LAW'S INFORMATION REVOLUTION AS PROCEDURAL REFORM: PREDICTIVE SEARCH AS A SOLUTION TO THE *IN TERROREM* EFFECT OF EXTERNALIZED DISCOVERY COSTS

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By allowing parties to proceed on an informed basis, liberal discovery under the Federal Rules of Civil Procedure was intended to support Rule 1's idealized goal of securing the "just, speedy, and inexpensive" resolution of civil cases. The large costs of conducting discovery may instead produce the opposite result. The creation of cross-party agency costs and the litigants' ability to externalize much of the effort and costs of discovery to their adversary can generate litigation that is expensive, slow, and unjust. The problem may be particularly acute in cases involving vast amounts of electronically stored information, where the amount of data and potential for externalized costs of discovery can rise exponentially. This Article examines how the expanded use of technology can serve as de facto procedural reform. Use of advanced technological tools such as predictive search allow the tasks and costs to be allocated in a way that simultaneously yields better incentives, mitigates asymmetric cost and information problems, and reduces cross-party agency costs. This in turn mitigates both the problems of overdiscovery and the in terrorem effect of discovery costs on pre-discovery settlements. The result is more information and lower costs, allowing the system of legal discovery to move toward fulfilling the idealized goals of Rule 1.

* Professor of Law, George Mason University Law School. This Article is dedicated to Larry Ribstein, who was my friend, frequent coauthor, and a constant and invaluable source of ideas for articles, including this one. Prior drafts of this Article benefited from comments from D. Bruce Johnsen, Jeff Parker, David Schleicher, and participants at the Robert A. Levy Workshop at George Mason Law School, the 2013 Annual Meeting of the American Law and Economics Association, the Law and Economics Center Research Roundtable on Law's Information Revolution at George Mason Law School, and the Larry Ribstein Memorial Conference at the University of Illinois College of Law.

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I. INTRODUCTION

The introduction of expansive discovery of "any nonprivileged matter that is relevant to any party's claim or defense"[1] was among the most

1. FED. R. CIV. P. 26(b)(1). Relevant information need not be admissible at the trial if the discovery appears reasonably calculated to lead to the discovery of admissible evidence. *Id.*

important conceptual innovations contained in the Federal Rules of Civil Procedure.[2] In theory, the production of information through liberal discovery would clarify the parties' positions and allow better-informed parties to quickly resolve their disputes.[3] Moreover, discovery under the Federal Rules was to be "self-regulating" and not place large burdens on the court system.[4]

In practice, however, the costs of liberal discovery under the Rules may exceed the benefits. The high costs of discovery may prevent rather than "secure the just, speedy, and inexpensive determination of every action and proceeding."[5] Litigation with expansive discovery is neither inexpensive nor speedy. Nor is it always "just" when it is speedy, as the anticipation of the high costs of discovery can cause litigants to settle cases based not on the underlying merits of the case, but on their desire to avoid the high cost of discovery.[6] Thus, the costs of liberal discovery under the Rules can both increase the direct costs of litigation *and* induce higher error costs.[7] Moreover, concern over these costs has prompted increased judicial involvement in regulating discovery, placed increasing burdens on courts, and resulted in a system that is far from "self-regulating."

The high costs of discovery were at the center of the Supreme Court's recent decisions on pleading standards, with the Court expressing concern over a plaintiff with "'a largely groundless claim' be[ing] allowed to 'take up the time of a number of other people, with the right to do so representing an *in terrorem*[8] increment of the settlement value.'"[9] Con-

2. *See generally* Steven N. Subrin, *Fishing Expeditions Allowed: The Historical Background of the 1938 Federal Discovery Rules*, 39 B.C. L. REV. 691 (1998) (discussing the history of Rule 26 during the promulgation of the Federal Rules in 1938).

3. "Mutual knowledge of all the relevant facts gathered by both parties is essential to proper litigation. To that end, either party may compel the other to disgorge whatever facts he has in his possession." Hickman v. Taylor, 329 U.S. 495, 507 (1947). Information that causes the parties to agree on the merits of the case can promote conditions favorable to settlement of disputes. *See, e.g.*, ROBERT G. BONE, CIVIL PROCEDURE: THE ECONOMICS OF CIVIL PROCEDURE 69–102 (2003) (discussing the economic model of the decision to litigate or settle a case); RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW § 21.5, at 601–03, § 21.6, at 604 (7th ed. 2007).

4. *See* Maurice Rosenberg & Warren R. King, *Curbing Discovery Abuse in Civil Litigation: Enough is Enough*, 1981 BYU L. REV. 579, 582.

5. FED. R. CIV. P. 1.

6. *See* Alan B. Morrison, *The Necessity of Tradeoffs in a Properly Functioning Civil Procedure System*, 90 OR. L. REV. 993, 994–95 (2012) (noting that the idealized goals embodied in Rule 1 hides the difficult tradeoffs that that must confronted when engaging in procedural reform).

7. *See* POSNER, *supra* note 3, § 21.1, at 593 (noting that the goal of efficient procedure is to minimize the sum of direct costs and error costs).

8. An *in terrorem* effect is defined as an effect that results from a "legal warning, usually one given in hope of compelling someone to act without resorting to a lawsuit or criminal prosecution." *In terrorem*, WIKIPEDIA, http://en.wikipedia.org/wiki/In_terrorem (last visited June 23, 2014). In this Article, this term is used to denote the deviation of the settlement value of a lawsuit from the expected judgment. *See* discussion *infra* text accompanying notes 42–44.

9. Bell Atl. Corp. v. Twombly, 550 U.S. 544, 558 (2007) (citing Dura Pharmaceuticals, Inc. v. Broudo, 544 U.S. 336 (2005) (quoting Blue Chip Stamps v. Manor Drug Stores, 421 U.S. 723, 741 (1975))) (internal quotation marks omitted). Some commentators have pointed out the irony in the Court's use of pleading standards as a mechanism to avoid discovery, given that the Federal Rules' adoption of notice pleading in 1938 rested upon the promise of liberal discovery. *See, e.g.*, Arthur R. Miller, *From* Conley *to* Twombly *to* Iqbal*: A Double Play on the Federal Rules of Civil Procedure,* 60

cerns over the high costs of discovery have also led to numerous major amendments to Rule 26.[10] Despite these prior attempts at discovery reform, addressing the high costs of discovery remains a central focus of current proposals to reform the rules.[11]

While many aspects of civil litigation can be costly, discovery is unique because of the way it allows one party to define and to externalize a large share of the responsibility and costs of his discovery request to his adversary.[12] Under current discovery practice, the party responding to a discovery request is expected to engage in a search to identify relevant documents and information in its possession, and produce them for inspection by the requesting party. Under traditional cost allocation rules, the costs fall where they lie, and the party that receives the discovery request bears the costs of responding to the discovery request.[13] The responding party's costs can be many times the requesting party's modest costs of formulating and reviewing the produced information.[14] This ability to force the adversary to undertake and bear the costs of responding predictably creates an incentive for the requesting party to make expansive discovery requests that are privately beneficial, but socially costly. These asymmetrical and externalized costs are also the source of the *in terrorem* effect of discovery costs on settlement.

Economic solutions to the problem of discovery cost externalization seek to move discovery practice towards better incentives and self-regulation. In particular, economic analyses of discovery have focused on making the requesting party internalize the costs of his request

DUKE L.J. 1, 1–2 (2010); Arthur R. Miller, *Simplified Pleading, Meaningful Days in Court, and Trials on the Merits: Reflections on the Deformation of Federal Procedure*, 88 N.Y.U. L. REV. 286, 286–87 (2013). For economic analyses for pleading standards, see Bone, *supra* note 3, at 125–57; Jonah B. Gelbach, *Locking the Doors to Discovery? Assessing the Effects of* Twombly *and* Iqbal *on Access to Discovery*, 121 YALE L. J. 2270, 2270 (2012); Keith N. Hylton, *When Should a Case Be Dismissed? The Economics of Pleading and Summary Judgment Standards*, SUPREME CT. ECON. REV. 39, 39 (2008); Paul Stancil, *Balancing the Pleading Equation,* 61 BAYLOR L. REV. 90, 94 (2009); William H. J. Hubbard, *The Problem of Measuring Legal Change, with Application to* Bell Atlantic v. Twombly 42 J. LEGAL STUD. 35 (2013).

10. *See, e.g.*, Martin H. Redish & Colleen McNamara, *Back to the Future: Discovery Cost Allocation and Modern Procedural Theory,* 79 GEO. WASH. L. REV. 773 (2011) (cataloging recent amendments to Rule 26 that include the addition and modification of the Rule 26(f) discovery conference in 1980 and 1983, the Rule 26(g) certification requirement and Rule 26(b) proportionality rule in 1983, the addition and modification of automatic disclosure under Rule 26(a) in 1993 and 2000). In addition, Rule 26 was again modified in 2006 to address issues relating to electronically stored information ("ESI"). *See* Bennett B. Borden et al., *Four Years Later: How the 2006 Amendments to the Federal Rules Have Reshaped the E-Discovery Landscape and Are Revitalizing the Civil Justice System*, 17 RICH J.L. & TECH. 4, 4 (2011). The proposed 2014 amendments to the Federal Rules contain amendments to the discovery rules. *See* FED. R. CIV. P. 26 (Proposed Amendment 2013).

11. These approaches to procedural reform further abandon the "self-regulation" model and focus on expanding judicial management of discovery. *See, e.g.*, JUDICIAL CONFERENCE ADVISORY COMM. ON CIVIL RULES AND THE COMM. ON RULES OF PRACTICE AND PROCEDURE, REPORT TO THE CHIEF JUSTICE OF THE UNITED STATES ON THE 2010 CONFERENCE ON CIVIL LITIGATION (2010), http://www.uscourts.gov/uscourts/RulesAndPolicies/rules/2010% 220report.pdf.

12. Redish & McNamara, *supra* note 10, at 779 (distinguishing between costs of discovery and other litigation costs).

13. *See* Oppenheimer Fund, Inc. v. Sanders, 437 U.S. 340, 358 (1978) ("[T]he presumption is that the responding party must bear the expense of complying with discovery requests . . . .").

14. *See* discussion *infra* Part III.

through a "requestor pays discovery cost" allocation rule.[15] While implementing this solution in practice has faced some resistance,[16] the idea that allocating costs to the requesting party can be used to usefully limit the scope and cost of discovery by improving litigant incentives is gaining acceptance.[17] More generally, the exponential growth of electronically stored data and its potential to exponentially increase the costs of discovery going forward[18] has increased the demand for a workable solution that limits the costs of discovery in these cases, including solutions based on improving litigant incentives.[19]

Cost-allocation rules, however, may not be a complete solution. The focus on cost externalization and cost-allocation rules does not address a second source of misaligned incentives in traditional discovery practice—the cross-party agency costs generated by the current structure of discovery practice. These agency costs are created when the responding party is assigned the task of sorting out relevant from irrelevant documents based on the requesting party's discovery request, a request that can be both extensive and vague.[20] Under these circumstances, the responding party's attorney is forced to make, in many cases without much

15. BONE, *supra* note 3, at 217–19; Robert D. Cooter & Daniel L. Rubinfeld, *An Economic Model of Legal Discovery*, 23 J. LEGAL STUD. 435, 455 (1994); Frank H. Easterbrook, *Discovery as Abuse*, 69 B.U. L. REV. 635, 638 (1989); Martin H. Redish, *Electronic Discovery and the Litigation Matrix*, 51 DUKE L.J. 561, 608 (2001); Redish & McNamara, *supra* note 10, at 773.

