average buyer’s preference.¹³⁵

Most buyers sort into low-, medium-, or high-value buyers based on their preferred level of precautions. This is determined by calculating the expected utility for each buyer under the three precaution levels according to the following formula (where *x* is low, medium, or high):

$$\text{Utility}_x = ((1 - \text{PROBCD}) * (\text{GD} * \text{PROB}_x - \text{COST}_x)) + (\text{PROBCD} * ((\text{GD} + \text{CD}) * \text{PROB}_x - \text{COST}_x))$$

Buyers with very low valuations may refuse to contract because they derive no utility under any level of precautions. These null buyers are excluded from further analysis.

FIGURE 2
BUYER DECISION FLOWCHART



All other buyers must then decide whether to inform sellers of their valuation type. As Figure 2 illustrates, they make this decision based on four factors: (1) the legal default rule (*Hadley* or full damages), (2) the net benefits of moving to tailored precautions (*Ulow*, *Umed*, or *Uhigh*), (3) the transaction costs required to contract around the default (*TCLow* or *TCHigh*), and (4) the cost or benefit of revealing their probability of suffering consequential damages. This last factor relates to the additional information costs modeled by Adler and is, thus, labeled *IC* in Figure 2.¹³⁶ If *PROBCD* for a buyer

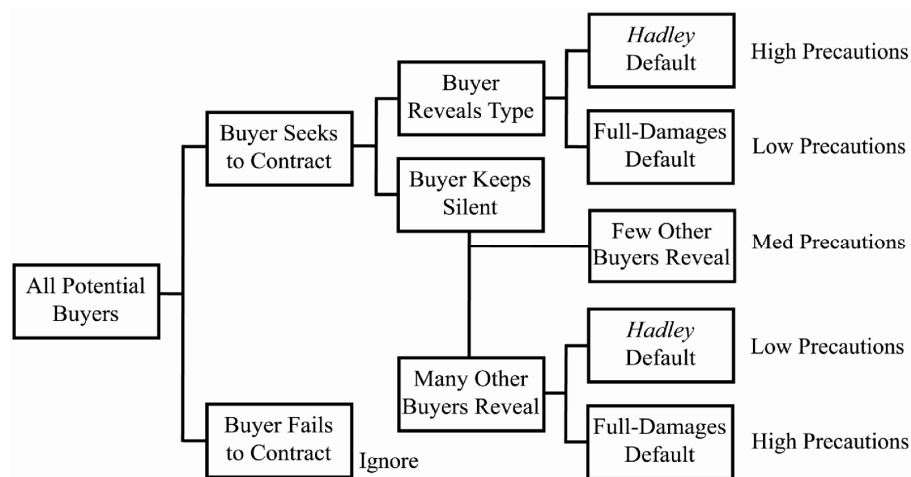
135. Thus it is also assumed that sellers know the overall probability function for buyer valuations but not the actual valuation for any given buyer. See *Bebchuk & Shavell, supra* note 5, at 285. Similarly, there is no other way for buyers to signal their type to sellers. See *id.*; *cf. id.* at 285 (modeling the *Hadley* problem in this manner).

136. Adler, *supra* note 7, at 1565-66.

exceeds the average probability of incurring consequential damages, then he will be charged a higher price. Conversely, if PROBCD is below average, the buyer will enjoy another benefit from revealing his type.¹³⁷

More specifically, high-value buyers will reveal their type under a *Hadley* default rule when the benefits of moving from medium to high precautions outweigh the transaction costs and information costs of doing so.¹³⁸ Low-value buyers will reveal their type under a full-damages default rule when the benefits of moving from medium to low precautions outweigh the costs.¹³⁹ Since medium-value buyers prefer medium precautions, they have no incentive to reveal their type under either default rule.

FIGURE 3
SELLER DECISION FLOWCHART



The seller must then choose how to treat each buyer, as Figure 3 illustrates. For the purposes of this model, buyers refusing to contract will be ignored in further analysis and buyers revealing their type will be given their requested level of precautions. But how should the seller treat silent buyers? There are two options. If few other contracting buyers have revealed their type, then the seller may continue to take average precautions for all silent buyers. Alternatively, if many other buyers reveal their type, the seller may deduce that silent buyers want more tailored precautions (that is, low

137. *Id.* This assumes there are no reliability concerns with the buyer's information revelation.

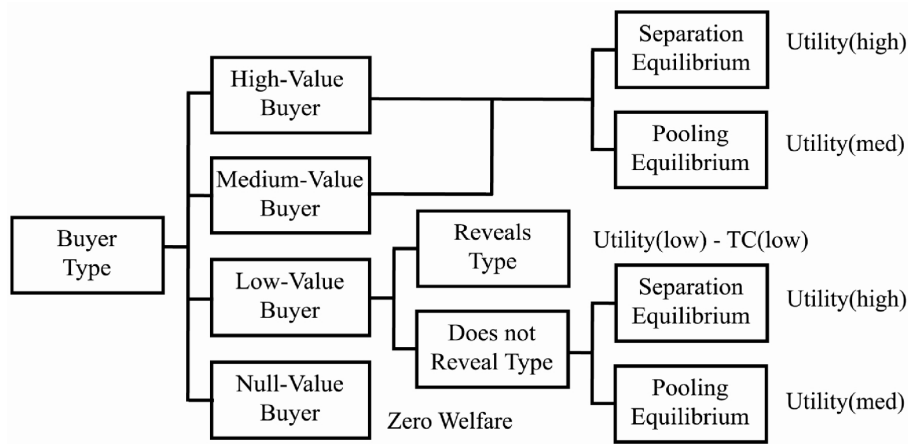
138. $Utility_{high} - Utility_{med} > TCHIGH + IC$

139. $Utility_{low} - Utility_{med} > TCLOW + IC$

precautions in a *Hadley* regime or high precautions in a full-damages regime).

Separation variables (SEPHIGH and SEPLow) are used to model this seller decision regarding precaution levels. If the proportion of contracting buyers¹⁴⁰ who reveal their type exceeds the variable, then sellers will take tailored precautions for everyone (including medium buyers) and a separating equilibrium results.¹⁴¹ Conversely, if the number of revealing buyers falls short of the separation variable, a pooling equilibrium results and all silent buyers receive medium precautions.

FIGURE 4
SOCIAL WELFARE FLOWCHART: FULL-DAMAGES DEFAULT



After all decisions take place, the model calculates total social welfare under both default rules for the given set of 100 buyers. Null buyers generate no welfare. Under a full-damages default, as illustrated in Figure 4, high- and medium-value buyers contribute utility_{high} under a separation equilibrium and utility_{medium} under a pooling one. Low-value buyers revealing their type contribute utility_{low} mi-

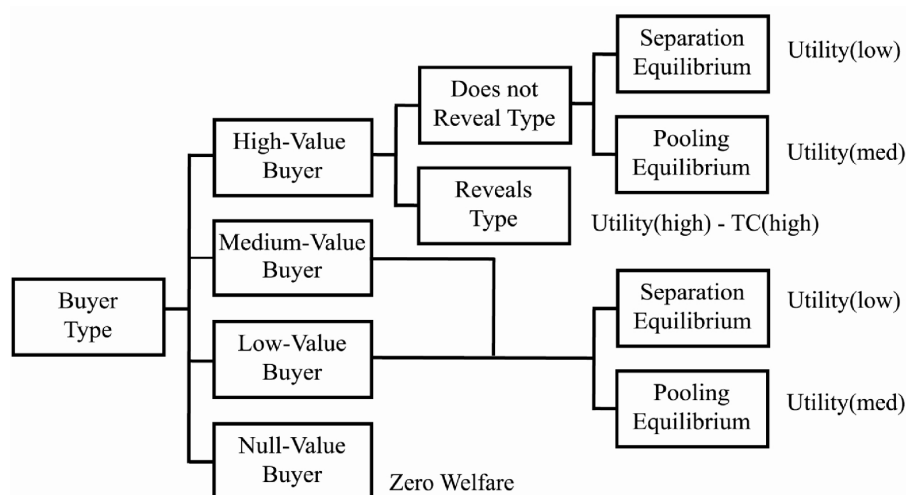
140. Buyers refusing to contract at all (null buyers) are ignored in this calculation.

141. For example, as initially modeled, under a *Hadley* default at least 20% of all contracting buyers need to identify themselves as high-value buyers before the nonidentifying buyers (low-value buyers, medium-value buyers, and high-value buyers refusing to identify their type) receive low precautions. If less than 20% of high-value buyers reveal their type, then nonidentifying buyers receive medium precautions. Of course, buyers choosing to identify their type will continue to receive their bargained-for level of precautions. As will become apparent through sensitivity analysis, this is an important variable. See *infra* Part III.D.4.

nus the transaction costs incurred.¹⁴² Low-value buyers remaining silent are treated like high- and medium-value buyers.

The social welfare calculations are similar under a *Hadley* default, as Figure 5 illustrates. Low- and medium-value buyers contribute $utility_{low}$ if the buyer population separates and $utility_{medium}$ if it does not. If they remain silent, high-value buyers contribute the same utility as low- and medium-value buyers. If they reveal their type, they contribute $utility_{high}$ minus transaction costs.

FIGURE 5
SOCIAL WELFARE FLOWCHART: *HADLEY* DEFAULT



Finally, once both sets of calculations are made, the total social welfare under each default rule can be compared to determine the more efficient default. An easy way to summarize the results is to calculate the net benefit of a *Hadley* default by subtracting the total social welfare under a full-damages regime from the total social welfare under a *Hadley* regime. A positive number means that *Hadley* outperforms full-damages. A negative number means that full-damages is a better approach.

But the real power of simulation modeling comes from the ability to play out the efficiency effects of both default rules hundreds or thousands of times. In each trial, a different set of 100 buyers is generated, and the net benefit (or cost) of a *Hadley* default is recalculated. Taken together, this analysis leads to a much greater un-

142. Information costs are excluded from the utility calculation because they are merely transferred from buyer to seller. In other words, these costs play into the buyer's decision but are not a deadweight loss for social welfare.

derstanding of the better default rule for a given market, along with the likely range of outcomes. Before running the simulations, however, the distribution of buyer valuations must be derived empirically for the three markets to be studied.

B. *Estimating the Distribution of Buyer Valuations Empirically*

1. *Data and Methodology*

Across the quadrangles of most universities, scholars in the field of marketing have long been interested in estimates of buyer valuation, although they call this variable by another name: willingness to pay (WTP).¹⁴³ Marketing researchers need WTP data to estimate product demand and to set prices.¹⁴⁴ WTP also becomes the yardstick by which new products (or modifications to existing products) must be measured. Over the years, marketing researchers have developed several techniques for estimating buyer WTP, which they use to conduct vast numbers of empirical studies.¹⁴⁵

143. See, e.g., SATTLER & VÖLCKNER, *supra* note 22, at 2 *passim* (analyzing “four methods of measuring willingness-to-pay”); Smith & Nagle, *supra* note 22 (explaining why pricing strategy should include estimation of buyer value in addition to willingness to pay); Wertebroch & Skiera, *supra* note 22 (examining various methods for determining buyer willingness to pay).

144. The typical use of marketing research in this context is not just for setting spot prices but, more broadly, for seeking an actionable consumer segmentation that allows sellers to capture consumer surplus through more sophisticated price discrimination. This requires sellers to estimate the distribution of buyer valuations, translate this data into a demand curve, identify a given customer’s position on the demand curve, and price accordingly. See, e.g., KENT B. MONROE, PRICING: MAKING PROFITABLE DECISIONS 26-54 (3d ed. 2003); David Besanko et al., *Competitive Price Discrimination Strategies in a Vertical Channel Using Aggregate Retail Data*, 49 MGMT. SCI. 1121 (2003); Andrea Shepard, *Price Discrimination and Retail Configuration*, 99 J. POL. ECON. 30 (1991). On the use of WTP methods to determine demand for private goods, see, for example, Diane Bruce Anstine, *How Much Will Consumers Pay? A Hedonic Analysis of the Cable Television Industry*, 19 REV. INDUS. ORG. 129 (2001); Philip M. Clarke, *Valuing the Benefits of Mobile Mammographic Screening Units Using the Contingent Valuation Method*, 32 APPLIED ECON. 1647 (2000); and George Dranitsaris et al., *The Economic Value of a New Insulin Preparation, Humalog® Mix 25™: Measured by a Willingness-to-Pay Approach*, 18 PHARMACOECONOMICS 275 (2000). On the use of WTP methods—especially contingent valuation—to determine the demand for public goods, see, for example, Catherine M. Chambers & John C. Whitehead, *A Contingent Valuation Estimate of the Benefits of Wolves in Minnesota*, 26 ENVTL. & RESOURCE ECON. 249 (2003); Adam Finn et al., *Valuing the Canadian Broadcasting Corporation*, 27 J. CULTURAL ECON. 177 (2003); and Dale Whittington et al., *Estimating the Willingness to Pay for Water Services in Developing Countries: A Case Study of the Use of Contingent Valuation Surveys in Southern Haiti*, 38 ECON. DEV. & CULTURAL CHANGE 293 (1990).

145. These techniques include actual transactions studies, contingent valuation, incentive-compatible auctions, and lottery procedures, such as the Becker, DeGroot, and Marschak (BDM) procedure. In historical data studies, researchers gather scanner data or other historical sales data to view buyer reactions at different price points. See, e.g., Alvin J. Silk & Glen L. Urban, *Pre-Test-Market Evaluation of New Packaged Goods: A Model and Measurement Methodology*, 15 J. MARKETING RES. 171 (1978)

In 2002, Klaus Wertenbroch and Bernd Skiera published a series of experiments in the *Journal of Marketing Research* where they estimated a population's WTP for three simple consumer products: a can of Coca-Cola, a piece of pound cake, and a type of ergonomic pen.¹⁴⁶ The technique used in these studies is called the Becker, DeGroot, and Marschak (BDM) procedure,¹⁴⁷ which the authors find more reliable than other WTP measurement techniques.¹⁴⁸ Wertenbroch and Skiera have agreed to share the data from these studies for use in this Article.

(discussing the use of the ASSESSOR model to estimate sales potential of new products). Contingent valuation measures buyer WTP via stated preferences, looking to behavioral intentions and responses to hypothetical choices. *See, e.g.*, ROBERT CAMERON MITCHELL & RICHARD T. CARSON, USING SURVEYS TO VALUE PUBLIC GOODS: THE CONTINGENT VALUATION METHOD 2 (1989); Richard T. Carson, *Contingent Valuation: A User's Guide*, 34 ENVTL. SCI. & TECH. 1413 (2000). Incentive-compatible auctions are designed to give all bidders the incentive to reveal their true WTP. Wertenbroch & Skiera, *supra* note 22, at 228-29. One example is a Vickrey auction, which allocates products to the highest bidder at the price offered by the second-highest bidder. *See* William Vickrey, *Counterspeculation, Auctions, and Competitive Sealed Tenders*, 16 J. FIN. 8, 20-23 (1961). Finally, the BDM procedure uses a random-number lottery process to determine a consumer's willingness to pay. *See* Gordon M. Becker, Morris H. DeGroot & Jacob Marschak, *Measuring Utility by a Single-Response Sequential Method*, 9 BEHAV. SCI. 226, 228-30 (1964). Although other researchers characterize the BDM lottery procedure as a type of incentive-compatible technique, *see* Wertenbroch & Skiera, *supra* note 22, it is worth distinguishing between the two because BDM is not an auction as traditionally understood. While both techniques are incentive compatible in that they give buyers every incentive to reveal true WTP, BDM can be conducted with just one buyer, at the point of purchase, and does not involve multiparty bidding.

146. Wertenbroch & Skiera, *supra* note 22, at 231-37.

147. *See* Becker, DeGroot & Marschak, *supra* note 145 (setting forth the BDM procedure). The description of the BDM procedure in this Article is adapted from the studies conducted by Wertenbroch and Skiera. Wertenbroch & Skiera, *supra* note 22, at 230-32, 235.

148. The studies find that the BDM procedure outperforms contingent valuation on measures of face, internal, and criterion validity. Wertenbroch & Skiera, *supra* note 22, at 232-34. Face validity was determined by correlating final offer prices with a number of other questions, such as "How thirsty/hungry are you right now?" and "How much do you like Coca-Cola/cake?" *Id.* at 232 tbl.2. Internal validity was determined using logit analysis of purchase probabilities to estimate demand and by correlations between observed and expected demand. *Id.* at 233; *see also* David Flath & E.W. Leonard, *A Comparison of Two Logit Models in the Analysis of Qualitative Marketing Data*, 16 J. MARKETING RES. 533, 534-36 (1979) (describing a logit model as a binary model using logistic distribution). Criterion validity was determined by the "percentage of consumers that followed through with their purchase obligation" and other post-transaction questions, such as how satisfied the consumer was with his purchase and whether he wished that he had bid higher. *Id.* at 233-34.

FIGURE 6
OVERVIEW OF THE BECKER, DEGROOT, AND MARSCHAK PROCEDURE

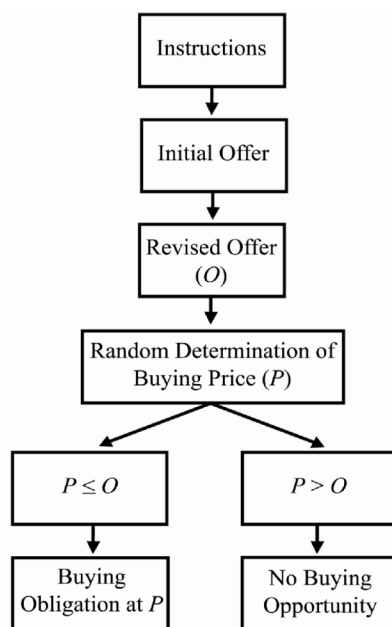


Figure 6 provides an overview of how the BDM procedure works.¹⁴⁹ A participant is presented with an opportunity to purchase a product at a price no greater than what she is willing to pay. The seller describes the product and gives instructions, and the participant makes an offer. The seller may give the participant a chance to revise the offer after emphasizing that the participant has every incentive to bid her true WTP. After the participant makes the final offer (O), the buying price (P) is randomly chosen—perhaps the participant draws P from an urn or a computer generates P —from a prespecified distribution.¹⁵⁰ If P is less than or equal to O , the participant has a buying obligation at price P . If P is greater than O , she has no buying opportunity.¹⁵¹

149. Wertenbroch & Skiera, *supra* note 22, at 230 fig.1.

150. The random numbers in the urn or computer model are typically taken from a reasonable distribution of price increments. For example, experiments selling a can of Coca-Cola may use random numbers ranging from \$0.25 to \$1.50, increasing in \$0.05 increments. *Cf.* Wertenbroch & Skiera, *supra* note 22, at 231. To avoid anchoring effects, sellers do not disclose this price distribution to participants. For a discussion on the distorting effects of anchoring, see Gretchen B. Chapman & Eric J. Johnson, *Incorporating the Irrelevant: Anchors in Judgments of Belief and Value*, in *HEURISTICS AND BIASES: THE PSYCHOLOGY OF INTUITIVE JUDGMENT* 120, 123-26 (Thomas Gilovich et al. eds., 2002); and Amos Tversky & Daniel Kahneman, *Judgment Under Uncertainty: Heuristics and Biases*, 185 *SCIENCE* 1124, 1128-30 (1974).

151. For example, if the participant offers \$20 and selects a random price of \$15 from the urn, then she must buy the product for \$15. By contrast, if she selects a random price

Conducted under these conditions, the BDM procedure should induce the participant to reveal her true WTP.¹⁵² For example, if she bids \$10 below her WTP and P is randomly selected at \$5 below her WTP, she loses consumer surplus by missing the buying opportunity. If she bids \$10 above her WTP and the random number selected is \$5 greater than her WTP, she must purchase at a price greater than her valuation. Finally, the ultimate price is determined exogenously from the offer, giving her every incentive to reveal true WTP.¹⁵³

The BDM procedure may provide reliable valuation data for several other reasons. First, unlike some other WTP estimation techniques, it creates opportunities for transactions at real point-of-purchase locations, allowing for better sample selection conditions.¹⁵⁴ Second, the procedure imposes a buying obligation on the consumer, removing a hypothetical bias that can come with research techniques where a participant need not pull out her purse.¹⁵⁵ Third, the BDM procedure avoids an anchoring bias by never stating a reference price and by keeping the random price distribution secret.¹⁵⁶ Finally, studies present evidence that the BDM procedure is easier to administer and less confusing for participants than other WTP research methods.¹⁵⁷

So far, the BDM method has only been used on consumable products and simple consumer durables, and it is unknown whether the domain of applicability will extend to more complex contracting situations.¹⁵⁸ It may be hard, for example, to envision a BDM study that tests WTP for oil refinery construction or complex derivatives. In theory, there is no reason why the BDM procedure could not be applied to more sophisticated markets, thus providing an empirical basis for es-

of \$25 from the urn, then she has no opportunity to buy the product and the exercise is concluded. Becker, DeGroot & Marschak, *supra* note 145, at 228-29; Wertenbroch & Skiera, *supra* note 22, at 230.

152. See Wertenbroch & Skiera, *supra* note 22, at 230.

153. See John H. Kagel, *Auctions: A Survey of Experimental Research*, in THE HANDBOOK OF EXPERIMENTAL ECONOMICS 501 (John H. Kagel & Alvin E. Roth eds., 1995); Vickrey, *supra* note 145.

154. See Wertenbroch & Skiera, *supra* note 22, at 230.

155. *Id.* at 230-31; see also Frank B. Cross, *Natural Resource Damage Valuation*, 42 VAND. L. REV. 269, 315-20 (1989) (discussing some of the biases due to the hypothetical nature of contingent valuation); Jeffrey C. Dobbins, Note, *The Pain and Suffering of Environmental Loss: Using Contingent Valuation to Estimate Nonuse Damages*, 43 DUKE L.J. 879, 921-29 (1994) (discussing the economic criticisms of contingent valuation biases); Note, "Ask a Silly Question . . .": *Contingent Valuation of Natural Resource Damages*, 105 HARV. L. REV. 1981, 1982 (1992) ("CV measurements of nonuse values are so speculative that the costs of using CV to assess damages to natural resources almost always outweigh the benefits.").

156. Indeed, it is critical not to disclose the probability distribution of random prices to participants to avoid anchoring effects. See Peter Bohm et al., *Eliciting Reservation Prices: Becker-DeGroot-Marschak Mechanisms vs. Markets*, 107 ECON. J. 1079, 1088-89 (1997); see also sources cited *supra* note 150. Of course, the participant's WTP may be influenced by existing market price benchmarks, especially for less complicated products.

157. Wertenbroch & Skiera, *supra* note 22, at 231-32.

158. *Id.* at 234.

timating buyer valuation more broadly.¹⁵⁹ But, for now, extended application of the BDM procedure is untested.¹⁶⁰ The data that are available, however, can be used to estimate buyer valuation distributions in simple consumer markets.