16. *See, e.g.*, Hagemeyer N. Am., Inc., v. Gateway Data Scis., Corp., 222 F.R.D. 594, 601 (E.D. Wis. 2004) (describing a requestor pays cost allocation rule as a "cost-benefit analysis" and rejecting use of such a "primitive" rule that ignores the standard cost allocation presumption).

17. For example, the expert deposition cost allocation rule under FED. R. CIV. P. 26(b)(4)(E)(i) requires the party seeking discovery to pay: "Unless manifest injustice would result, the court must require that the party seeking discovery pay the expert a reasonable fee for time spent in responding to discovery under Rule 26(b)(4)(A) or (D) . . . ." In addition, cost allocation rules have been seriously considered as a mechanism to control the costs of discovery in cases involving large amounts of ESI. *See, e.g.*, the ESI cost allocation analysis in Zubulake v. UBS Warburg LLC, 217 F.R.D. 309 (2003) and Rowe Ent., Inc. v. William Morris Agency, Inc., 205 F.R.D. 421 (2002) under FRCP 26(b)(2)(B). A responder-pays-cost-allocation rule for discovery is included in the Federal Circuit Advisory Council's Model E-discovery Order, http://patentlyo.com/media/docs/2013/08/ediscovery-model-order-1.pdf. The Federal Circuit, however, did not sponsor or endorse the model rules. *See* Jason Rantanen, *The Disappearing Federal Circuit Advisory Council Model Orders*, (Aug. 12, 2013) PatentlyO, http://patentlyo.com/patent/2013/08/the-disappearing-federal-circuit-advisory-council-model-orders.html; Federal Circuit Advisory Council, *Model orders*, http://www.cafc.uscourts.gov/images/model_orders.pdf (last visited July 6, 2014). In addition, some New York courts have adopted a requestor e-discovery cost bearing presumption under CPLR § 3101 and 3120. *See, e.g.*, T.A. Ahern Contractors Corp. v. Dormitory Auth. of New York, 875 N.Y.S.2d 862, (N.Y. Sup. Ct. 2009); Delta Fin'l Corp. v. Morrison, 819 N.Y.S.2d 908, 914 (N.Y. Sup. Ct. 2006) (includes atty. fees); Etzion v. Etzion, 796 N.Y.S.2d 844, 846 n.48 (N.Y. Sup. Ct. 2005); Lipco Elec. Corp. v. ASG Consulting, 798 N.Y.S.2d 345 (N.Y. Sup. Ct. 2004); *see also* Preliminary Draft of Proposed Amendments*, supra* note 10, at 293 (amendment to Rule 26(C)(1)(b) explicitly listing the "allocation of expenses" as one of the terms that can be specified for disclosure or discovery).

18. Jason R. Baron, *Law in the Age of Exabytes: Some Further Thoughts on 'Information Inflation' and Current Issues in E-Discovery Search*, 17 RICH. J.L. & TECH. 1, 4 (2011); Redish, *supra* note 15, at 561.

19. *See The Sedona Conference Best Practices Commentary on the Use of Search and Information Retrieval Methods in E-Discovery*, 8 SEDONA CONF. J. 189, 193 (2007).

20. William W. Schwarzer, *In Defense of "Automatic Disclosure in Discovery*,*"* 27 GA. L. REV. 655, 661 (1993) (noting the similarities between a lawyer's duty to respond to automatic disclosure under the 1993 amendments to Rule 26 and a lawyer's duty to respond to "vague, catch-all" traditional discovery requests that are "routinely" observed in litigation).

specific guidance, substantive decisions about a document's relevancy to his adversaries' case. In effect, the responding party's attorney, under threat of court-imposed sanctions, must act as his adversary's agent.[21]

Forcing a lawyer to provide these benefits to his adversary conflicts with the lawyer's normal ethical duty to his client, and turns the standard incentives of the adversarial system on its head.[22] In particular, this system creates cross-party agency costs that yield misaligned incentives that are much stronger than those that exist in the well-studied agency relationship between a lawyer and his client.[23] By limiting his effort in accurately sorting between relevant and irrelevant documents, the responding party's lawyer will produce fewer relevant documents and more irrelevant ones. As a result, the responding party and his lawyer can (1) increase the requesting party's cost of discovery, (2) reduce the requesting party's value of discovery, and (3) reduce the responding party's costs. Thus, the generation of cross-party agency costs yields incentives to shirk that simultaneously harms the adverse party and provides multiple benefits to the responding lawyer and his client.[24]

This Article illustrates how major changes to the nature and allocation of discovery costs, and a solution to the problem of "too much" discovery costs, can come from outside the civil rulemaking apparatus.[25] The expanded use of predictive search technology to conduct discovery, and the sensible allocation of responsibilities and costs between the parties, alters the cost structure of discovery in a way that mitigates the problems of high and externalized discovery costs. Importantly, costs are not just lower. The use of technologies such as predictive coding are more accurate,[26] and allow the tasks and costs to be allocated in a way

21. *See* Redish & McNamara, *supra* note 10, at 779 ("[T]he extent of a [responding] party's discovery costs are determined not by the litigant himself but by the scope and content of the request filed by his opponent, and none of those expenditures benefits the producing party's own case."). Redish and McNamara would allocate the costs of responding to a discovery request to the requesting party under the theory of *quantum meruit*. *Id.* at 788–91.

22. As Justice Jackson noted in his concurring opinion in *Hickman v. Taylor*, 329 U.S. 496, 516 (1947): "[A] common law trial is and always should be an adversary proceeding. Discovery was hardly intended to enable a learned profession to perform its functions either without wits or on wits borrowed from the adversary." *See also* Griffin B. Bell et al., *Automatic Disclosure in Discovery—The Rush to Reform*, 27 GA. L. REV. 1, 40 (1992) (noting that how the automatic disclosure requirement to disclose information "relevant to disputed facts alleged with particularity in the pleadings," contained in the 1993 Amendments to FED. R. CIV. P. 26, would undermine the adversary system).

23. *See* Rosenberg & King, *supra* note 4, at 582 (suggesting that lawyer-client agency costs generated by hourly billing practices were a contributing cause of overdiscovery); *see generally*, Bruce L. Hay, *Contingent Fees and Agency Costs*, 25 J. LEGAL STUD. 503 (1996); Geoffrey P. Miller, *Some Agency Problems in Settlement*, 16 J. LEGAL STUD. 189 (1987); A. Mitchell Polinsky & Daniel L. Rubinfeld, *Aligning the Interests of Lawyers and Clients*, 5 AM. L. & ECON. REV. 165 (2003); Larry E. Ribstein, *Ethical Rules, Agency Costs, and Law Firm Structure,* 84 VA. L. REV. 1707 (1998).

24. *See* Redish & McNamara, *supra* note 10, at 790 (noting the multiple layers of benefits created by the responding party in discovery that inure to the benefit of requesting party. These are benefits that would be reduced by cross-party agency costs).

25. *See* Baron, *supra* note 18, at 4 ("[A]dvocacy by others that e-discovery is an all-encompassing problem needing correction through major rules reform is . . . ill-advised. . . . The answer lies principally in culture change (i.e., fostering cooperation strategies), combined with savvier exploitation of a range of sophisticated software and analytical techniques.").

26. NICHOLAS M. PACE & LAURA ZAKARAS, RAND INSTITUTE FOR CIVIL JUSTICE, WHERE THE MONEY GOES: UNDERSTANDING LITIGANT EXPENDITURES FOR PRODUCING ELECTRONIC

that simultaneously yields better incentives, mitigates asymmetric cost and information problems, and reduces cross-party agency costs.[27] The result is more information, fewer errors, and lower cost, which allows the system of legal discovery to move towards fulfilling Rule 1's idealized goal of just, speedy, *and* inexpensive litigation.

Thus, the expanded use of technology to manage and conduct discovery can produce *de facto* discovery reform. Providing a workable solution to the longstanding problems of overdiscovery through technology is a prime example of how law's information revolution alters the market for legal services and improves litigation.[28] These technological tools exist now,[29] and courts have approved their use as an alternative to older, less accurate, and more costly methods of search.[30]

While the application of predictive search technology to electronic discovery may be the most developed example of how technology can al-

DISCOVERY, (2012), http://www.rand.org/content/dam/rand/pubs/monographs/2012/RAND_MG1208.pdf; David C. Blair & M. E. Maron, *An Evaluation of Retrieval Effectiveness for a Full-Text Document-Retrieval System*, 28 COMM. ACM 289 (1985); Andrew Peck, *Search, Forward: Will Manual Document Review and Keyword Searches Be Replaced by Computer-Assisted Coding?*, LAW TECHNOLOGYNEWS.COM (Oct. 1, 2011), http://law.duke.edu/sites/default/files/centers/judicialstudies/TAR_conference/Panel_1-Background_Paper.pdf; Maura R. Grossman & Gordon V. Cormack, *Technology-Assisted Review in E-Discovery Can Be More Effective and More Efficient than Exhaustive Manual Review*, 17 RICH. J.L. & TECH. 11 (2011).

27. *See* Cooter & Rubinfeld, *supra* note 15, at 455 (noting that symmetrical costs will promote resolution of the dispute "on terms corresponding to the complete information trial judgment"); Redish, *supra* note 15 (discussing cost internalization); Stancil, *supra* note 9 (discussing the effect of asymmetric costs and asymmetric information on litigation outcomes).

28. RICHARD SUSSKIND, THE END OF LAWYERS? RETHINKING THE NATURE OF LEGAL SERVICES Chps. 3 & 4 (2008) (discussing technology and the market for legal services); Daniel M. Katz, *Quantitative Legal Prediction – or – How I Learned to Stop Worrying and Start Preparing for the Data Driven Future of the Legal Services Industry*, 62 EMORY L.J. 909 (2013) (discussing the effect of technology on the provision of legal services); Bruce H. Kobayashi & Larry E. Ribstein, *Law's Information Revolution,* 53 ARIZ. L. REV. 1169 (2011) (discussing generally the application of technology to the legal services market).

29. *See, e.g.*, Document Review, PANGEA3, http://www.pangea3.com/solutions/litigation/document-review.html (last visited July 6, 2014) (Website of Pangea3, a provider of legal outsourcing services, including technologically driven document review and integrated discovery solutions). *See also* Katz, *supra* note 28.

30. *See, e.g.*, Da Silva Moore v. Publicis Groupe, 868 F. Supp. 2d 137 (S.D.N.Y. 2012) (stating that use of predictive coding was appropriate considering: (1) the parties' agreement; (2) the vast amount of ESI to be reviewed; (3) the superiority of computer-assisted review to the available alternatives (i.e., linear manual review or keyword searches); (4) the need for cost effectiveness and proportionality under Rule 26(b)(2)(C), and (5) the transparent process proposed). *See also In re* Biomet M2a Magnum Hip Implant Products Liability Litigation, 3:12-MD-2391 (N.D. Ind., Apr. 18, 2013); Global Aerospace Inc. v. Landow Avation, L.P., No. CL 61060, 2012 Va.Cir.LEXIS 50 (Va. Cir. Ct. Apr. 23, 2012); Michael Moscato, *Rise Of The Machines—Predictive Coding Goes Mainstream*, Law360 (May 17, 2013, 6:04 PM), *available at* http://www.law360.com/articles/442891/rise-of-the-machines-predictive-coding-goes-mainstream (reporting that both the DOJ and FTC have approved use of predictive coding to respond to the agencies' requests for information in merger investigations); Debra Cassens Weiss, *Lawyer for E-Discovery Company Predicts Predictive Coding Will Become an Ethical Obligation*, ABA J. (December 6, 2012), *available at* http://www.abajournal.com/news/article/lawyer_for_e-discovery_company_predicts_predictive_coding/ (discussing *Kleen Products v. Packaging Corp. of America*, and plaintiffs' argument that defendants' failure to use predictive coding made electronic review of records defective); *see also* EORHB, Inc. v. HOA Holdings, LLC, No. 7409-VCL, 2012 WL 4896670 (Del. Ch. Oct. 15, 2012) (ordering the use of predictive coding by both sides without a request by either party); MODEL RULES OF PROF'L CONDUCT R. 1.01 cmt. ("To maintain the requisite knowledge and skill, a lawyer should keep abreast of changes in the law and its practice, *including the benefits and risks associated with relevant technology* . . . .") (emphasis added).

ter legal practice, it is not the only example. The provision of legal services, like any industry, is subject to the forces of disruptive innovation, which can alter the way in which legal services are delivered,[31] the organization of law firms,[32] legal education,[33] legal regulation,[34] and even the structure and content of law itself.[35] These disruptive forces can bring needed legal change to address important problems where solutions based on traditional legal reform have proven elusive.[36]

The Article is organized as follows. Part II presents a model of litigation and discovery. In Part III, the model is used to examine the incentives for discovery under manual search, and to demonstrate how the current cost allocation rule incentivizes broad and costly discovery and facilitates *in terrorem* settlements in the presence of asymmetric discovery costs. Part IV examines the promise and limits of cost-internalization as a solution to the overdiscovery problems. Part V examines the nature of cross-party agency costs. Part VI examines how technology, and, in particular, the use of predictive search, alters the cost structure of discovery in a way that mitigates both the overdiscovery problem and cross-party agency costs.

II. A MODEL OF LEGAL DISCOVERY

This Part presents a stylized model of legal discovery to illustrate the basic economics of discovery and its effect on pre-discovery settlement. The analysis in this paper focuses on the parties' incentives to settle in the shadow of expensive discovery. The analysis examines the parties' incentives to increase the scope of discovery, and how pre-discovery settlement is affected by the anticipation of the effects and costs that would be generated during discovery.[37]

The basic model of litigation is presented in Section A. Section B.1 sets out the nature of search. Section B.2 sets out the costs of discovery. Section B.3 sets out the benefits of discovery.

A. The Structure of Litigation

In the model of litigation used in this paper, the plaintiff files a claim against the defendant for a fixed sum $\$J$. After the filing of the

31. *See, e.g.*, Kobayashi & Ribstein, *supra* note 28.

32. *See, e.g.*, Larry E. Ribstein, *The Death of Big Law*, 2010 WIS. L. REV. 749 (2010).

33. *See, e.g.*, Oliver R. Goodenough, *Developing an E-Curriculum: Reflections on the Future of Legal Education and on the Importance of Digital Expertise*, 88 CHI.-KENT L. REV. 845, 847 (2013); Larry E. Ribstein, *Practicing Theory: Legal Education for the Twenty-First Century*, 96 IOWA L. REV. 1649, 1649 (2011); Daniel M. Katz, *MIT School of Law*, 2014 U. ILL. L. REV. 1431.

34. *See, e.g.*, Kobayashi & Ribstein, *supra* note 28, at 1169.

35. John O. McGinnis & Steven Wasick, *Law's Algorithm* (Nw. Law, Working Paper No. 12-22, 2013), *available at* http://ssrn.com/abstract=2130085.

36. *See* Benjamin H. Barton, *A Glass Half Full Look at the Changes in the American Legal Market*, 38 INT'L. REV. L. & ECON. 29 (2014), *available at* http://dx.doi.org/10.1016/j.irle.2013.04.010.

37. As noted above, high discovery costs and the generation of an *in terrorem* effect on pre-discovery settlement was a primary focus of the Supreme Court in its recent decisions on pleading standards.

complaint, parties submit their initial disclosures[38] and formulate their discovery plan.[39] Both parties estimate that if the case is litigated to judgment in the absence of discovery, the probability of a judgment for the plaintiff will be entered and damages of $\$J$ will be awarded to the defendant equals $p_{0.}$ Discovery alters the parties' estimate of the probability that the plaintiff will prevail. The plaintiff and defendant incur costs $C_P^{discovery}$, and $C_D^{discovery}$, respectively, and the discovery process yields a post-discovery probability that the plaintiff will prevail at trial, p_1.

The parties can choose to settle the dispute for an amount $\$S_0$ prior to discovery or the parties can choose continue to litigate the claim. If no settlement is reached, the parties conduct discovery according to their discovery plan. At the end of discovery, the parties can choose to settle the case for S_1 or continue to trial. If the case is tried, the plaintiff and defendant incur trial costs C_P^{trial}*, and* C_D^{trial}, respectively, and the plaintiff will be awarded $\$J$ with probability p_1.

The model of litigation is simplified in order to highlight the effects of discovery on pre-discovery settlement.[40] In order to focus the Article on settlement in the shadow of discovery costs, we assume throughout the rest of the Article that post-discovery, both parties anticipate that the case will settle for the expected judgment based on the post-discovery probability p_1:

$$(1) S_1 = p_1 J.$$

Under the assumption that the parties agree, pre-discovery, that $E(p_1) = p_1$, the parties will anticipate that the case will settle for S_1 post-discovery. If the parties equally split any existing bargaining surplus, the pre-discovery settlement equals:

$$(2) S_0 = p_1 J + (C_D^{discovery} - C_P^{discovery})/2.$$

Figure 1 illustrates the condensed decision tree under these assumptions.[41]

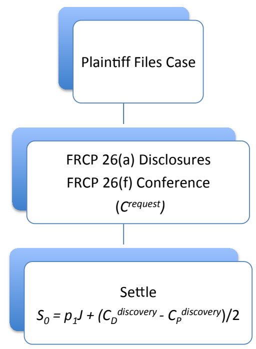
38. FED .R. CIV. P. 26(a)(1)(ii) ("[A] party must, without awaiting a discovery request, provide to the other parties: . . . a copy—or a description by category and location—of all documents, electronically stored information, and tangible things that the disclosing party has in its possession, custody, or control and may use to support its claims or defenses, unless the use would be solely for impeachment").

39. FED. R. CIV. P. 26(f) ("[T]he parties must confer as soon as practicable . . . [and] must consider the nature and basis of their claims and defenses and the possibilities for promptly settling or resolving the case; make or arrange for the disclosures required by Rule 26(a)(1); . . . and develop a proposed discovery plan.").

40. For example, the model does not consider the effects or costs associated with a motion to dismiss, or other pre-trial issues. It also abstracts from summary judgment and other forms of adjudication prior to trial.

41. The uncondensed decision tree and the underlying assumptions are described in detail in the model appendix.

FIGURE 1: THE CONDENSED STRUCTURE OF LITIGATION



The pre-discovery settlement S_0 consists of two components. The first term is the expected judgment:

$$(3) E(p_1J) = p_1J.$$

The second term is the *in terrorem* effect of discovery costs on pre-discovery settlement:[42]

$$(4) I = (C_D^{discovery} - C_P^{discovery})/2$$

The *in terrorem* effect will increase the size of the settlement paid by the defendant above the expected judgment when the defendant's expected discovery costs are greater than the plaintiff's expected discovery costs. It follows that under the assumption of an equal split of the bargaining surplus, symmetric discovery expenditures will cause the *in terrorem* effect to go to zero.[43] Thus, it is asymmetric discovery costs that cause the expected settlement to deviate from the expected stakes.[44]

42. As defined *supra* note 8, the *in terrorem* effect denotes the amount the pre-discovery settlement deviates from the expected judgment.

43. In the absence of an agreement, the ability to externalize discovery expenditures can give rise to a prisoner's dilemma where each side chooses to externalize costs, even though they would be better off if both agreed to limit discovery. *See, e.g.*, BONE, *supra* note 3, at 222–23; Ronald J. Gilson & Robert H. Mnookin, *Disputing Through Agents: Cooperation and Conflict Between Lawyers in Litigation*, 94 COLUM. L. REV. 509 (1994) (discussing legal cooperation and the role of lawyers in resolving conflict in adversarial proceedings). Such incentives, however, to the extent that they are symmetric, would not affect the expected size of pre-discovery settlement. It may make such settlement more likely, however. *See* Posner, *supra* note 3, at 601–03.

44. *See generally* BONE, *supra* note 3, at 45–50; Cooter & Rubinfeld, *supra* note 15, at 437; David Rosenberg & Steven Shavell, *A Model in Which Suits Are Brought for their Nuisance Value*, 5 INT. REV. L. & ECON. 3, 4–5 (1985); Stancil, *supra* note 9, at 92.

B. The Costs and Benefits of Discovery

This Section discusses the costs and benefits of discovery. Subsection 1 examines the imperfect nature of the information search process. Subsection 2 examines the costs created by a discovery request. Subsection 3 examines the benefits of such an information search.

1. The Information Search Process

A discovery request triggers a document search. Because no search is perfect, a critical determinant of both the costs and benefits of an information search is the accuracy of the search. The "accuracy" of a search will have two components. The first is the ability of the search to correctly identify relevant documents. A failure to identify relevant documents is a false negative, or type II error. The second component is the ability of the search to correctly identify nonrelevant documents. Erroneously identifying a nonrelevant document as relevant is a false positive, or type I error.

Table 1 illustrates the general error cost structure of the document sorting process. The left hand column categorizes the true characteristic of a document (relevant/not relevant).[45] The top row categorizes the document sorting process' classification of the documents, a positive (a document identified as relevant) or a negative (a document identified as not relevant).

45. For a privilege search, the categories in the first column would be privileged/not privileged. Note that the category relevant/not relevant denotes that the document's probative value is sufficiently high to be of value to the requesting party. *See* FED. R. EVID. 401 ("Evidence is relevant if: (a) it has any tendency to make a fact more or less probable than it would be without the evidence; and (b) the fact is of consequence in determining the action."). This concept is distinct from the concept of responsiveness (denoting whether or not production of the document is warranted given the discovery request) or reasonable under the proportionality test contained in FED. R. CIV. P. 26(b)(2)(C) and discussed *infra* note 61.