2. *Fitting the Data to a Probability Distribution*

Table 8 calculates summary statistics for the three markets studied by Wertenbroch and Skiera, and Figure 7 graphically displays the valuation distribution for pens.¹⁶¹ The pen data skews heavily to

159. Conducting these experiments might require some additional steps. For example, researchers would need to select a meaningful sample, provide detailed product information, and establish credit mechanisms to avoid liquidity constraints. Similarly, spot credit mechanisms could conceivably open more complex markets to empirical testing. *See id.*

160. There may be other concerns, not necessarily with the BDM method itself, but with the use of experimental data more generally. All field-based methods for estimating WTP might be subject to strategic misrepresentation by participants. *See id.* at 234-36. For example, if participants believe that a study is being used to explore a price increase, then they may falsely underreport WTP in order to strategically keep prices low. *See id.* at 234 (noting that a subject's response may not be accurate if his "normative response goals extend beyond the immediate survey context"). A second form of strategic misrepresentation, the escalation of commitment, relates to behavioral economics. *See id.* A participant may overstate her WTP because having agreed to participate in the study, she does not want to walk away empty-handed. *Id.* Wertenbroch and Skiera test for this by giving one group of participants a reward for participating in the study, regardless of the ultimate purchase outcome. *Id.* at 234-35. They find that the two groups—the reward group and the non-reward group—do not differ statistically in their valuation of the product, arguing against a significant escalation of commitment bias in the BDM context. *Id.* at 235-36. A third strategic problem may occur if a participant bids more than her WTP in order to secure an option to buy but walks away without buying if the random price P is too high. *See id.* at 234; *see also* Jeff T. Casey & Philippe Delquié, *Stated vs Implicit Willingness to Pay Under Risk*, 61 ORGANIZATIONAL BEHAV. & HUM. DECISION PROCESSES 123, 134, 136 (1995) (discussing the effect of a subject's belief that his payment or loss may never be enforced). This is why it is critical that participants in an experiment follow through with buying obligations. *See* Elizabeth Hoffman et al., *Using Laboratory Experimental Auctions in Marketing Research: A Case Study of New Packaging for Fresh Beef*, 12 MARKETING SCI. 318, 328 (1993). Studies thus far suggest that this effect is minimal: just 4 out of 81 buyers refused to purchase in the Wertenbroch study, Wertenbroch & Skiera, *supra* note 22, at 234, and just 2 out of 765 buyers refused to purchase in the Hoffman study, Hoffman et al., *supra*, at 328. Fourth, some studies suggest that just placing extra attention on a product causes participants to systematically overstate their WTP and that by trying to measure WTP distributions, researchers might affect the results. *See* Ziv Carmon & Itamar Simonson, *Price-Quality Trade-Offs in Choice Versus Matching: New Insights into the Prominence Effect*, 7 J. CONSUMER PSYCHOL. 323 (1998); Wertenbroch & Skiera, *supra* note 22, at 234. Finally, broader issues of bounded rationality may surface. *Compare* Daniel Kahneman et al., *Experimental Tests of the Endowment Effect and the Coase Theorem*, 98 J. POL. ECON. 1325 (1990) (exploring behavioral inconsistencies between WTP and Willingness to Accept (WTA) for identical products), *with* W. Michael Hanemann, *Willingness to Pay and Willingness to Accept: How Much Can They Differ?*, 81 AM. ECON. REV. 635 (1991) (suggesting that differences between WTP and WTA can be consistent with economic theory). On the differences between WTP and WTA and the implications of these differences for economic analysis of the law, *see* Elizabeth Hoffman & Matthew L. Spitzer, *Willingness to Pay vs. Willingness to Accept: Legal and Economic Implications*, 71 WASH. U. L.Q. 59 (1993).

161. For the methods, results, and discussion of the studies of these markets, *see* Wertenbroch & Skiera, *supra* note 22, at 231-37. A convenience sample of university students was used for the pen experiment, possibly limiting inferences from this data to a greater population. *Id.* at 235. Random sampling was used in the Coca-Cola and cake ex-

the right—there are many low-value buyers and just a few high-value buyers (one generous soul offers \$16).

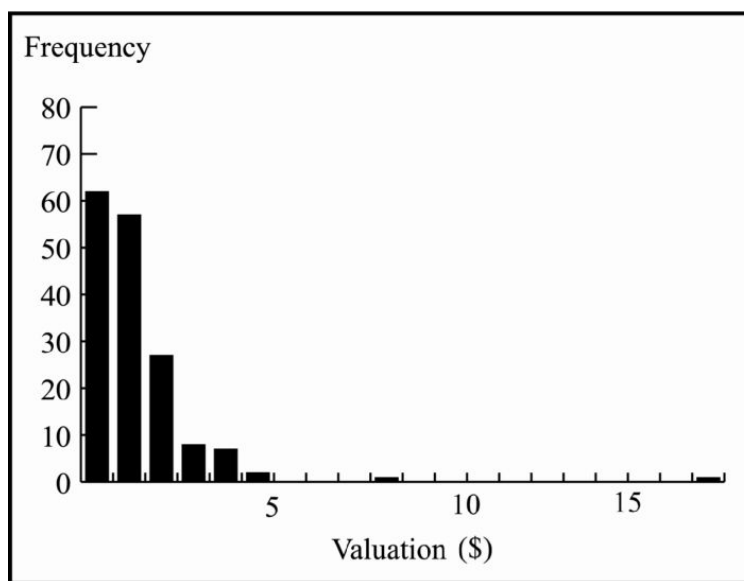
TABLE 8
DESCRIPTIVE STATISTICS FOR VALUATION DATA

	N	MINIMUM VALUE	MAXIMUM VALUE	MEAN	STD.	SKEWNESS	SE SKEWNESS
PENS*	165	0.00	16.00	1.38	1.57	5.58	0.19
COCA-COLA**	100	0.00	3.00	1.07	0.65	0.22	0.24
CAKE**	100	0.00	2.50	1.12	0.56	-0.29	0.24

* value in U.S. \$
** value in DM (DM 1.00 is approximately U.S. \$0.55)

FIGURE 7

BUYER VALUATION DISTRIBUTION FOR PENS (N = 165)



This sample data provides a basis for estimating the overall distribution of values in the ergonomic pen market, at least for the population covered in the study. Statistical goodness-of-fit tests, such

periments. *Id.* at 231. For additional details on the study methodology, see *id.* at 231-37. For details on the face validity, internal validity, and criterion validity of this experiment, see *id.* at 234-35. While the authors divided the 165 pen participants undergoing the BDM procedure into two different treatment groups, they reported no statistical difference in the WTP of both groups, so the data are combined in this Article. *Id.* at 235-36. Data from participants offering contingent-valuation estimates of their WTP for pens are excluded.

as the Chi-Square test, measure how well the data fits a number of common probability distributions.¹⁶² For the pen data, a lognormal distribution offers the tightest fit¹⁶³ and will be used to select the random VALUE variable for each buyer in the pen market simulation.¹⁶⁴

162. The Chi-Square test breaks down the known distributions into areas of equal probability and compares the sample data points within each area to the number of expected data points. See DEREK ROWNTREE, *STATISTICS WITHOUT TEARS: A PRIMER FOR NON-MATHEMATICIANS* 150-54 (1981). Similarly, the Kolmogorov-Smirnov test essentially calculates the largest vertical distance between the two cumulative distributions. On the calculation and uses of this test, see Jean Dickinson Gibbons, *Kolmogorov-Smirnov Symmetry Test*, in 4 *ENCYCLOPEDIA OF STATISTICAL SCIENCES* 396 (Samuel Kotz et al. eds., 1982); and M.A. Stephens, *Kolmogorov-Smirnov-Type Tests of Fit*, in 4 *ENCYCLOPEDIA OF STATISTICAL SCIENCES*, *supra*, at 398. For an adaptation of the Kolmogorov-Smirnov Test, see Donald W.K. Andrews, *A Conditional Kolmogorov Test*, 65 *ECONOMETRICA* 1097 (1997). The Anderson-Darling test is similar, but it weighs the differences between the two distributions at their tails greater than at their mid-ranges. On the calculation and uses of this test, see M.A. Stephens, *Anderson-Darling Test of Goodness of Fit*, in 1 *ENCYCLOPEDIA OF STATISTICAL SCIENCES*, *supra*, at 81, 81-85.

163. The goodness-of-fit statistics for the pen valuation data are as follows:

DISTRIBUTION	CHI-SQUARE TEST	KOLMOGOROV-SMIRNOV TEST	ANDERSON-DARLING TEST
Lognormal*	70.55	0.11	16.23
Exponential	83.45	0.15	12.10
Extreme Value	84.18	0.13	1.61
Logistic	105.09	0.14	3.76
Weibull	102.73	0.20	8.19
Beta	103.45	0.022	15.70
Gamma	113.64	0.18	5.86
Normal	118.18	0.21	11.62
Uniform	771.80	0.75	218.47

* Mean = 1.73; standard deviation = 2.42

The lognormal distribution is commonly used to model situations where values are positively skewed—such as securities or real estate valuation. The natural logarithm of the variable yields a normal distribution. This means that the variable can increase without limits but cannot fall below zero. Most of the values are near the lower limit. While the lognormal distribution offers the best fit for this data, the goodness-of-fit tests do not have a high level of statistical significance. The main point of this example, though, is not to argue that this specific data fits the lognormal distribution with a high level of confidence but rather to ground the distribution of buyer valuations in empirical data. Another approach is to build a custom probability distribution reflecting the *exact* experimental results. The results of this Article hold when this approach is taken. In fact, rerunning the analysis with a custom probability distribution substituted for the lognormal distribution causes the *Hadley* default to outperform the full-damages default even *more* frequently than 90%. The qualifications discussed *infra* Part III.D also hold with a custom probability distribution, although the percentage of results where a full-damages default generates more welfare changes slightly.

164. The specific distribution parameters (mean 1.73; standard deviation 2.42) are calculated with raw data from the Wertebroch and Skiera study. Wertebroch & Skiera, *supra* note 22, at 231-37.

FIGURE 8A
BUYER VALUATION
DISTRIBUTION FOR COCA-COLA (N = 100)

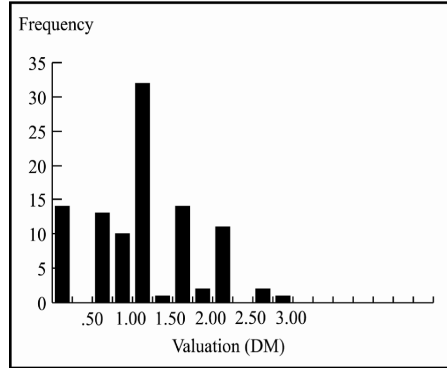
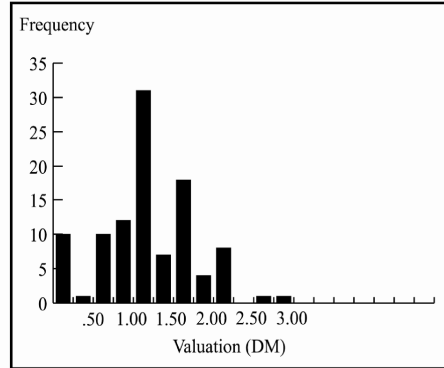


FIGURE 8B
BUYER VALUATION
DISTRIBUTION FOR CAKE (N = 100)



The analysis can be replicated for the other markets. Figure 8a reveals that the distribution of buyer WTP for a can of Coca-Cola looks quite different than the valuation distribution for ergonomic pens. Statistical tests confirm that buyer valuation for Coca-Cola is better modeled with a logistic probability distribution.¹⁶⁵

165. The goodness-of-fit statistics for the Coca-Cola valuation data are as follows:

DISTRIBUTION	CHI-SQUARE TEST	KOLMOGOROV-SMIRNOV TEST	ANDERSON-DARLING TEST
Logistic*	47.8	0.10	1.19
Beta	48.1	0.16	24.32
Weibull	51.7	0.14	4.25
Normal	55.5	0.11	1.35
Gamma	55.0	0.11	1.52
Triangular	59.4	0.16	7.12
Lognormal	63.0	0.19	28.45
Exponential	73.0	0.25	30.18
Uniform	115.0	0.32	16.43

* Mean = 1.06; scale = 0.37

A logistic distribution with a mean of 1.06 and a scale of 0.37 will be used in the simulation. The logistic distribution is commonly used to describe growth—for example, the size of a population over time. For the purposes of this Article, the logistic distribution is truncated at zero to avoid negative valuations, and the negative tail is reallocated proportionally to the positive values.