TABLE 1: SEARCH OUTCOME MATRIX

	IDENTIFIED (+)	**NOT IDENTIFIED (-)**
RELEVANT	A (CORRECT POSITIVE)	C (FALSE NEGATIVE)
NOT RELEVANT	B (FALSE POSITIVE)	D (CORRECT NEGATIVE)

The two diagonal elements of Table 1 are the correct outcomes. A denotes the total number of correctly identified relevant documents, while D denotes the number of correctly identified nonrelevant documents. The off-diagonal elements of Table 1 represent the errors of the search. C denotes the number of relevant documents that are not correctly identified (a false negative, or type II error), and B represents the number of nonrelevant documents that are falsely identified as relevant (a false positive, or type I error). A+B are the total number of produced documents, and the observed production rate α (the ratio of produced documents to total documents searched) equals:

$$\alpha = A+B/(A+B+C+D).$$

The precision of the search v (the fraction of produced documents that are relevant) equals:

$$v = A/(A+B).$$

The recall of the search ρ (the fraction of relevant documents that are produced) equals:

$$\rho = A/(A+C).$$

A search with a higher recall will increase the benefits of the search by identifying more of the relevant documents. Holding the number of total (A+B+C+D) and relevant (A+C) documents fixed, increasing the recall of a search will increase A and will also result in offsetting decreases in C. Increases in A also increase the precision and the production rate, holding B constant. In addition, a more accurate search can increase the precision of the search even if A does not change by decreasing the number of false positives B. Increasing the precision of the search through reductions in B decreases the cost of review by decreasing the total number of produced documents A+B and the production rate α.

The accuracy of a search method, including both the recall and precision of a search, will be a function of the technology used.[46] Both the

46. Studies comparing the accuracy of different technologies used to conduct document review have used a measure known as F1 to index the overall accuracy of a sorting method, where F1 is the

recall and precision of a search can also be affected by the parties' actions. For example, under a manual search of documents, those reviewing the documents can apply discretion in a way that results in the production of documents in borderline cases. This would increase recall and decrease precision relative to a search standard that did not result in the production of borderline documents. The result would be, on the margin, a search that produced more relevant information at a higher cost.

Under computerized review, the precision and recall will be a function of the resources directed to defining and refining the search. For example, the accuracy of a keyword search will depend upon the parties' effort in choosing keywords and Boolean search terms.[47] Similarly, the accuracy of a predictive search will depend upon the size of the sample of documents used to train the search algorithm, and the parties' efforts in accurately coding documents from this sample.

The accuracy of a search will affect both the benefits and costs of a search. A low quality computer search resulting from inadequate investments in defining and refining keywords or training the search algorithm will produce a search with both low precision and recall. A low recall search will produce low benefits to the requesting party, as the search will fail to identify large numbers of relevant documents. Reductions in the amount of up-front investments will lower these costs, but the resulting low precision search will erroneously identify as relevant large numbers of irrelevant documents, and increase the requesting party's costs of review.

2. *The Costs of Discovery*

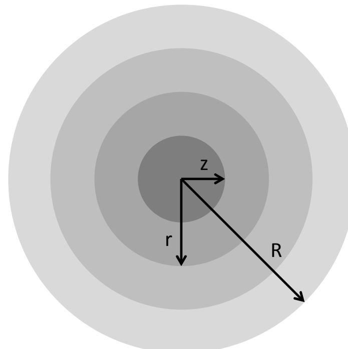
In this Subsection, we examine the costs generated by a discovery request and imperfect document search. To illustrate the nature of these costs, suppose that the universe of potentially discoverable information held by one party is located on a disk of radius R meters.[48] Figure 2 illustrates an example of the universe of potentially discoverable information and the area to be searched in response to the discovery request. Areas of the disk depicted in Figure 2 containing a dense amount of relevant information are depicted as a dark shaded area, where areas that contain less relevant information are depicted as lighter shaded areas. In the example, the disk is organized so that more relevant information is stored closer to the center of the disk.

geometric mean of recall and precision: $F1 = \frac{2}{\frac{1}{\rho}+\frac{1}{\nu}}$. *See, e.g.*, Grossman & Cormack, *supra* note 26 (examining e-discovery tools, including F1).

47. Boolean search uses keywords connected with logical operators such as 'and', 'or', 'w/5', etc. *See* Gregory L. Fordham, *Using Keyword Search Terms in E-Discovery and How They Relate to Issues of Responsiveness, Privilege, Evidence Standards and Rube Goldberg*, 15 RICH. J.L. & TECH. 1, 8, 9 (2009).

48. A disk was used in the example to capture the effect of costs of search that increase exponentially in r.

FIGURE 2: THE UNIVERSE OF DISCOVERABLE INFORMATION



The requesting party's discovery request specifies both the nature of the information to be produced, as well as the sub area to be searched by specifying the search of a disk of radius $r \leq R$. The cost of making a request, F, can vary with the nature and complexity of the request for information. The model, however, assumes that F is fixed with respect to r:

$$(5) C^{request} = F \text{ for } r > 0, 0 \text{ otherwise.}$$

In response to a discovery request, information on the disk is searched and sorted at a marginal cost \$$M$ per square meter. The magnitude of M will depend upon whether human or computer based sorting is used.[49] We assume that M includes the costs of relevancy sorting M_{RS} (the cost of sorting documents into those that are responsive to the discovery request and those that are not). It also includes the costs of privilege review M_{PR} and the costs of production M_{PD}. In addition, there are up-front costs of defining and refining the search, L, which are fixed with respect to the scope of the search. The cost of responding to a request to search r meters from the center of the disk equals:

$$(6) C^{response} = L + M\pi r^2.$$

There are also costs associated with reviewing the documents produced in response to the discovery request. We assume that the cost of reviewing the produced documents,

$$(7) C^{review} = \alpha Q \pi z^2, \text{ where } z \leq r, \text{ and } \alpha < 1.$$

The term α is the production rate from the relevancy sorting, or the fraction of the total documents searched that are produced for review, and Q is the marginal cost of review. The production rate will depend

49. Under this cost structure, the costs of searching the disk rise at an increasing rate as the scope of the search r is increased.

upon the precision of the search, which, as discussed above, will depend upon the method used to perform the search and the effort of the litigants.

If $Q = M$, the cost of review will be lower than the cost of response for two reasons. First, the requesting party will only have to examine the documents produced, which is a fraction α of the documents reviewed by the responding party. In addition, just because the requestor asked for documents does not mean that he must review them. For example, if the produced documents are indexed by location, the requestor can ask for a search of documents located within a radius r, but can choose to review only those documents that were produced from a location within a radius $z < r$.

3. *The Benefits of Discovery*

One measure of the benefits of discovery to the requestor is the effect that discovery has on the expected judgment. In the model, we assume that discovery operates to change the probability that the plaintiff will obtain a fixed judgment J = \$200,000. If we let $E_0 = p_0J$ denote the expected judgment in the absence of discovery, and let $E_1 = p_1J$ denote the equilibrium expected judgment post-discovery, then, holding the discovery efforts of the defendant constant, the value of discovery to the plaintiff equals $V = E_1 - E_0$.[50] Thus, in order to examine how discovery affects the value of the lawsuit, we must consider how discovery affects the probability the plaintiff obtains a judgment.

In the examples used below, it is assumed that only one side (the defendant) has any discoverable information, and that the plaintiff alters p_1 by asking for a search of information contained within a radius r and by reviewing information contained within a radius z_P of the disk illustrated in Figure 2. We assume that increasing the scope of the information reviewed increases p_1, or $p_1'(z_p) > 0$. How increased discovery affects the

50. Note that the private value of the lawsuit may not equal the social value of the lawsuit. *See generally* Louis Kaplow, *Private Versus Social Costs in Bringing Suit*, 15 J. LEG. STUD. 371 (1986); Steven Shavell, *The Fundamental Divergence Between the Private and Social Motive to Use the Legal System*, 26 J. LEGAL. STUD. 575 (1997) (discussing the other costs that must be factored into litigation decisions, including legal costs incurred by others or deterrence and other social benefits); Steven Shavell, *The Social versus the Private Incentive to Bring Suit in a Costly Legal System*, 11 J. LEGAL STUD. 333 (1982) (comparing private and social costs of lawsuits with the private and social benefits). At one extreme is the case where litigation involves a pure transfer of resources from one litigant to another. In this case, the expenditures by the parties aimed at securing a larger share of these resources, while of private benefit, are not socially beneficial. *See generally* Jack Hirshleifer, *The Private and Social Value of Information and the Reward to Inventive Activity*, 61 AM. ECON. REV. 561 (1971) (distinguishing socially valuable investments in information (discovery) from investments in information that are privately but not socially valuable (foreknowledge)). More generally, information that allows a more accurate resolution of a lawsuit can be socially beneficial through its effect on improving incentives, or by lowering the costs of litigation by making settlement more likely. *See* Bruce L. Hay, *Civil Discovery: Its Effects and Optimal Scope*, 23 J. LEGAL STUD. 481, 500–14 (1994) (examining the effect of the scope of discovery on the defendant's level of precaution); Chris William Sanchirico, *Character Evidence and the Object of Trial*, 101 COLUM. L. REV. 1227 (2001). (analyzing the effect of evidence rules and trials on the provision of incentives for and the regulation of activity outside the courtroom).

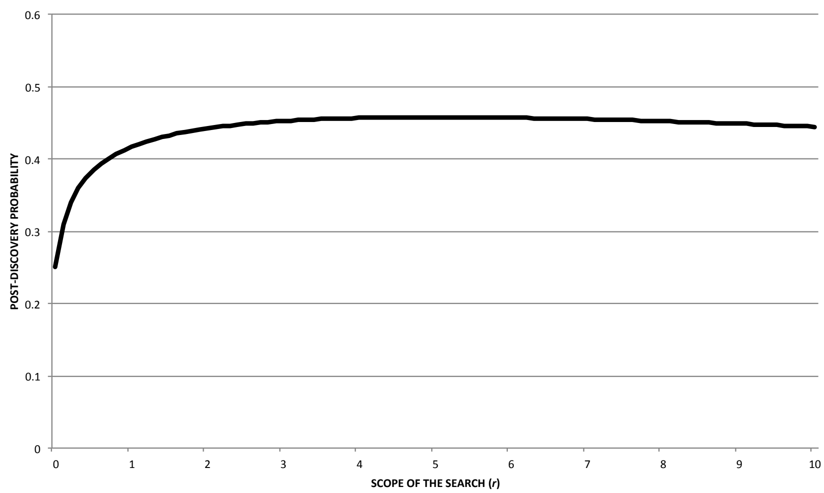
plaintiff's probability of obtaining a judgment will depend upon the information subject to discovery, and the extent to which relevant information is actually discovered. Thus, the probability function will be affected by the technology used to conduct the document search and by the parties' efforts in conducting the search.

In order to precisely illustrate the benefits of discovery, the model assumes that the post-discovery probability that the plaintiff will obtain a judgment is determined by the following function:

$$(8)\ p_1 = \frac{e^{-hz_P} k_P * \ln(\frac{z_P}{\delta_D}+1) + \omega_P}{e^{-hz_P} k_P * \ln(\frac{z_P}{\delta_D}+1) + \omega_P + \omega_D}$$

Figure 3 illustrates a specific example of the effect of this function where $\delta_D = 0.1$, $h = .05$, and $k_P = 1$.[51]

FIGURE 3: PROPERTIES OF THE PROBABILITY FUNCTION



The assumption of a low δ_D assumes that the disk to be searched is organized. Thus, searching farther out from the center will reach areas where fewer relevant documents per Δr are found. This yields the sharply diminishing returns illustrated in Figure 3. The assumption that $h > 0$ implies that the search illustrated in Figure 3 is subject to fatigue and becomes less efficient in finding relevant documents as one expands the search. As is illustrated in the Figure, this effect can result in p_1 falling as the plaintiff's search expands.

51. The example also assumes that pre-discovery, the prior probability of a judgment for the plaintiff $p_0 = .25$ so the expected value of the lawsuit in the absence of discovery $E_0 = \$50,000$. This is achieved by assuming that $\omega_P = 6$ and $\omega_D = 2$.

The parameter $k_P = 1$ is a scaling variable that determines the efficacy of the search in finding relevant documents.[52] In general, the value of k_P will be a function the level of investment made in defining the information to be produced (F) and in refining the quality of the search used to find such information (L). These will both increase the recall of the search conducted in response to the request for information, resulting in the retrieval of more relevant documents. Thus k_P will be an increasing function of these investments. In addition, k_P will be higher, *ceteris paribus*, for superior search technologies that yield more accurate results.

III. An Example of Discovery with Manual Search, No Cross-Party Agency Costs

In this Section, we present an example of one-sided discovery under manual search in the absence of cross-party agency costs. Under manual search, the responding party manually inspects documents for relevance and privilege. Relevant and nonprivileged documents are produced and reviewed by the requesting party. Section A examines the costs and benefits of manual search under these conditions. Section B demonstrates the incentive for cost externalization and overdiscovery under the traditional responder pays cost-allocation rule. Section C examines the *in terrorem* effect of discovery costs on pre-discovery settlement under the traditional responder pays cost-allocation rules.

A. Discovery with Manual Search

In this Section, we examine discovery under manual search. The example in this Section assumes the absence of cross-party agency costs, *i.e.*, that the parameters of the probability function reflect a good faith effort by both the requesting party and the responding party in defining and carrying out the manual search.[53] In order to illustrate the economics of this process, we adopt specific parameter values for the probability function in equation (8) to illustrate how discovery alters the probability the plaintiff will prevail under manual search in the absence of cross-party agency costs. We will then alter the parameters in later Sections to illustrate the effects of cross-party agency costs, different technologies, and cost-allocation rules.

The example assumes there are low fixed and high marginal costs of response under manual search. Specifically, the example assumes the cost of search in response to a discovery request $M = \$1000/m^2$ and that up-front costs of manual search are low. The example assumes for convenience that $L = 0$. The example assumes that all discoverable infor-

52. Thus, the parameter k_P will be a positively related to the recall of the search. That is, a higher recall search of given scope z will return more relevant documents, and should have a higher k_P and a greater effect on p_I.

53. In this Section, we assume that $k_p = 1$ reflects a quality of manual search that is not diminished by cross-party agency costs. This assumption is relaxed below.

mation is contained on disk with R = 10m, and that the cost of a discovery request F is fixed for all levels of r and z, and equals $1000.

We assume that the privilege and relevancy sorting result in fraction α of the searched documents being produced in response to the discovery request of scope r. More generally, the fraction of documents produced per square meter may vary with r.[54] The example assumes that the marginal cost of review under manual search $Q = M = \$1{,}000/\text{m}^2$.[55] Under these conditions, $Q\alpha(r) = M\alpha(r) < M,$ where $0 < \alpha(r) < 1$, and $\alpha'(r) > 0$.[56] And as noted above, the requesting party may choose to examine a subset of the produced documents $z < r$. Thus, the resulting cost of review equals $Q\pi\alpha(r)z^2$.

In the absence of discovery, the probability the plaintiff will obtain a judgment J = $200,000 is $p_0 = .25$, so that the expected value of the lawsuit E_0 = $50,000. The requesting party's benefit from discovery of scope z is generated by the probability function depicted in Figure 3. Figure 4A depicts the post-discovery expected value of the lawsuit, $E = p_1J$, as well as the cost of discovery as a function of the plaintiff's choice of z. The Figure plots the total costs of discovery as well as the component costs of review and response. Figure 4B depicts the marginal costs and benefits as a function of the plaintiff's choice of z. The Figure plots the total marginal costs (including the costs of response and review) and the costs of review only as a function of z.

The allocation of the costs of discovery affects the nature and scope of discovery. If the requesting party had to bear all of the costs of his request, he would expand the scope of the search z until the marginal benefits equal the total marginal costs. This occurs at $z^* = 1.1$. At this point, the post-discovery probability that the plaintiff recovers increases to .42, and the post-discovery expected value of the lawsuit E^* = $84,080. As noted above, in the absence of discovery, the probability of plaintiff recovery equals $p_0 = .25$, and the expected value of the lawsuit is E_0 = $50,000. Thus, compared to the expected recovery in the absence of discovery, the post-discovery expected value E^* represents a $34,080 marginal gain in expected value. The total costs of discovery at $z^* = 1.1$ are only C^* = $5184, so the plaintiff's increase in the value of the lawsuit exceeds the cost of discovery by $28,896.

54. For example, if the precision of the search falls as more documents must be searched, then α can increase with r because more irrelevant documents are returned per square meter. If the recall of a larger search also falls, the production rate α will increase when the additional irrelevant documents outweigh the decrease in relevant documents returned.

55. This assumes that there are no differences in the cost of reviewing a particular document when responding to a request (which includes sorting on privilege and on relevance) and when reviewing produced documents.

56. Specifically, the example assumes that $\alpha(r) = .1 + .001r$. That is, the maximum cull rate, which equals 1 minus the production rate α, is ninety percent at $r = 0$, falling slightly to eighty-nine percent for $r = 10$. Thus, with $Q = M = \$1000/\text{m}^2$, the costs of review for a search of scope r are assumed in the example to be between ten percent and eleven percent of the costs of response.

FIGURE 4A: THE COSTS AND BENEFITS OF DISCOVERY

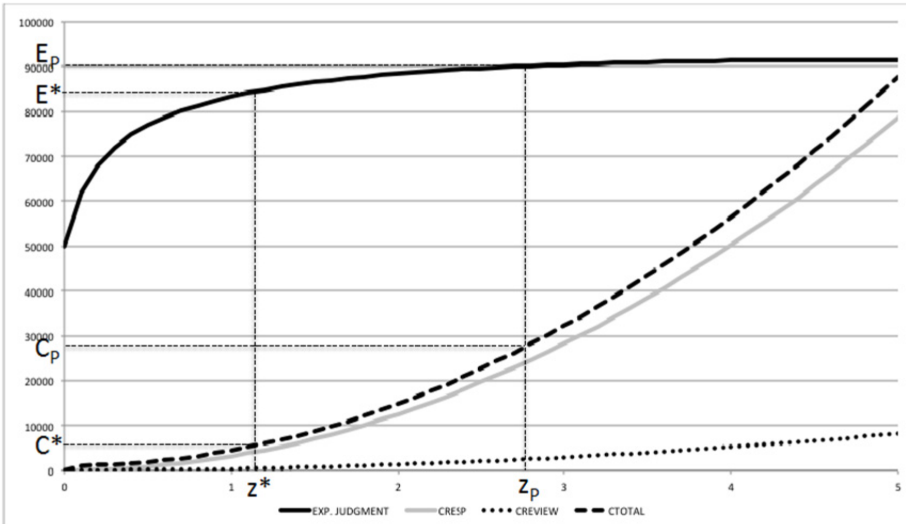
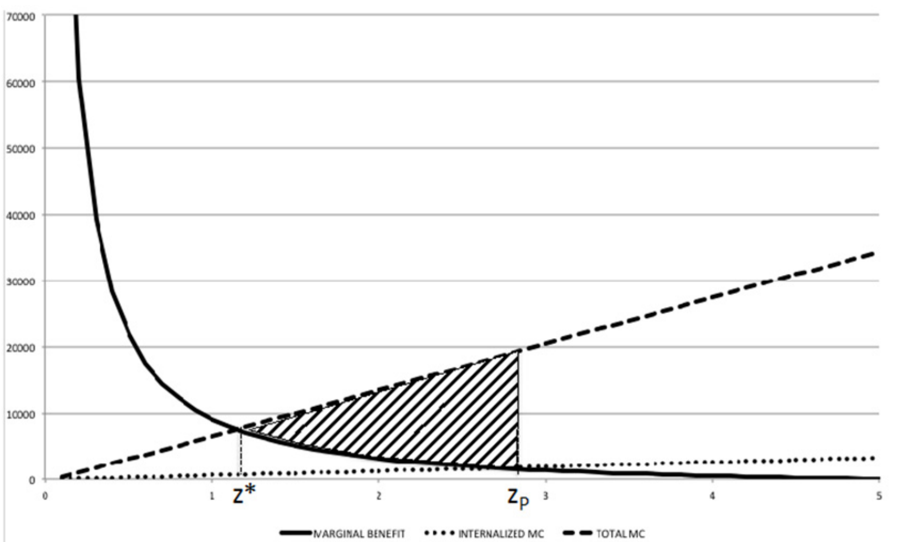


FIGURE 4B: THE MARGINAL COSTS AND BENEFITS OF DISCOVERY



B. The Effect of Cost Externalization on the Extent and Cost of Discovery

We are now in a position to demonstrate the effects of cost externalization on the scope of discovery. Figures 4A and 4B also depict how the plaintiff will choose the extent of discovery under the traditional discovery cost-allocation rule. Under this cost-allocation rule, the costs of request and review are borne by the plaintiff, and the costs of response are borne by the defendant. The incentives of the plaintiff are to only consider the costs of request and review in determining the size of his search, and to ignore the cost of response. Figure 4B plots separately the requesting party's internalized marginal costs of expanding the scope of the search, which will include only marginal costs of review for $z > 0$. Under the conditions of the example, this results in a search $z_P > z^*$, where the marginal benefits of discovery equal the marginal costs of review. Specifically, $z_P = 2.7$, and the equilibrium post-discovery probability of recovery by the plaintiff rises to .45, and the expected recovery increases to $E_P =$ \$90,023. The total cost of discovery rises to \$26,241, with the plaintiff bearing \$2351 of these costs.

The plaintiff's choice of z_P illustrates the incentives for excessive discovery.[57] Here, the incremental costs of discovery beyond z^* exceed the plaintiff's private incremental benefits. Specifically, by expanding the search beyond z^* to z_P, the plaintiff's expected recovery increases by \$5943, while costs increase by \$21,057. This expansion results in incremental costs that exceed the incremental private benefits by the shaded area in Figure 4B. It is rational, however, for the plaintiff to expand his search beyond z^* to z_P because the plaintiff's internalized costs only increase by \$1967.

C. *Cost Externalization and the* In Terrorem *Effect of Discovery Under the Standard Cost Allocation Rule with Asymmetric Discovery Costs*

In this Section, we examine how the litigant's choice of r and z affect the expected pre-discovery settlement. Figure 5 adds the parties' threat points to Figure 4A, as well as the value of S_0 when $\alpha_0 = .5$. Under the assumption that the plaintiff will set $r = z_P = 2.7$, the expected judgment equals $E_P =$ \$90,023. The plaintiff's and defendant's threat points are $TI_P =$ \$87,672 and $TI_D =$ \$112,914. With $\alpha_0 = .5$, $S_0(z_P) =$ \$100,293. The *in terrorem* effect of discovery costs on settlement $I_P =$ \$10,270, is the difference between $S_0(z_P)$and E_P.