Finally, the pound cake data are graphed in Figure 8b. The evidence supports a probability distribution similar to the one selected for the Coca-Cola data.¹⁶⁶

3. An Aside: Testing the Majoritarian Solution to Hadley

As a brief aside, if the majoritarian solution to *Hadley* was sufficiently robust, it would be straightforward to use this data to empirically determine the optimal default rule for any given market. Lawmakers could conduct an experiment to solicit WTP data from a random sample of buyers in the market. They would then make inferences about the distribution of valuations for the broader contracting population. This might advocate a majoritarian, and thus most efficient, default rule.

For example, suppose a lawmaker faces a sample of 100 buyers with performance valuations distributed as in Figure 1a.¹⁶⁷ The lawmaker could immediately observe that 65% of the buyers in this sample have valuations below the mean.¹⁶⁸ This suggests that the *Hadley* rule, appropriate with many low-value buyers, looks promising. Using inferential statistics, the lawmaker might then generalize from the sample to the relevant population by testing the following hypotheses:

H₀: Buyer valuations for the population are not skewed positively
($\mu_3 \leq 0$)

H_a: Buyer valuations for the population are skewed positively
($\mu_3 > 0$)

166. The goodness-of-fit statistics for the cake valuation data are as follows:

DISTRIBUTION	CHI-SQUARE TEST	KOLMOGOROV-SMIRNOV TEST	ANDERSON-DARLING TEST
Logistic*	25.3	0.08	0.84
Triangular	25.3	0.11	2.43
Beta	26.2	0.16	13.04
Normal	35.1	0.11	1.08
Gamma	34.1	0.13	1.66
Weibull	34.2	0.13	2.36
Uniform	50.7	0.21	7.19
Lognormal	51.4	0.14	15.42
Exponential	124.9	0.30	22.50

* Mean = 1.14; scale = 0.32

A logistic distribution with a mean of 1.14 and a scale of 0.32 will be used in the simulation. As with the Coca-Cola distribution, the probability is adjusted slightly to avoid negative values.

167. See *supra* p. 899 fig.1a. Figure 1a is identical to the table of value distributions presented *supra* note 51.

168. Specifically, the first 65 buyers have a valuation less than the mean of 5.1.

The statistic for skewness, μ_3 , measures the degree of asymmetry of a distribution around its mean.¹⁶⁹ Positive skewness indicates a distribution with a right-sided tail; negative skewness indicates the opposite.¹⁷⁰ In this example, the lawmaker could reject the null hypothesis at the 99% confidence level:

$$\mu_3 = 1.086 \pm (2.58) * (\text{the standard error})$$

$$\mu_3 = 1.086 \pm (2.58) * (0.241)$$

$$\mu_3 = 0.464 \text{ to } 1.708$$

Therefore, reject H_0 at the 99% confidence level because μ_3 does not appear to be less than zero.

Such an inference supports the *Hadley* rule as the superior default. The sample of 100 buyers yields a highly confident inference that buyer valuations for the entire population are not skewed to the left.¹⁷¹ A lawmaker subscribing to the majoritarian solution should reject the full-damages default rule and impose a *Hadley* default rule to lower transaction costs and increase social welfare.

This same analysis would advocate the *Hadley* rule in the market for pens. The skewness statistic is so large that the null hypothesis can be rejected with great confidence.¹⁷² The data for Coca-Cola and cake, however, do not conclusively point to a majoritarian default; the null hypothesis cannot be rejected in both cases.¹⁷³

But, as discussed earlier, the majoritarian solution does not fully capture the intricacies of contracting under asymmetric information.¹⁷⁴ The next task is to combine information on buyer valuation distributions with other variables in the *Hadley* model.

169. More specifically, skewness is based on the relationship between the mean and the mode: greater distances between the mean and mode lead to a higher value for the skewness statistic. ROWNTREE, *supra* note 162, at 61.

170. *Id.* at 59.

171. This is true because the inferred skewness for the population is greater than zero, rejecting a left-skewed population at the 99% confidence level.

172. Taking the statistics from Table 8, *supra* p. 931:

$$\mu_3 = 5.58 \pm (2.58) * (0.19)$$

$$\mu_3 = 5.09 \text{ to } 6.07$$

Therefore, reject H_0 at the 99% confidence level.

173. Again, using the statistics calculated in Table 8, *supra* p. 931. For Coca-Cola:

$$\mu_3 = 0.22 \pm (2.58) * (0.24)$$

$$\mu_3 = -0.40 \text{ to } 0.84$$

Therefore, do not reject H_0 at the 99% confidence level.

For cake:

$$\mu_3 = -0.29 \pm (2.58) * (0.24)$$

$$\mu_3 = -0.91 \text{ to } 0.33$$

Therefore, do not reject H_0 at the 99% confidence level.

174. See *supra* Part II.B.2.

C. *Selecting the Better Default Rule*

In the 1940s, Stanislaw Ulam, a Polish mathematician working with John von Neumann on the Manhattan Project, wanted to estimate his chances of winning a game of fifty-two card solitaire.¹⁷⁵ To solve the problem, he programmed a computer to play out the card game continually and track the results.¹⁷⁶ Ulam's musings at Los Alamos led to the modern analytical technique of Monte Carlo simulation, which uses statistical computer sampling to approximate solutions to quantitative problems.¹⁷⁷ Random values are repeatedly generated to model the impact of uncertain variables on a range of outcomes. Monte Carlo simulation, deriving its name from similarities to the games of chance played in Monaco, has been used extensively to model decisionmaking under uncertainty in physics, engineering, business, and mathematics.¹⁷⁸ There is also precedent for running Monte Carlo techniques in legal scholarship.¹⁷⁹

Using Monte Carlo simulation, this Part finds that a *Hadley* default rule typically outperforms a full-damages default rule in three simple markets. The distribution of buyer valuations for each market is grounded in empirical research from the Wertenbroch and Skiera studies.¹⁸⁰ But to conduct the simulation, assumptions must be made for other variables in the *Hadley* model.¹⁸¹

Table 9 displays a list of initial assumptions, chosen to reflect a reasonable contracting system (each assumption is relaxed later to conduct sensitivity analysis).¹⁸² Note that three variables—the probability of incurring consequential damages, transaction costs, and the separation threshold—do not differ initially between low- and high-value buyers. The impact of different assumptions by buyer type for these variables is considered shortly.¹⁸³

175. See Eckhardt, *supra* note 23, at 131-36.

176. *Id.*; Nicholas Metropolis, *The Beginning of the Monte Carlo Method*, 15 LOS ALAMOS SCI. 125 (1987).

177. See Eckhardt, *supra* note 23, at 131; see also RUSSELL DAVIDSON & JAMES G. MACKINNON, *ECONOMETRIC THEORY AND METHODS* 157 (2004); GENTLE, *supra* note 23; JÄCKEL, *supra* note 23; MANNO, *supra* note 23.

178. MANNO, *supra* note 23, at 9.

179. See, e.g., BRUCE ACKERMAN & IAN AYRES, *VOTING WITH DOLLARS: A NEW PARADIGM FOR CAMPAIGN FINANCE* 229-31 (2002) (using Monte Carlo simulation to test a campaign finance secrecy algorithm); Frank Partnoy, *The Siskel and Ebert of Financial Markets?: Two Thumbs Down for the Credit Rating Agencies*, 77 WASH. U. L.Q. 619, 660 (1999). On the related concept of using agent-based computer simulation to inform legal doctrine, see Randal C. Picker, *Simlaw 2011*, 2002 U. ILL. L. REV. 1019.

180. See *supra* Part III.B.

181. Additional experiments that simultaneously estimate these other variables might yield more robust results. See *infra* Part IV.

182. For example, the precaution variables are chosen such that low precautions cost less and are less effective than medium precautions, so the average-value buyer prefers medium precautions.

183. See *infra* Part III.D.

TABLE 9
KEY ASSUMPTIONS IN THE *HADLEY* SIMULATION MODEL

VARIABLE	ASSUMPTION
1. Buyer valuation (VALUE)	Market specific
2. General damages (GD)	\$0.20 ¹⁸⁴
3. Probability of consequential damages (PROBCD)	N (90%, 5%) ¹⁸⁵
4. Success with low precautions (PROBLOW)	50%
5. Cost of low precautions (COSTLOW)	\$0.20
6. Success with medium precautions (PROBMED)	70%
7. Cost of medium precautions (COSTMED)	\$0.40
8. Success with high precautions (PROBHIGH)	90%
9. Cost of high precautions (COSTHIGH)	\$0.75
10. Transaction costs for low-value buyers (TCLOW)	\$.05
11. Transaction costs for high-value buyers (TCHIGH)	\$.05
12. Separation threshold for low-value buyers (SEFLOW)	20%
13. Separation threshold for high-value buyers (SEPHIGH)	20%

With these assumptions, the welfare benefits of a *Hadley* default versus a full-damages default can be played out many times. Each trial generates a new set of performance valuations for the 100 buyers. The model then determines how many low-value buyers reveal their type under a full-damages default and how many high-value buyers reveal their type under a *Hadley* default. If enough buyers reveal their type, the population separates and nonidentifying buyers receive tailored precautions under the default rule. Ultimately, the model calculates total social welfare under both default rules—according to the algorithms of Figures 4 and 5¹⁸⁶—and compares the results.

1. Pens

For example, a single iteration for the pen market might yield the outcome shown in Table 10. In this instance, the most generous buyer values the pen at \$9.76 and the minimum buyer values the pen at \$0.08. The total social welfare under each default rule is quite close, but the *Hadley* default does slightly better.

184. All damages are assumed to be general damages if a buyer's total valuation is less than \$0.20.

185. This variable is randomly selected from a normal distribution with a mean of 90% and a standard deviation of 5%.

186. See *supra* p. 924 fig.4; p. 925 fig.5.

TABLE 10
RESULTS OF ONE ITERATION OF THE *HADLEY* SIMULATION MODEL
(PENS)

	RESULT
1. Total number of buyers	100
2. Buyers choosing to contract	82
3. Number of low-value buyers	36
4. Number of medium-value buyers	22
5. Number of high-value buyers	24
6. Lowest buyer	\$0.08
7. Highest buyer	\$9.76
8. Buyers identifying their type under full damages	23%
9. Buyers identifying their type under <i>Hadley</i>	24%
10. Social welfare under full damages	68.5
11. Social welfare under <i>Hadley</i>	70.8
12. Net benefit from <i>Hadley</i> default rule	2.3
Better default rule	<i>Hadley</i>

Of course, the results of one trial are not very meaningful. After saving this data, the simulation next generates a different sample of 100 random buyer valuations and reevaluates the superior default rule. The process is repeated hundreds or thousands of times to arrive at a range of outcomes indicating the likely efficiency benefits of one default rule over another. Monte Carlo simulation thus allows lawmakers to live in a thousand or more parallel universes, where they can compare the effects of both default rules.¹⁸⁷

A run of 10,000 trials for the pen market—under the assumptions of Table 9¹⁸⁸—generates the results displayed in Figure 9, *infra*. This figure graphs the net efficiency benefit of a *Hadley* default rule, and a social welfare number greater than zero indicates that *Hadley* outperforms a full-damages default. In this simulation, almost 90% of the results are positive, suggesting that the *Hadley* rule leads to a more efficient outcome much of the time. The expected value, or average overall efficiency benefit of the *Hadley* rule, is 4.8.