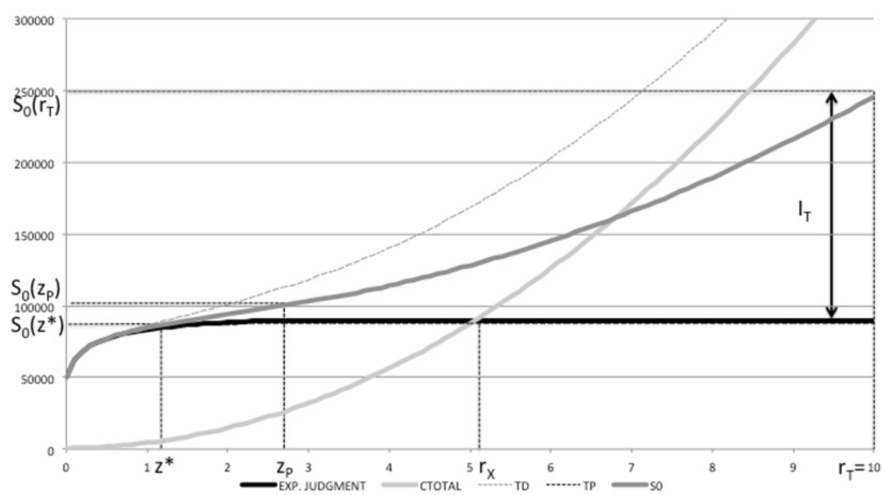
Note that the defendant's choice of $r = z_P = 2.7$ would not maximize the size of the pre-discovery settlement. The settlement maximizing choice is to request that the defendant search the entire disk, i.e., $r = r_T = 10$. If the requesting party reviews all of the produced documents, *i.e.*, $z = r_T$, the expected post-discovery recovery falls to \$88,881 because of the reduced efficiency of the search, and TI_P falls to \$54,340 due to the rising costs of review. The expected settlement, however, rises to $S_0(r_T) =$ \$228,611, as the increasing costs of review and decreasing expected judgment are more than offset by the increasing costs of response, which increase TI_D to \$402,881. The *in terrorem* effect would equal $I_T =$ \$139,730. The plaintiff's choice,however, of $r_T = z_T = 10$ at the time of the

57. BONE, *supra* note 3, at 217.

discovery conference may not be a credible threat. If discovery occurs, both the plaintiff and defendant would be better off if the search were limited to $r_P = z_P = 2.7$.[58]

Such a request could be transformed into a credible threat if the requesting party can request a search of size r, but only review a subset $z < r$ of the materials produced.[59] This outcome is illustrated in Figure 5. In the example, the plaintiff can credibly maximize S_0 when he asks for the entire disk to be searched, *i.e.*, at $r = r_P = 10$, but only reviews information contained within $z = z_P$. With $r_P = 10$ and $z_P = 2.7$, the expected judgment will still equal $90,023 and the plaintiff's threat point T_P will still equal $87,672. The defendant's threat, however, point T_D will rise to $402,881, and S_0 will rise to $245,277. The *in terrorem* effect equals $I_T = \$155{,}254$.

FIGURE 5: THE *IN TERROREM* EFFECT OF ONE-SIDED DISCOVERY ON SETTLEMENT



The example clearly illustrates the abusive nature of the request $r_T = 10$. The incentive to ask for a search of the entire disk is generated largely by the costs imposed on the defendant and their effect on the size of the settlement S_0, and not by the effect of discovery on the expected judgment. Indeed, the request generates costs that are greater than the value of the judgment. If left unregulated, the requesting party is incentivized to raise the costs of the responding party solely for the effect it has on the equilibrium pre-discovery settlement.

58. Thus, this outcome would not be in the set of equilibrium outcomes if the analysis considers *perfect* equilibria, that is, those equilibria where the parties are constrained to choices that are optimal when reached, even when such choices are not reached in equilibrium. *See, e.g.*, JEAN TIROLE, THE THEORY OF INDUSTRIAL ORGANIZATION 428–29 (1988).

59. *See* Rosenberg & Shavell, *supra* note 44 (analyzing the effect of asymmetric litigation costs on the credibility of nuisance claims).

Under the current system, parties must rely on judicial regulation to address overbroad (z_P) or abusive (r_T) discovery requests. The latter are regulated through Rule 26(g) and sanctions under Rule 37.[60] The former would be regulated under the proportionality test contained in the Rule 26(b)(2)(c) limits on discovery.[61] While such judicial regulation of discovery can be used to limit excessive costs in theory, the courts' ability to effectively limit overdiscovery and abusive discovery may not be effective in practice.[62] Moreover, even if it could be effective, the move toward increasing judicial management of discovery increases the burden on courts, and moves the system away from its goal of self-regulation.[63]

IV. COST INTERNALIZATION AS A SOLUTION TO THE OVERDISCOVERY PROBLEM

The economists' solution to the problem of too much discovery is to replace, or at least reduce, the need for judicial management with better litigant incentives.[64] One way to improve incentives is to alter the traditional cost-allocation rule so that the requesting party bears the full cost of his request. In this Part, we examine how a cost-allocation rule that requires the requesting party to fully internalize the costs of his request alters the incentives for discovery. In Section A, we show how this rule yields the correct marginal incentives for a given cost structure. Section B examines ways in which this rule affects the incentives of the responder when the potential for settlement is considered.

60. Under FED. R. CIV. P. 26(g), the party or his attorney certifies that every discovery request is "not interposed for any improper purpose, such as to harass, cause unnecessary delay, or needlessly increase the cost of litigation" and is "neither unreasonable nor unduly burdensome or expensive, considering the needs of the case, prior discovery in the case, the amount in controversy, and the importance of the issues at stake in the action." FED. R. CIV. P. 26(g)(1)(B)(ii), (iii).

61. Under FED. R. CIV. P. 26(b)(2)(C),

> the court must limit the frequency or extent of discovery . . . if it determines that . . . the burden or expense of the proposed discovery outweighs its likely benefit, considering the needs of the case, the amount in controversy, the parties' resources, the importance of the issues at stake in the action, and the importance of the discovery in resolving the issues.

FED. R. CIV. P. 26(b)(2)(C)(iii).

62. *See* Easterbrook, *supra* note 15, at 638 (noting high information costs are likely to make any such judicial regulation "hollow"); Redish and McNamara, *supra* note 10, at 780–81 (discussing problems with judicial implementation of proportionality rule); Scott A. Moss, *Litigation Discovery Cannot be Optimal But Could Be Better: The Economics of Improving Discovery Timing in a Digital Age*, 58 Duke L.J. 889, 909 (2009) (same); Ronald J. Hedges, *A View from the Bench and the Trenches: A Critical Appraisal of Some Proposed Amendments to the Federal Rules of Civil Procedure*, 227 F.R.D. 123 (2005) (noting that the proportionality rule was not being used by judges); Shira A. Scheindlin & Jeffrey Rabkin, *Electronic Discovery in Federal Civil Litigation: Is Rule 34 Up to the Task?*, 41 B.C.L. REV. 327 (2000) (same); Richard L. Marcus, *Discovery Containment Redux*, 39 B.C.L. REV. 747 (1998); Richard L. Marcus, *Retooling American Discovery for the Twenty First Century: Toward a New World Order?*, 7 TUL. J. INT'L & COMP. L. 153 (1999) (noting nonuse of proportionality provisions).

63. *See* FED. R. CIV. P. 26 (Proposed Amendment 2013) (increasing the prominence of the proportionality rule by placing it in Rule 26(b)(1) as a one of the guiding principles used to define the scope of and limits on discovery).

64. *See supra* note 15 and accompanying text.

A. The Cost Allocation Rule as a Solution to the Cost Externalization Problem

Once cost externalization is identified as the source of overdiscovery and abusive discovery, the solution is easily identifiable: allocate the costs of discovery to the requesting party.[65] If the requesting party is forced to internalize all of the costs of his request, then he will maximize the post-discovery expected judgment $E_1 = p_1 J$ net of discovery costs by choosing $r = r^*$. In terms of Figure 4, the requesting party now compares the marginal benefits to the total marginal cost curve, which are equalized at r^*.

The requestor-pays cost allocation rule thus eliminates the incentives for over-discovery illustrated in Figure 4. This solution, however, will also alter pre-discovery settlement incentives that exist in the shadow of discovery. These incentives and the effect of the internalization rule are examined in Section B.

B. The Effect of Cost Distribution and the Reverse In Terrorem *Effect on Settlement*

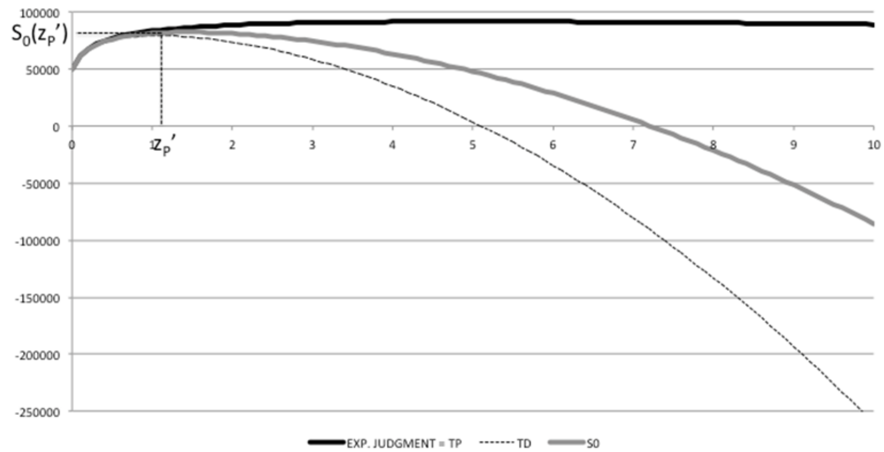
While the idea of changing the cost allocation rules to requestor pays has gained some acceptance, there have been numerous objections to an unconditional requestor pays rule. Specifically, some have raised concerns that the additional burdens of discovery costs placed on wealth-constrained litigants will deter the filing of meritorious lawsuits, as well as moral hazard issues involving cost inflation by the responding party.[66] In this Section, we examine the effect of a requestor pays rule on the distribution of costs, its effect on settlements, and the plaintiff's incentives to file lawsuits.

Figure 6 illustrates the effect of the requestor pays cost-allocation rule on the threat points of the plaintiff and defendant, and on S_0 assuming the parties split equally any bargaining surplus. The threat point of the defendant will now be the post-discovery expected judgment, $E_1 = p_1 J$, which equals \$84,080 with $z_P = 1.1$. The threat point of the plaintiff will be the expected judgment minus the costs of response and review, or $T_P = \$78,896$. The pre-discovery settlement falls to $S_0 = 81,487$.

65. Allocating to the requesting party the costs of discovery borne by the responding party is in effect a "Pigovian" tax on expanding the scope of a discovery request. *See generally* A. C. PIGOU, THE ECONOMICS OF WELFARE (1920) (introducing the idea of a Pigovian tax, meant to correct an inefficient market outcome).

66. Redish & McNamara, *supra* note 10, at 805.

FIGURE 6: THE REVERSE *IN TERROREM* EFFECT



The example and Figure 6 illustrate how the responder pays cost allocation rule creates the potential for a reverse *in terrorem* effect, in the sense that the rule has the potential to significantly diminish the settlement below the expected judgment. The effects, however, on the extent of discovery are much different, because the extent to which the reverse *in terrorem* effect is imposed is largely controlled by the requesting party. Specifically, the requesting party will internalize the negative effects that expanding the discovery request has on the expected settlement S_0. This tempers the incentive to engage in overdiscovery. In addition, the requesting party has no incentive to request a search r that is greater than the set of information he is planning to review z_P'.[67] The result is a small negative or "reverse" *in terrorem* effect, where I = -$2593.

As noted by others, one way this issue can be minimized is by having a conditional cost allocation rule that switches from responder to requestor pays at some point $r_s < r^*$. For example, normal discovery with the traditional responder pays cost allocation rule can be coupled with a system of extraordinary discovery in which the requestor pays rule is applied. Such a system also could be implemented within a graduated discovery program implemented as part of a Federal Rules of Civil Procedure section 26(f)(3) plan, where initial phases are conducted with a responder pays rule, but at some point the cost allocation rule is reversed to requester pays.[68] In order to obtain the correct marginal incentives when discovery occurs, the point at which this switch occurs can be judi-

67. As noted above, if the plaintiff can commit to a level of discovery, and rationally anticipates that he will not have to incur the costs of discovery because of settlement, the amount of discovery chosen at the discovery conference will be greater than r^*. Specifically, continuing the numerical example used above, the amount of discovery included in the discovery plan will equal $r_P' = 1.5$. The settlement will equal S_0 = $82,104.

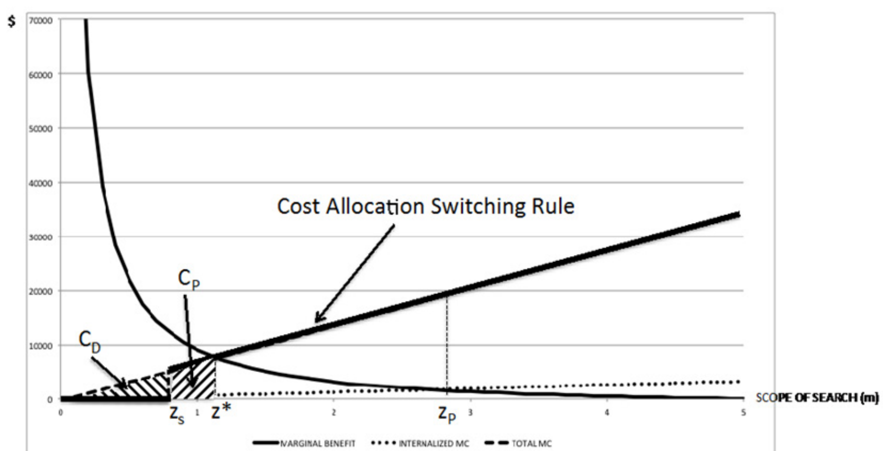
68. FED. R. CIV. P. 26(f)(3).

cially managed through a proportionality rule,[69] or it can be arbitrary.[70] The only thing that must occur to achieve the correct marginal incentives is the that switch takes place for some value of $r_s < r^*$.

Such a conditional cost-allocation rule is illustrated in Figure 7A. Under such a system, having initial rounds of discovery under the traditional responder pays cost allocation rules mitigates the distributional effects of the unconditional requestor pays system, yet yields the correct marginal incentives for the requestor.

A more difficult issue to address is the effect of the distribution of costs on the expected pre-discovery settlement S_0. Cooter & Rubinfeld have a "best" discovery rule where r_s is set so that $C_P = C_D$ in Figure 7A.[71] Such a rule would impose symmetric costs on the litigants so that the *in terrorem* effect $I = 0$ at r^*. The effect of such a rule is illustrated in Figure 7B. Applied on a case-by-case basis, however, such a rule would require that the judge or magistrate have the same information that would allow him to set $r = r^*$. As a result, the "best" rule would share some of the informational constraints that limit judicial management of discovery using the proportionality rule.[72]

FIGURE 7A: A CONDITIONAL RESPONDER PAYS COST ALLOCATION RULE



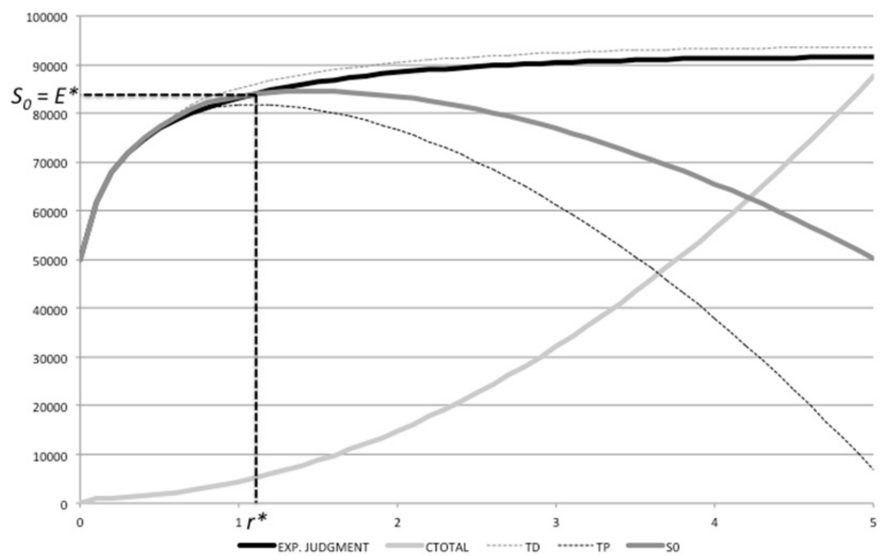
69. FED. R. CIV. P. 26(b)(2)(C)(iii).

70. *See* Federal Circuit Advisory Board E-Discovery Model Order, *supra* note 17, at 7 (arbitrary fixed limits on the number of custodians and five search terms per custodian, coupled with requestor "bearing all reasonable costs caused" by discovery beyond these arbitrary limits). *But see* Moss, *supra* note 62, at 897 (discussing altering the timing of discovery to promote separation of cases based on their underlying merit).

71. Cooter & Rubinfeld, *supra* note 15, at 455–57. Note that this rule is not a rule in which the parties are responsible for fifty percent of the total ex-post costs of discovery. Under this rule, the requesting firm will not have the correct marginal incentives, as each party will receive a fifty percent subsidy on their discovery expenses.

72. Edward H. Cooper, *Discovery Cost Allocation: Comment on Cooter and Rubinfeld*, 23 J. LEGAL STUD. 465, 468–70 (1994) (discussing informational and other limits on the administrability of Cooter & Rubinfeld's "best" discovery rule). *See also supra* note 62.

FIGURE 7B: CONDITIONAL COST ALLOCATION RULE AND SETTLEMENT



V. CROSS-PARTY AGENCY COSTS

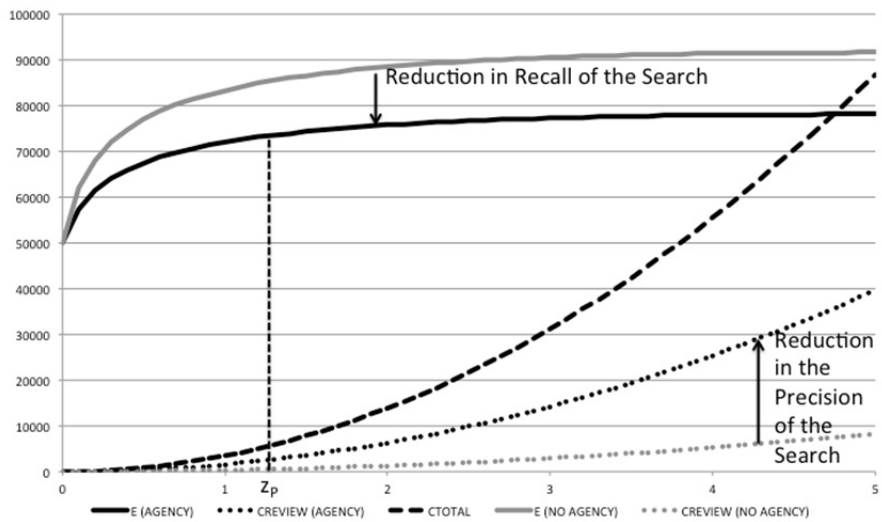
In this Part, we examine the nature and effect of cross-party agency costs resulting from the responder's misaligned incentives to carry out the document search. The responding party has an incentive to alter the document search so that the precision and recall of the search are both reduced. A decrease in the accuracy of the document search benefits the responding party in three ways. First, a decrease in the recall of a search will reduce the number of relevant documents found and lower the value of the information produced to the requesting party.[73] Second, a decrease in the precision of the search will increase the number of irrelevant documents produced, raising the requesting party's cost of review. Decreasing the precision of the search increases the cull rate α and increases the total number of documents produced without increasing the number of relevant documents. This will also inflate αQ, resulting in an increase of the requesting party's costs.[74] Finally, a lower precision search will cost the responding party less per document, but will increase the costs of production.[75]

73. The result of this strategy would be to decrease *k*. This in turn would decrease the benefits of the search to the plaintiff by altering the probability function (8).

74. *See, e.g.*, Baron, *supra* note 18, at 14–15 (discussing alleged cost inflation by the responding party in *Truz v. UBS Realty Investors LLC* through the production of a large number of documents resulting from a low precision search). *See also* BONE, *supra* note 3, at 217–24, Cooter & Rubinfeld, *supra* note 15, at 454.

75. Decreasing the quality of the relevancy search has opposing effects on the incremental costs of response *M*. On one hand, *M* will fall if the decrease in the quality of the search is achieved by instructing those conducting the search to spend less time per document. The decreased precision of the

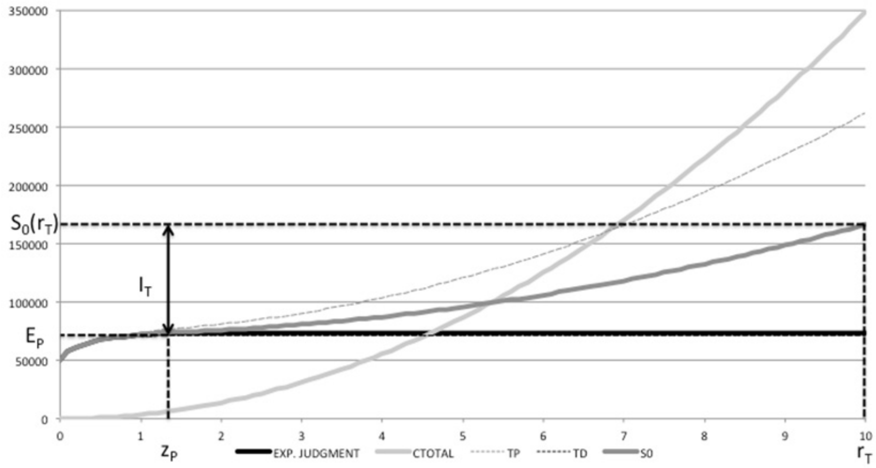
FIGURE 8: THE EFFECT OF CROSS-PARTY AGENCY COSTS



Clearly, cross-party agency costs affect both the marginal and distributional incentives of the requesting party. Figure 8 shows the effect of cross party agency costs on the costs and benefits of discovery. The example assumes that the responding party's low quality search efforts alter the incremental costs of responding, so that M = \$600. The example assumes that the decreased precision of the search increases the base production rate α to .5, and increases the cost of review. The example also assumes that the decreased precision decreases the effectiveness of the search so that k =.6. As is illustrated in the Figure, the resulting review cost inflation and decrease in relevant information reduces the plaintiff's review of documents if discovery occurs to $z_p = 1.3$. At z_P, the total cost of discovery is \$5844 and the expected judgment under these circumstances falls to \$73,468.

search, however, will result in higher incremental costs as the responding party must produce a larger volume of documents. The example assumes that the former change outweighs the latter.