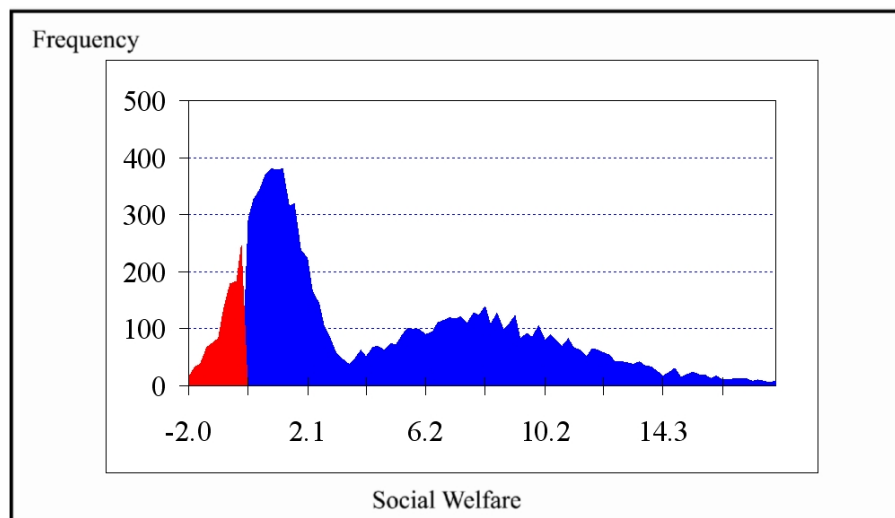
The distribution of the results is also important. The minimum result is negative 3.2, the maximum is 29.7, and the positive area under the curve exceeds the negative area. In other words, the upside from choosing a *Hadley* default far outweighs the potential downside. Note two clusters of data. There is a break point around 3.5—about half of the trials are less than this value, while the other half exceed it. The lower set of results occurs when the full-damages default leads to a separating equilibrium. *Hadley* often does slightly

187. See GENTLE, *supra* note 23; JÄCKEL, *supra* note 23; MANNO, *supra* note 23.

188. See *supra* p. 937 tbl.9.

better in these cases, but the range of outcomes is tight, and the default rule may not matter much.

FIGURE 9
NET BENEFIT OF *HADLEY* RULE OVER FULL-DAMAGES RULE—PENS
(N = 10,000 TRIALS)



When the full-damages default leads to a pooling equilibrium, however, the benefits from choosing the *Hadley* rule can be quite large. Extremely high-value buyers, who get greater social welfare with high precautions, drive much of this difference. They receive medium precautions under a pooling full-damages equilibrium. But if the *Hadley* rule causes separation, these high-value buyers get high precautions. And even when *Hadley* pools, the highest-value buyers often contract around the default individually. This follows classic penalty-default theory,¹⁸⁹ and the level of precautions received by extreme-value buyers in the pen market has a major impact on the relative efficiency of the two defaults.

The analysis is quite complicated, though, and *Hadley* causes at least three other effects. First, there is another group of high-value buyers who end up with less efficient contracts under *Hadley*. These buyers derive almost as much utility under medium precautions, and they choose not to incur the transaction costs (and sometimes the information costs) of contracting around a *Hadley* default. But when the buyer pool separates, these buyers end up being mistaken for low-value buyers and they receive inefficiently low precautions. Second, medium-value buyers can also do worse with this default. They

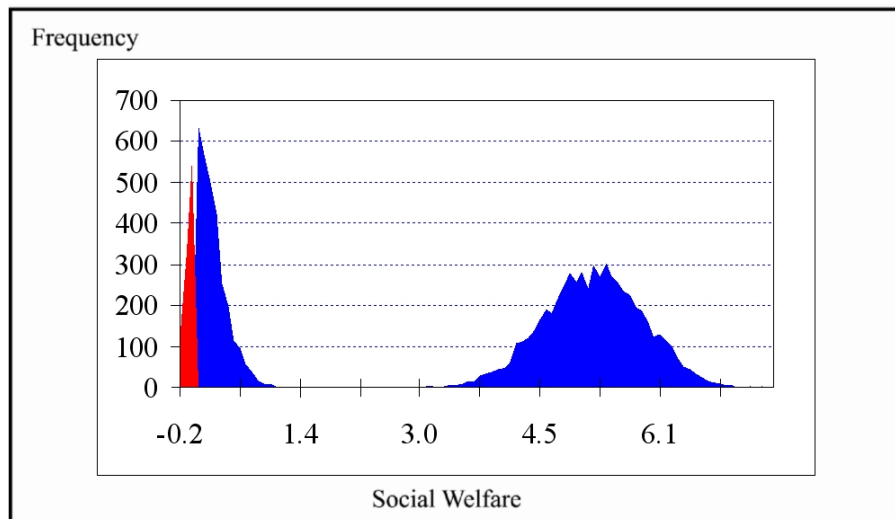
189. See Ayres & Gertner, *supra* note 5, at 91, 108-18; Craswell, *supra* note 33, at 5-10.

receive low precautions under *Hadley* instead of the medium precautions that they prefer, and get, with a full-damages pooling equilibrium. Finally, most low-value buyers come out better under a *Hadley* separating equilibrium: they receive their preferred precautions without needing to incur transaction costs. The *Hadley* rule can thus cause many different effects, some of which may be unintentional.

2. Coca-Cola and Cake

Figures 10 and 11, *infra*, present the Monte Carlo simulation results in the markets for Coca-Cola and pound cake. The default rules in these two markets behave similarly, and both markets can be analyzed together. *Hadley* still generates more welfare than full damages—89% of the time with Coca-Cola and 83% of the time with cake. The expected value in both markets remains positive, but there are different reasons for *Hadley*'s superiority in these two markets.

FIGURE 10
NET BENEFIT OF *HADLEY* RULE OVER FULL-DAMAGES RULE—COKE
(N = 10,000 TRIALS)



The most important difference is that there are fewer high-value buyers. This means that the *Hadley* rule almost never leads to a separating equilibrium because there are not enough high-value buyers to signal their type. It also means that, unlike the pen study, extremely high-value buyers are very rare and do not have much impact on the choice of default rule.

As before, the results divide into two clusters. In the Coca-Cola market, for example, about 40% of the trials result in a net *Hadley*

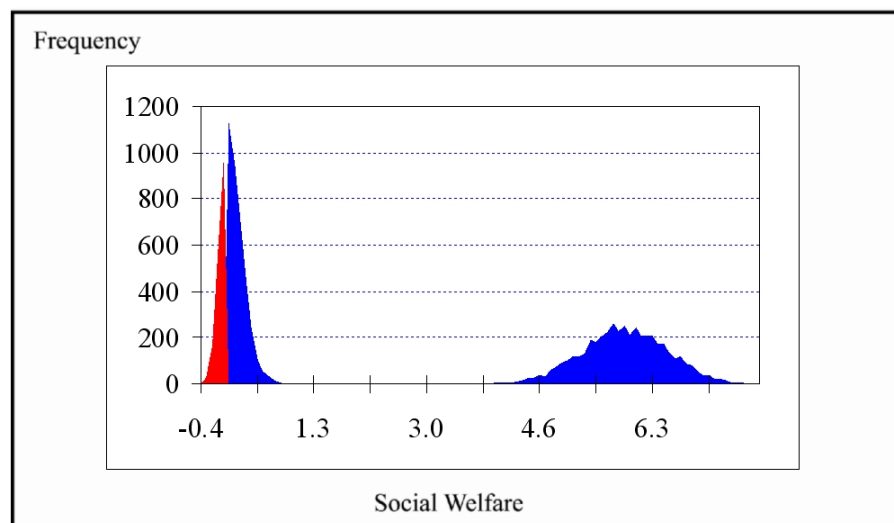
benefit under 2.0; the other 60% exceeds 2.0. The lower set of values occurs when both default rules cause a pooling equilibrium. The choice of default rule here is a close call, based on many small effects. The *Hadley* rule generally does better, but not by much.

By contrast, *Hadley* outperforms full damages by a significant margin in the second data cluster. These results occur when the full-damages default leads to separation, while buyers in the *Hadley* default continue to pool. This is a counterintuitive result: How could a *Hadley* rule leading to pooling—and thus fewer tailored precautions—outperform a full-damages rule leading to separation?¹⁹⁰

The explanation is subtle. There is a group of low-value buyers who gain almost as much utility contracting under medium precautions as they do from contracting under low precautions. With a full-damages default, the benefit to these buyers of moving to low precautions does not exceed the transaction costs and they do not reveal their type. However, there is another group that contains enough low-value buyers who benefit from low precautions (or from information disclosure benefits) that under a full-damages default, the buyer pool separates. This means that under a full-damages default, the first group of low-value buyers now receives high precautions, which are much less efficient. Under the *Hadley* default, these low-value buyers continue to receive medium precautions, which results in a net gain to social welfare.

FIGURE 11

NET BENEFIT OF *HADLEY* RULE OVER FULL-DAMAGES RULE—CAKE
(N = 10,000 TRIALS)



190. *Contra* Ayres & Gertner, *supra* note 5, at 108-18.

More generally, if transaction costs prevent some low-value buyers from revealing their type, but the buyer pool still separates under a full-damages default, there is a social welfare loss as these low-value buyers receive excess precautions. The seller mistakenly concludes that they are high-value types.

In these simulations, then, the *Hadley* default rule outperforms a full-damages default nearly 90% of the time in all three markets. This happens largely for two different reasons. In the market for pens, extreme-value buyers do not always receive high precautions with a full-damages default, but they will contract for these efficient precautions with *Hadley*. This is an empirical example of the classic penalty-default theory.¹⁹¹ In the markets for Coca-Cola and cake, the *Hadley* default does better, not because of the effects of extreme-value buyers (there are fewer of these), but rather because low-value buyers who do not contract around a full-damages default rule sometimes receive inefficiently high precautions by mistake.

D. *Qualifying the Findings*

The analysis thus far might be criticized for relying too heavily on assumption-based modeling. While the distribution of buyer valuations is grounded in empirical data, the other variables in the *Hadley* model take on assumptions. This Part uses sensitivity analysis to address this concern, and it finds that the merits of the *Hadley* default rule must indeed be qualified. In fact, there are lessons to be learned through a detailed examination of the various situations where *Hadley* may generate *less* social welfare.

Specifically, in the markets studied, the *Hadley* rule does not outperform a full-damages default in four important circumstances. First, *Hadley* is not preferable when high-value buyers systematically have a much greater chance of incurring consequential damages. Second, a full-damages default outperforms *Hadley* when most of the efficiency gains from information revelation go to low-value buyers. Third, the *Hadley* rule is often worse when the transaction costs of contracting around a default rule are much greater for high-value buyers than for low-value buyers. Finally, the analysis assumes perfect competition, and introducing seller power into the empirical models might change the results.

Take the last qualification first. Jason Scott Johnston has developed a game theoretical model of the *Hadley* rule, where he relaxes assumptions of perfectly competitive markets.¹⁹² In other words, sellers

191. See Ayres & Gertner, *supra* note 5, at 91, 108-18; Bebchuk & Shavell, *supra* note 5; Craswell, *supra* note 33, at 5-9.

192. See Johnston, *supra* note 7.

are no longer “identical price-taking firms.”¹⁹³ This introduces several new complexities. For instance, sellers now have an incentive to learn about buyer valuations, not in order to take efficient precautions, but rather to increase their individual profits through price discrimination.¹⁹⁴ It also adds another dimension of information revelation: buyers seek to learn whether different sellers have different probabilities of breach.¹⁹⁵ Rerunning the empirical analysis with a model that incorporates these effects might lead to new conclusions.¹⁹⁶

The balance of this Part addresses the other qualifications in turn, illustrating them with results from the ergonomic pen study.¹⁹⁷ It also considers the important role played by the separation variable.

1. High-Value Buyers Suffer Consequential Damages More Frequently

Barry Adler’s work on the *Hadley* doctrine suggests that it may not result in an efficient outcome when consequential damages are modeled stochastically.¹⁹⁸ This Part provides empirical support for this finding, while also exploring the boundary conditions necessary for *Hadley* to succeed. Recall that the earlier analysis assumes that a buyer’s chance of incurring consequential damages (PROBCD) is taken from a normal probability distribution with a mean of 90% and a standard deviation of 5%.¹⁹⁹ This assumption is used for every buyer.

The *Hadley* rule becomes inferior when two changes are made to this assumption. First, there must be a very wide difference in the probability of incurring consequential damages. This is illustrated by changing the parameters of PROBCD to a mean of 70% and a standard deviation of 15%, which means that most buyers face a probability of incurring consequential damages ranging from 40% to 100%. Second, the probability of incurring consequential damages must be correlated with buyer valuation. In other words, high-value buyers are more likely to incur consequential damages than low-value buyers (a correlation coefficient of 0.8 is used in this analy-

193. *Id.* at 625.

194. *Id.* at 625-26.

195. *Id.*

196. *Id.* at 626; *see also* Ayres & Gertner, *supra* note 2, at 736-37; Schwartz, *supra* note 112, at 397-99. This Article, while acknowledging these complications, leaves empirical analysis of models with seller market power for another day. It is worth noting, however, that even in these models, the distribution of buyer valuations is an important variable and insights from empirical simulation models might convey useful information.

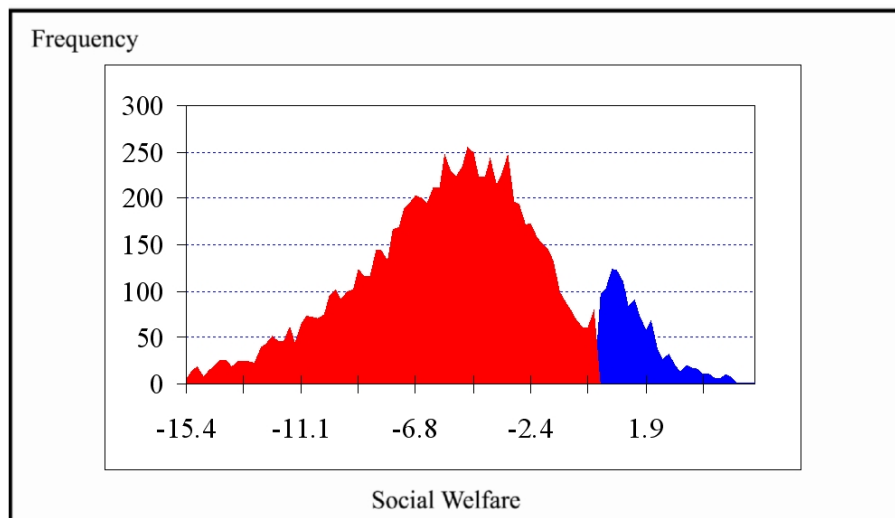
197. Unless noted otherwise, the qualifications also hold true for the Coca-Cola and pound cake data.

198. *See supra* Part II.B.3.

199. *See supra* note 134.

sis). With these changes, a full-damages default is usually more efficient than *Hadley*, as illustrated in Figure 12.

FIGURE 12
HIGH BUYERS FACE GREATER PROBABILITY OF CONSEQUENTIAL DAMAGES (N = 10,000 TRIALS)



This change is explained largely by high-value buyer behavior. Facing much greater information costs, high-value buyers rarely reveal their type under a *Hadley* default. At the same time, low-value buyers, with cheaper information costs, separate even more frequently under a full-damages rule. When this happens, high-value buyers get efficient high precautions, and the benefits of a full-damages rule are large.²⁰⁰ If both rules result in a pooling equilibrium, *Hadley* is often slightly better.

200. This exception rarely holds in the markets for Coca-Cola and cake. There are fewer high-value buyers and the benefits of tailored precautions under a full-damages rule is much diminished. *Hadley* usually remains the superior default rule.

TABLE 11
 CONSEQUENTIAL DAMAGE ASSUMPTIONS—SENSITIVITY ANALYSIS

SCENARIO	PROBCD MEAN (%)	PROBCD STANDARD DEVIATION (%)	CORRELATION BETWEEN PROBCD AND VALUE	PERCENT OF RESULTS WHERE <i>HADLEY</i> IS SUPERIOR (N = 500 TRIALS)
low deviation, no correlation	70	5	0	92.6
low deviation, high correlation	70	5	0.8	78.6
high deviation, no correlation	70	15	0	59
high deviation, high correlation	70	15	0.8	13.8

The optimal default rule changes only if both adjustments to PROBCD take place. With a tight standard deviation, the information cost effects are too small to matter. And if PROBCD and VALUE are uncorrelated, then *Hadley* remains the better default.²⁰¹ Table 11 illustrates this point. As Adler's theoretical model suggests, stochastic consequential damages can affect the optimal default²⁰²—but only when the probability of incurring damages deviates greatly and is tied disproportionately to high-value buyers.

2. Low-Value Buyers "Take Most of the Benefits" from Tailored Precautions

Each seller precaution level might be viewed as a discrete trade-off along two dimensions: cost and effectiveness (modeled in this case as the probability of successfully completing performance). Decreasing the cost or increasing the effectiveness of any one precaution level will make it more attractive relative to the other precaution choices. But making a precaution level especially attractive does not necessarily change the optimal default rule. Very cheap low precautions or very expensive high precautions may still result in an economic system where *Hadley* generates more welfare.²⁰³

Different precaution assumptions can, however, cause a full-damages default to become more efficient than *Hadley*. The key con-

201. With a wide deviation in PROBCD, the effects are magnified: very low levels of correlation between the two variables can cause a full-damages default to outperform *Hadley*.

202. See Adler, *supra* note 7, at 1551-52, 1560-61.

203. For example, reducing the cost of low precautions in the pen market from \$0.20 to \$0.05 causes *Hadley* to still perform better nearly 60% of the time. If the cost of low precautions continues to be lowered, however, the full-damages default rule will typically become more efficient due to the effects described in this Part.

cern is the differentiation between low, high, and medium precautions on the cost-effectiveness spectrum. Specifically, a full-damages default can become optimal when low precautions are positioned very far away from medium precautions or when high precautions are positioned very close to medium precautions. In a sense, these changes allow low-value buyers to “take most of the benefits” from tailored precautions. High-value buyers may as well stick with medium precautions.

In the initial analysis, the cost-effectiveness positions of low, medium, and high precautions are evenly spaced.²⁰⁴ This means that high- and low-value buyers each benefit similarly by moving to tailored precautions. Figure 13 portrays four ways to adjust evenly spaced precautions. Low precautions become more differentiated (or sharper) relative to medium precautions by reducing COSTLOW and PROBLow. Conversely, low precautions become less differentiated (or duller) by raising COSTLOW and PROBLow. High precautions follow a similar pattern.

FIGURE 13
ADJUSTMENTS TO SELLER PRECAUTIONS

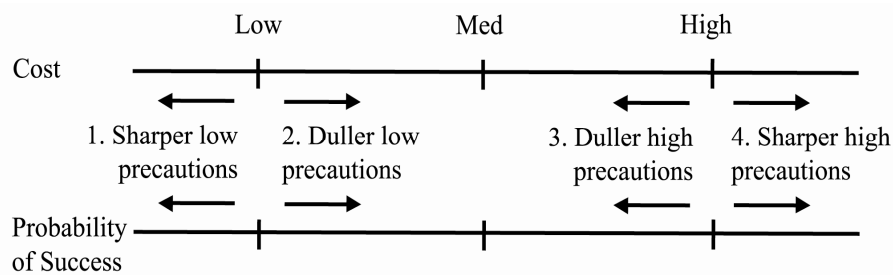


Table 12, *infra*, shows the results of the Monte Carlo simulation with different precaution scenarios. Sharper high precautions or duller low precautions cause *Hadley* to outperform the full-damages default almost 100% of the time. But dulling high precautions drops the effectiveness of *Hadley* to 75%. The full-damages default usually generates more welfare than *Hadley* when low precautions are very sharp. And it outperforms *Hadley* over 97% of the time when low precautions are sharpened and high precautions are dulled at the same time.

204. One slight exception: the cost of moving from low to medium precautions (\$0.20 to \$0.40) is a bit cheaper than the cost of moving from medium to high precautions (\$0.40 to \$0.75), reflecting diminishing marginal returns to the precaution investment. See *supra* p. 937 tbl.9.

TABLE 12
PRECAUTIONS SENSITIVITY ANALYSIS

COSTLOW (\$)	PROBLOW (%)	COSTHIGH (\$)	PROBHIGH (%)	PERCENT OF RESULTS WHERE HADLEY IS SU- PERIOR (N = 500 TRIALS)
0.20	50	0.75	90	90.0
0.05	35	0.75	90	29.2
0.30	65	0.75	90	99.8
0.20	50	0.60	80	75.2
0.20	50	0.90	95	99.2
0.05	35	0.60	80	2.8

Sharpening low precautions causes several effects. First, cheaper prices entice null buyers to enter the market, resulting in many more low-value buyers. These buyers usually reveal their type, and a separating equilibrium typically occurs under a full-damages rule. If *Hadley* pools, these low-value buyers do worse with medium precautions. And *Hadley* is often less efficient when it leads to a separating equilibrium as well. Medium buyers are much worse off with the sharper low precautions, which they receive in a *Hadley* separation, than with the high precautions that they receive under a full-damages default.

The analysis is reversed when high precautions are dulled. High-value buyers have less cause to reveal their type, and the *Hadley* default pools more often. Even when *Hadley* separates, high-value buyers that keep quiet receive inefficient low precautions. These buyers are better off under full damages, receiving either medium precautions (with pooling) or high precautions (with separation).

Simultaneously sharpening low precautions and dulling high precautions magnifies both effects.

3. *High-Value Buyers Incur Much Greater Transaction Costs*

The optimal default rule can also change when transaction costs incurred by high-value buyers are much greater than those incurred by low-value buyers. There are two interesting scenarios—either of which prevents *Hadley* from performing better than full damages. First, the transaction costs for low-value buyers might be so cheap that they can easily contract around inefficient defaults. Second, the transaction costs for high-value buyers might be very expensive,²⁰⁵ hindering them from contracting around inefficient defaults. The two

205. This might be true, for instance, if it becomes quite complicated to make special arrangements to protect against high levels of consequential damages.

scenarios are related and cause similar effects, but they do so through different means.

For instance, when TCLOW is reduced to \$0.01, *Hadley* outperforms the full-damages default rule only 12% of the time, as illustrated in Table 13. Because low-value buyer transaction costs are so cheap, the full-damages rule always leads to a separating equilibrium. Most of the time the *Hadley* rule also results in separation, but high-value buyers with a high probability of incurring consequential damages will not reveal their type. Under *Hadley*, they are treated as low-value buyers and get inefficiently low precautions. Under a full-damages rule, they are treated as high-value buyers and get efficient precautions.²⁰⁶

TABLE 13
TRANSACTION COST SENSITIVITY ANALYSIS

TCLOW (\$)	TCHIGH (\$)	PERCENT OF RESULTS WHERE <i>HADLEY</i> IS SUPERIOR (N = 500 TRIALS)
0.05	0.05	91
0.01	0.05	12
5.00	0.05	100
0.05	0.01	100
0.05	5.00	7

When TCHIGH is increased to relatively high levels, it becomes too expensive for high-value buyers to separate, and the *Hadley* rule results in a pooling equilibrium. When the full-damages rule leads to separation, it is the more efficient outcome because high-value buyers receive efficient precautions that they do not get under *Hadley*. Full-damages usually fares better in a pooling equilibrium, as well, although very rarely the *Hadley* rule results in greater total welfare. An extremely high-value buyer may benefit so much from high precautions that he or she incurs the high transaction costs and still comes out ahead. As TCHIGH approaches infinity, however, this no longer occurs and the full-damages default is always better.

4. *The Impact of the Separation Variable*

Recall that the separation variable indicates the minimum number of buyers required to identify their type before silent buyers receive tailored precautions.²⁰⁷ For example, if more than 20% of buyers

206. Again, this qualification is not necessary in the markets for Coca-Cola and cake for the reason described *supra* note 200.

207. See *supra* text accompanying notes 139-41.

identify their type as high in a *Hadley* regime, sellers will give all other buyers low precautions. This concept receives little discussion in the contracts literature because most models assume identical valuations for low-value and high-value buyer classes.²⁰⁸ In this simulation model, however, valuations vary within each group. This means that buyer identification is not an all or nothing affair—the model needs to manage an intermediate level of separation.

Changing the separation variable by itself has little effect on the results in Part III.C. The *Hadley* rule continues to outperform a full-damages default even when low-value buyers always separate (SELOW equals 0%) and high-value buyers always pool (SEPHIGH equals 101%).²⁰⁹ But adjusting the separation variable will sometimes mute or magnify the qualifications discussed in this Part. For example, doubling the separation variable for low-value buyers to 40% reinstates *Hadley* as the superior default rule when high-value buyers have a greater probability of incurring consequential damages.²¹⁰ The full-damages default now leads to a pooling equilibrium most of the time, and high-value buyers no longer receive efficient precautions. Similarly, raising SELOW mutes the impact of cheap transaction costs for low-value buyers.²¹¹

The way that sellers treat silent buyers, then, might significantly affect the optimal consequential-damages default rule. Further research is needed on this topic.²¹²

IV. SUMMARY AND BROADER IMPLICATIONS

This case study offers evidence that the *Hadley* default rule typically generates more social welfare than a full-damages default rule. The work implies that markets with similar conditions might also benefit from the *Hadley* rule. In markets where there are few high-value buyers—such as the market for pens—*Hadley* induces these

208. See, e.g., Adler, *supra* note 7, at 1561-62 & 1561 n.38; Bebchuk & Shavell, *supra* note 5, at 292-303. Adler suggests that modeling buyer valuation stochastically might be a fruitful endeavor. See Adler, *supra* note 7, at 1561 n.38.

209. This is generally caused by low-value buyers who refuse to identify their type in a full-damages regime and receive inefficiently high precautions. They derive more utility in a *Hadley* regime where they get medium precautions. And recall that extremely high-value buyers will still contract around the *Hadley* default rule for efficiently high precautions, even when it results in a pooling equilibrium.

210. See *supra* Part III.D.1.

211. For example, rerunning line 2 in Table 13, *supra* p. 948, (TCLOW = .01; TCHIGH = .05) with a higher separation variable for low-value buyers (SELOW = 35%) leads to a result where *Hadley* does better in 54% of the trials.

212. It would be interesting to test empirically whether sellers choose different separation variables based on their underlying knowledge of buyer type. For example, if sellers realize that only 10% of buyers are high-value types, they might require just 5% to 10% of all contracting buyers to reveal their type before other buyers receive tailored precautions. The number of medium-value buyers might also play into this calculus.

extreme-value buyers to contract for efficiently high precautions. A full-damages default for the same buyer population will sometimes lead to a pooling equilibrium instead, and the resulting welfare loss can be large. In short, this study provides empirical support for the classic penalty-default literature.²¹³

The Coca-Cola and cake studies suggest that *Hadley* can also outperform a full-damages default in markets where buyer valuations are less skewed. This occurs when *Hadley* leads to a pooling equilibrium and the full-damages default causes separation—a counterintuitive result. The explanation is that some buyers have a slight preference for low precautions, but not enough to incur the transaction costs of contracting around a full-damages default rule. If enough other low-value buyers incur these costs, the population separates and the first group of buyers who prefer low precautions receives inefficiently high precautions. They are mistaken for high-value buyers.

For both of these reasons, an efficiency-minded lawmaker selecting a consequential-damages default rule in markets with similar conditions might be justified in choosing the *Hadley* limitation. While *Hadley* does not always perform better, it is the surer bet.

Under several circumstances, however, *Hadley* is an inferior choice. First, if high-value buyers systematically have a much higher probability of incurring consequential damages, then they are less likely to contract around the default. An additional cost is imposed as sellers learn this information. Extreme differences can change the optimal default rule.

Second, the findings will not hold when low-value buyers take most of the benefits from tailored precautions—that is, the cost-effectiveness trade-off of low precautions is strongly differentiated from those of medium and high precautions. The treatment of medium-value buyers, in part, drives this change. Medium-value buyers now do worse under a *Hadley* default because they receive inefficiently low precautions.

Third, if transaction costs for high-value buyers are very expensive, they will not contract around inefficient defaults. Similar results occur (for different reasons) when transaction costs for low-value buyers are very cheap. While selecting a consequential-damages default rule is a tricky task, fraught with competing effects,²¹⁴ empirical research can help lawmakers learn more about the right conditions for either imposing—or shunning—a *Hadley* default.

213. See sources cited *supra* notes 5, 7.

214. See, e.g., discussion *supra* note 112; see also Adler, *supra* note 7; Ayres & Gertner, *supra* note 2; Johnston, *supra* note 7; Schwartz, *supra* note 112.

This case study provides a framework for empirical analysis. But the work also raises new questions, and additional research would help along multiple fronts.

First, more complicated markets need to be examined. The techniques used by marketing scholars to measure buyer willingness to pay, such as the BDM procedure, will conceivably extend into more complex markets.²¹⁵ Applying data from these studies might lead to tighter-fitting buyer valuation distributions. Work on complex markets would also move the research closer to the typical domain of contract law.

Second, it would be powerful to conduct empirical research that simultaneously measures multiple variables in the *Hadley* model. This Article grounds buyer valuation in empirical research and models the other variables with assumptions and sensitivity analysis.²¹⁶ Research that extends this work by empirically measuring buyer valuations, probability estimates for incurring consequential damages, cost and effectiveness of seller precautions, and the transaction costs needed to choose different precaution levels would yield more meaningful results.

Third, more work is needed on selecting the optimal level of granularity for contract default rules.²¹⁷ Exploring the classic jurisprudential rules-versus-standards tension might be helpful in the *Hadley* context.²¹⁸ Building a greater empirical database on the merits of the *Hadley* rule versus a full-damages default in other markets would be a good start. Lawmakers are unlikely to launch primary WTP research to select a default rule for any given dispute, but additional research might lead to a sharper set of rules—or provide other guidance—for courts deciding when to award consequential damages in a specific case.

Finally, scholars need to launch empirical research that incorporates seller market power. Moving empirical *Hadley* analysis to game-theoretical models that relax assumptions of perfect competition will yield more robust insights.²¹⁹

V. USING MARKETING DATA IN CONTRACT LAW SCHOLARSHIP

The *Hadley* case study illustrates the potential benefits of testing economic theories of contract law with empirical research. It chal-

215. See Wertenbroch & Skiera, *supra* note 22, at 234; see also *supra* notes 158-60 and accompanying text.

216. See *supra* Parts III.C-D.

217. See *supra* notes 122-24 and accompanying text.

218. For some of the commentators that have explored this topic, see Diver, *supra* note 124; Kaplow, *supra* note 124; and Katz, *supra* note 124.

219. For some of the studies that have relaxed these assumptions, see Ayres & Gertner, *supra* note 2, at 746-62; Johnston, *supra* note 7; and Schwartz, *supra* note 112.

lenges the a priori claim that economic contracts scholarship has reached a dead end.²²⁰ But, more generally, the study hints that marketing research might be a fruitful source of data for contract law scholars. This Part briefly explores some possible benefits of connecting the two disciplines.

The case for using marketing research in contract law scholarship is straightforward. Contract theory, on one hand, needs empirical data to test a variety of claims.²²¹ Marketing scholars, on the other hand, have conducted vast amounts of empirical research over the past several decades.²²² In some cases, this research may address the same questions being asked in contract law. Both disciplines, after all, deal with issues of transactional exchange and consumer preferences.²²³ Where there is overlap, contract theory might reap immediate benefits by drawing upon this marketing work.

The potential applications of empirical research span most branches of contract law. On the contract formation side, economic theory wrestles with offer and acceptance,²²⁴ promissory estoppel,²²⁵ unconscionability,²²⁶ mistake,²²⁷ impossibility,²²⁸ and other issues. Contract interpretation raises some of the same questions as *Hadley*, specifically: What default rules should be imposed to guide interpretation problems that arise with incomplete or ambiguous con-

220. For a discussion of this claim, see *supra* notes 114-24 and accompanying text.

221. See Korobkin, *supra* note 20, at 1036-37; Landes, *supra* note 18, at 170; Weintraub, *supra* note 18, at 4.

222. See, e.g., DAVID A. AAKER ET AL., *MARKETING RESEARCH* (7th ed. 2001); Donald T. Campbell & Julian C. Stanley, *Experimental and Quasi-Experimental Designs for Research on Teaching*, in *HANDBOOK OF RESEARCH ON TEACHING* (N.L. Gage ed., 1963), reprinted in DONALD T. CAMPBELL & JULIAN C. STANLEY, *EXPERIMENTAL AND QUASI-EXPERIMENTAL DESIGNS FOR RESEARCH* (1963); PHILIP KOTLER, *MARKETING DECISION MAKING: A MODEL BUILDING APPROACH* (1971).

223. Compare Schwartz & Scott, *supra* note 34, at 555-56, and Russell Korobkin, *Bounded Rationality, Standard Form Contracts, and Unconscionability*, 70 U. CHI. L. REV. 1203, 1216-18 (2003) (contracts), with AAKER ET AL., *supra* note 222, at 627, 665, and Steven M. Shugan, *Editorial: Defining Interesting Research Problems*, 22 *MARKETING SCI.* 1, 14 (2003) (marketing).

224. See, e.g., Richard Craswell, *Offer, Acceptance, and Efficient Reliance*, 48 *STAN. L. REV.* 481 (1996).

225. See, e.g., Avery Katz, *When Should an Offer Stick? The Economics of Promissory Estoppel in Preliminary Negotiations*, 105 *YALE L.J.* 1249 (1996); Steven Shavell, *An Economic Analysis of Altruism and Deferred Gifts*, 20 *J. LEGAL STUD.* 401 (1991).

226. See, e.g., Richard A. Epstein, *Unconscionability: A Critical Reappraisal*, 18 *J.L. & ECON.* 293 (1975); Korobkin, *supra* note 223; Alan Schwartz, *A Reexamination of Nonsubstantive Unconscionability*, 63 *VA. L. REV.* 1053 (1977).

227. See, e.g., Melvin A. Eisenberg, *Mistake in Contract Law*, 91 *CAL. L. REV.* 1573 (2003); Eric Rasmusen & Ian Ayres, *Mutual and Unilateral Mistake in Contract Law*, 22 *J. LEGAL STUD.* 309 (1993).

228. See, e.g., Richard A. Posner & Andrew M. Rosenfield, *Impossibility and Related Doctrines in Contract Law: An Economic Analysis*, 6 *J. LEGAL STUD.* 83 (1977); Alan O. Sykes, *The Doctrine of Commercial Impracticability in a Second-Best World*, 19 *J. LEGAL STUD.* 43 (1990); George G. Triantis, *Contractual Allocations of Unknown Risks: A Critique of the Doctrine of Commercial Impracticability*, 42 *U. TORONTO L.J.* 450 (1992).

tracts?²²⁹ And scholars draw heavily on economic analysis to study contract remedy issues ranging from expectation damages²³⁰ and specific performance²³¹ to limitations on damage recovery such as mitigation,²³² subjective loss,²³³ and the *Hadley* rule.²³⁴ All of these economic theories might gain from empirical testing.

And across campus, marketing researchers follow a long tradition of empirical research.²³⁵ Over the last several decades, they have pioneered numerous data-driven studies that guide managerial decisionmaking in diverse situations.²³⁶ Marketing scholars build dedicated research centers to capture and analyze data.²³⁷ These centers

229. See Posner, *supra* note 11, at 839-42.

230. See SHAVELL, *supra* note 6, at 343-53; John H. Barton, *The Economic Basis of Damages for Breach of Contract*, 1 J. LEGAL STUD. 277 (1972); Steven Shavell, *Damage Measures for Breach of Contract*, 11 BELL J. ECON. 466 (1980) (refining the circumstances under which expectation damages are desirable). For a more general economic treatment of contract remedies, see Lewis A. Kornhauser, *An Introduction to the Economic Analysis of Contract Remedies*, 57 U. COLO. L. REV. 683 (1986).

231. See, e.g., Alan Schwartz, *The Case for Specific Performance*, 89 YALE L.J. 271 (1979); Thomas S. Ulen, *The Efficiency of Specific Performance: Toward a Unified Theory of Contract Remedies*, 83 MICH. L. REV. 341 (1984).

232. See, e.g., Goetz & Scott, *supra* note 37.

233. See, e.g., Timothy J. Muris, *Cost of Completion or Diminution in Market Value: The Relevance of Subjective Value*, 12 J. LEGAL STUD. 379 (1983).

234. See sources cited *supra* note 7.

235. See, e.g., CAMPBELL & STANLEY, *supra* note 222; KOTLER, *supra* note 222; David H. Ahl, *New Product Forecasting Using Consumer Panels*, 7 J. MARKETING RES. 160 (1970); Gerald Albaum & Robert A. Peterson, *Empirical Research in International Marketing: 1976-1982*, 15 J. INT'L BUS. STUD. 161 (1984); N.D. Cadbury, *When, Where, and How to Test Market*, HARV. BUS. REV., May-June 1975, at 96.

236. To illustrate the range of topics addressed by the marketing sciences, consider Eyal Biyalogorsky et al., *Research Note: Overselling with Opportunistic Cancellations*, 18 MARKETING SCI. 605 (1999) (offering techniques to improve profitability through pricing); Randolph E. Bucklin & Catarina Sismeiro, *A Model of Web Site Browsing Behavior Estimated on Clickstream Data*, 40 J. MARKETING RES. 249 (2003) (examining browsing behavior of 5000 random visitors to the website of an Internet automotive reseller); Ganesh Iyer, *Coordinating Channels Under Price and Nonprice Competition*, 17 MARKETING SCI. 338 (1998) (exploring how sellers should coordinate distribution channels when retailers compete on both price and nonprice terms); Ramya Neelamegham & Pradeep Chintagunta, *A Bayesian Model to Forecast New Product Performance in Domestic and International Markets*, 18 MARKETING SCI. 115 (1999) (offering a methodology to forecast the success of new product launches based on past launches); and Sanjeev Swami et al., *SilverScreener: A Modeling Approach to Movie Screens Management*, 18 MARKETING SCI. 352 (1999) (offering a decision support system in the media industry). The work speaks to many different audiences, including managers, consumers, regulators, investors, litigators, and consultants. See Shugan, *supra* note 223, at 8-13 (suggesting fifteen different audiences likely to benefit from marketing research). Of particular interest is Professor Shugan's suggestion that "litigation [is a] fertile area for provocative and important [marketing] research problems." *Id.* at 13. He goes on to discuss, for example, how marketing research can contribute to damages assessment in private litigation disputes. *Id.*

237. A few notable marketing research centers include the following: The Alfred West Jr. Learning Lab at The Wharton School of the University of Pennsylvania, at <http://www.wharton.upenn.edu/learning/> (last visited Mar. 4, 2005); Center for Retail Management at Kellogg School of Management, Northwestern University, at <http://www.kellogg.northwestern.edu/research/retail/index.htm> (last visited Mar. 4, 2005);

research applied business problems with vast data sets and sophisticated analytical techniques.²³⁸ This proliferation of empirical research is aided, no doubt, by technological advancements that allow easier data capture at the point of purchase and comprehensive analysis at the back end.²³⁹ The work yields vast repositories of empirical data.

In some cases, marketing researchers may be asking the same questions as contract law scholars. The use of willingness-to-pay research to test *Hadley* models is one example.²⁴⁰ A similar approach might benefit other areas of contract law. For instance, there may be immediate connections with other problems related to measuring expectation damages, such as reduced recovery for subjective loss²⁴¹ or the lost-volume seller problem.²⁴² Economic work in these areas also depends on buyer valuation estimates or seller cost estimates that might be tested with marketing data. Similarly, marketing research

Center for Marketing and Technology at the Haas School of Business, University of California at Berkeley, at <http://groups.haas.berkeley.edu/CMT/index.html> (last visited Mar. 4, 2005); and the Kilts Center for Marketing at the University of Chicago, at <http://gsbwww.uchicago.edu/kilts/> (last visited Mar. 20, 2005).

238. *E.g.*, sources cited *supra* note 237.

239. Silk and Urban's ASSESSOR application pioneered this type of research. *See* Silk & Urban, *supra* note 145. Other technological models include the following: Robert Blattberg & John Golanty, *Tracker: An Early Test Market Forecasting and Diagnostic Model for New Product Planning*, 15 J. MARKETING RES. 192 (1978) (the TRACKER model); John R. Hauser & Steven P. Gaskin, *Application of the "Defender" Consumer Model*, 3 MARKETING SCI. 327 (1984) (the Defender Consumer model); Lewis G. Pringle et al., *NEWS: A Decision-Oriented Model for New Product Analysis and Forecasting*, 1 MARKETING SCI. 1 (1982) (the NEWS model); and Yankelovich, Skelly & White, Inc., *LTM Estimating Procedures*, in *NEW-PRODUCT FORECASTING* 249 (Yoram Wind et al. eds., 1981) (the LTM model). ACNeilson BASES, a group that tests and advises on markets, offers the BASES system for testing new products and price points, inter alia, prior to broad market release. ACNeilson BASES, at <http://www.bases.com/> (last visited Mar. 24, 2004). ACNeilson advertises this system as "the global leader in Simulated Test Marketing." ACNEILSON BASES, *SEE TOMORROW, TODAY* (Corporate Brochure), available at <http://www.bases.com/images/pdf/BASES%20Brochure.pdf> (last visited Mar. 4, 2005).

240. *See supra* Part III.

241. A number of commentators suggest that the appropriate default rule again depends on value distributions of the contracting population. Imposing a market-value default rule, for example, might force parties with high subjective values to reveal this preference by contracting around the default. *See* Goetz & Scott, *supra* note 37; Muris, *supra* note 233.

242. The issue here is whether a breached-against seller who resells the good for the same price should receive any compensation for lost sales volume. Lawmakers may want to choose a default rule that exposes a seller's cost structure so buyers will take efficient precautions against breach. For instance, a penalty default rule awarding no lost-profit damages could force high-cost retailers to come forward and contract for a nonrefundable deposit or liquidated damages. The situation thus parallels *Hadley*, but now the distribution of seller costs—or seller willingness-to-accept (WTA), to use the marketing term—is a key variable. *See* Robert Cooter & Melvin Aron Eisenberg, *Damages for Breach of Contract*, 73 CAL. L. REV. 1432 (1985); Charles J. Goetz & Robert E. Scott, *Measuring Sellers' Damages: The Lost-Profits Puzzle*, 31 STAN. L. REV. 323 (1979); Victor P. Goldberg, *An Economic Analysis of the Lost-Volume Retail Seller*, 57 S. CAL. L. REV. 283 (1984).

may inform issues of contract interpretation²⁴³ or contract formation.²⁴⁴ It is worth exploring explicit connections more carefully.

While the call for empirical contract law research is loud, the work thus far is sparse.²⁴⁵ This may be explained by the significant investments of time, money, and training needed to conduct empirical projects.²⁴⁶ Thus, importing data from another research discipline might bring immediate benefits. The field of marketing may be a ready-made source of data for testing and refining economic models of contract law.

VI. CONCLUSION

The last three decades of contract law scholarship have increasingly relied on economic theory to support normative claims. But as the models grow more complicated, commentators are beginning to question whether economic analysis of contract law has failed. A new wave of empirical research is needed to test and refine theoretical claims, but it is unclear whether meaningful empirical projects are even possible.

The famous rule of *Hadley v. Baxendale* illustrates this tension, perhaps better than any other area of contract law. *Hadley* takes on great significance in the literature as an archetype for contract default rules that improve an economic system by exposing asymmetric information. But *Hadley* does not always work, and unfortunately it is difficult to determine when it will. Key variables in the *Hadley* models, such as the distribution of buyer valuations, are hard to measure. And the impact of multiple effects needs to be summed. Ultimately, there are hard questions about the appropriate level of granularity for the default rule: should it be applied to a single buyer, a single product, a single market, or the entire legal system?

Drawing upon recent work in the field of marketing, this Article has conducted an empirical assessment of the *Hadley* rule in three simple markets. It finds that *Hadley* typically generates more social

243. For example, interpretation issues can raise similar doctrinal choices between majoritarian defaults that mimic popular desires and penalty defaults that force efficient disclosure of private information. See Posner, *supra* note 11, at 839-42. This approach may also help private parties, as opposed to lawmakers, design efficient mechanisms for contract interpretation. In fact, private parties might be able to populate the models with their own historical data, mitigating some of the challenges of gathering empirical information. Cf. Katz, *supra* note 124.

244. Economic models of the mutual mistake doctrine, for example, depend on variables for buyer valuation and seller costs. See Rasmusen & Ayres, *supra* note 227, at 314-15. There are likely to be other doctrinal applications related to contract formation.

245. Heise, *supra* note 18, at 816; Korobkin, *supra* note 20, at 1036; Landes, *supra* note 18, at 176.

246. Goldsmith & Vermeule, *supra* note 17, at 164-65; Heise, *supra* note 18, at 85-123; Landes, *supra* note 18, at 178-79.

welfare than a full-damages default rule, suggesting that markets facing similar conditions might also benefit from the *Hadley* rule.

But these conclusions must be qualified. They do not hold when high-value buyers are much more likely to incur consequential damages or face very high transaction costs. A full-damages default rule is often better when low-value buyers take most of the benefits from tailored precautions. And introducing seller market power might also change the results. Thus, the work presents evidence in support of *Hadley*, but it also raises the need for more research in this area.

Finally, this Article suggests that existing work in the field of marketing may serve as a ready-made source of data for testing economic theories of contract law. Marketing enjoys a rich tradition of empirical research, and the case for linking contract and marketing scholarship appeals on an intuitive level. Both disciplines deal fundamentally with transactional exchange. The use of willingness-to-pay data to assess the *Hadley* rule is one example of the connection. It is possible that broader use of marketing research can address other perceived dead ends in contract law theory.