FIGURE 9: CROSS PARTY AGENCY COSTS AND SETTLEMENT



Cross party agency costs also reduce the pre-discovery expected settlement. Figure 9 illustrates the expected settlement in the presence of cross-party agency costs. In the example, the unconstrained plaintiff would still expand the scope of the search to $r_T = 10$. The pre-discovery settlement amount S_0, however, falls to $166,338. The decrease in the settlement has three sources. The first comes from the reduction in the expected judgment that results from a less expansive and less effective information search z if discovery occurs. The second source is the reduction in the costs of discovery borne by the responding party that would result from his shirking during relevancy sorting. Finally, the last source is the increase in review costs that result from the lower precision search. In this example, the increase in review costs are offset by the decrease in response costs, so that total costs are not affected. The costs, however, are redistributed to favor the responding party, resulting in a reduction in the size of the *in terrorem* effect I_T to $92,870.

The example shows how cross-party agency costs can induce distortions in the amount and cost of discovery, the plaintiff's expected recovery, and the nature of the settlement that occurs in the shadow of these distortions. Judicial management is used to mitigate these distortions. One such approach has judges selectively shifting the costs of discovery between the responder and requestor using Rule 26(b)(2)(b).[76] For example, under the seven factor test in *Zubulake*, the court could consider both "[t]he extent to which the request for information is specifically tailored to discovery relevant information," and "[t]he relative ability of each party to control costs and its incentive to do so."[77] Thus, purposeful cost inflation would lower the probability that a requestor pays cost-allocation rule would be used, while an overbroad discovery request

76. *See, e.g.*, Zubulake v. UBS Warburg, LLC, 217 F.R.D. 309, 315–16, 321–23 (S.D.N.Y. 2003).
77. *Id.* at 322.

would result in an increase in the probability a requestor pays rule will be applied.

Note, however, that use of a requestor pays cost-allocation rule itself does not align the incentives of the responding party or effectively diminish the incentive to generate cross-party agency costs. In the absence of judicial regulation, the responding party has the same incentives to reduce the recall of the search. This will result in lower benefits to the requesting party and lower costs for the responding party.[78] The responding party also has incentives to decrease the precision of the search in order to increase the number of irrelevant documents produced and the requesting party's cost of review. The effect on the direct costs generated by decreasing the precision of a search, which are passed on the requesting party, is ambiguous.[79] The total effect, however, on raising the costs of the responding party from decreases in the precision of a search is positive on net. The result is an inefficient, low value information search, which yields low recoveries for the plaintiff.

VI. LAW'S INFORMATION REVOLUTION AS A SOLUTION TO THE OVERDISCOVERY PROBLEM

A large part of the discovery cost problem associated with traditional methods of discovery are the high marginal costs associated with the manual search of the documents. One solution to the problems generated by the high marginal costs of manual search is to replace some of the manual review with low marginal cost automated review. Indeed, while ESI has brought high volumes of documents and potentially high costs to the discovery process, the ability to perform full-text searches of these documents brings the potential solution of replacing high marginal cost and imperfect human sorting with much lower marginal cost and perhaps more accurate computer sorting. In this Part, we examine how the use of technology alters the litigation strategies and outcomes of the litigants. Section A of this Part examines generally how the use of computer search to perform the initial sorting of documents for relevance and privilege can alter the costs and benefits of discovery. Section B examines the use of keyword search as a substitute for the manual sorting of documents and shows how use of a computer search, coupled with the traditional task-allocation and cost-allocation rules can result in inferior litigation outcomes. Section C examines how the use of predictive search and a cost-internalizing task-allocation rule can improve litigation outcomes.

78. Costs are lower as the low quality search will cost less. Moreover, a lower recall results in the production of fewer documents.

79. A low precision manual search will cost less per document, but also results in higher production costs, which are passed on to the requesting party under a requestor pays cost allocation rule.

A. Computer Search and the Costs of Discovery

In this Section, we examine how technology affects the costs and benefits of search and discovery. In contrast to the manual human search analyzed above, which is characterized by high incremental costs M^h associated with the time and cost of manual review of documents by human beings, computer search technology uses low incremental cost keyword or predictive search to conduct the initial sorting of the data. Thus, $M^c < M^h$. The low incremental costs of applying the keyword search or predictive search algorithm, coupled with the potential reduction in the number of documents that must be manually sorted, can be a major source of discovery cost savings.

The extent to which use of a given technology will lower costs and alter litigation outcomes is a function of the accuracy of the search that is conducted. Moreover, the accuracy of these searches is a function of the parties' level of up-front investments in the quality of the information request and search, including the process of defining and refining computer search terms and improving and training the computerized search algorithm.[80] While these costs are fixed with respect to the scope of the search z, the parties' choice of the level of L will affect the scope of the request through its effect on both the recall and precision of the search. Specifically, the model assumes that increases in L, the up-front fixed costs associated with computerized sorting, increase both the precision and recall of a search. Thus, increased investment will decrease the number of irrelevant documents retrieved from a given set of documents. The total number of produced documents and the cost of review will fall if the reduction in the number of irrelevant documents produced that results from the increased precision of the search is greater than the increase in relevant documents produced that results from the increase in the recall of the search.

In the case of privilege review, the traditional rule allocates the decision to the party that is the best-informed actor and that will internalize the consequences of his actions. The accuracy of this review will be a function of the responding party's up-front investment L_{PR}. For a request of scope r, the total costs of the privilege review will equal:

(9) $C^{PR} = L_{PR} + M_{PR}\Upsilon(L_{PR})\pi r^2$, where $\Upsilon''_{PR}(L_{PR}) < 0$.[81]

In setting the level of up-front investment, the responding firm will choose the up-front investment in its privilege review search terms L_{PR} so

80. *See generally* PACE & ZAKARAS, *supra* note 26 (exploring the costs associated with the various phases of e-discovery production); Grossman & Cormack, *supra* note 26 (exploring whether exhaustive manual review is the most effective approach to document review); Katz, *supra* note 28 (discussing the effect of technology on the provision of legal services); *Sedona Conference Best Practices Commentary on the Use of Search and Information Retrieval Methods in E-Discovery*, *supra* note 19.

81. M_{PR} is the marginal cost of reviewing the identified documents, and $\Upsilon(L_{PR})$ is the rate at which the computerized privilege review identifies privileged documents.

that the marginal benefits of the review equal the marginal costs, or when:

$$(10)\ \Upsilon\text{'}_{PR}(L_{PR}) = [B\text{'}(L_{PR})\text{-}1]/(M_{PR}\pi r^2),$$

where $B\text{'}(L_{PR})$ is the marginal benefit of privilege review as L_{PR} is increased.[82] Thus, allocation of these costs to the responding party under the traditional cost allocation rules will yield aligned incentives to invest in an accurate privilege review.[83]

In contrast, cross-party agency costs are generated when the responding party must undertake and bear the costs of the up-front investment in relevancy sorting, L_{RS}. To see this, suppose that the responding party performs the keyword search under traditional cost-allocation rules. That is, the responding party conducts and pays for the costs of the computer based keyword search and privilege review, while the requesting party pays for the cost of a request F and also the costs of reviewing the documents produced by the computer keyword search. Under the traditional cost-allocation rule, the plaintiff's costs of review under keyword search are:

$$(11)\ C^{review} = Q\alpha(L_{RS})\pi z^2, \text{ where } \alpha\text{'}(L_{RS}) < 0.$$

Under these assumptions, the defendant's costs of response under the traditional cost-allocation rule with computerized search is given by:

$$(12)\ C^{response} = L_{RS} + M_{RS}\,\pi r^2 + C^{PR}$$

Because reductions in the marginal cost of review αQ inure to the benefit of the requesting party, the responding party has no incentive to invest in reducing these costs. Such a strategy would not only decrease the direct expenditures on L_{RS}, but it would also increase the requesting party's costs of review through its effect on $\alpha(L_{RS})$. Thus, in the absence of any constraints from judicial oversight, the responding firm would want to minimize L_{RS} in order to minimize his response costs.[84]

82. Recently, the Federal Rules of Evidence were amended so that inadvertently disclosed privileged information could be clawed back. *See* FED. R. EVID. 502(b). This lowers the cost of a type II error in the privilege search, and allows the responding firm to lower its up-front investments in producing a high recall privilege search. For a discussion of the effect of the amendment, see Paul W. Grimm et al., *Federal Rule of Evidence 502: Has it Lived Up to its Potential?*, 17 RICH. J.L. & TECH. 1, 8 (2011).

83. For privilege review, assigning the responding party the task of determining L_{PR} allocates this task and the attendant costs to the cheapest or least cost avoider. *See* Redish & McNamara, *supra* note 10, at 796–99 (citing GUIDO CALABRESI, THE COSTS OF ACCIDENTS, at 26–31 (1970)). In general, the least cost avoider is the party with the "maximum degree of internalization of the costs among the participants . . . ." *Id.* at 798; CALABRESI, *supra*, at 144.

84. Equation (12) assumes that the marginal cost of the relevancy search borne by the responding party is not affected by up-front investment in the search. The responding firm's marginal incentives to invest in privilege review is given by equation (10), discussed above.

These misaligned incentives on the cost side are reinforced by the effect of L_{RS} on the information value of the search, specifically, the ability of the search to identify relevant documents. The effect of changes in the recall of the search can be incorporated in the model by having the parameter k_P from equation (8) be a function of the up-front investment L_{RS}, *i.e.*, $k_P = k_P(L_{RS})$, where $k_P'(L_{RS}) > 0$. That is, for any given search of scope z, the effect of the search on p_1, and thus the value of discovery, will be greater for the requesting party as the up-front investment L_{RS} increases. Because the responding party would want to minimize these benefits, this effect would incentivize the responding party to minimize $k_P(L_{RS})$ by minimizing L_{RS}. Thus, assigning the responding party the task of defining keyword search terms or training the predictive coding algorithm generates misaligned incentives and cross-party agency costs on the benefit as well as the cost side if not addressed.

A solution to the problem of cross-party agency costs generated by these misaligned incentives to invest in the quality of the relevancy search is to allocate the responsibility for the up-front investment in relevancy sorting to the party requesting the search.[85] Under the traditional cost allocation rule, the up-front costs L_{RS} are allowed to lie where they fall, and would be borne by the requesting party.[86] Under this *task-allocation* rule, the requesting party will internalize the consequences of a sub-optimally inaccurate search, as inadequate investments in L_{RS} will generate a search with low recall, resulting in the production of fewer relevant documents. Inadequate investments in L_{RS} would also generate a search with low precision, resulting in an increase in the number of irrelevant documents produced, and an increase in the requesting party's cost of review $\alpha Q(L_{RS})$. By requiring the requesting party to undertake, and thus bear, the up-front costs of search, the requesting party will have the incentive to choose the level of L_{RS} that maximizes the requesting party's value of the search net of the costs of L_{RS}.[87] Specifically, for a given r, the requesting party will set L_{RS} so that:

$$(13)\, Q\alpha'(L_{RS}) = [V'(L_{RS})\text{-}1]/(\pi r^2),$$

85. Redish & McNamara, *supra* note 10, at 796–99 (suggesting a model that places the burden on the cheapest cost avoider). The use of the cheapest cost avoider principle to allocate who is responsible for undertaking these up-front investments is distinct from Redish & McNamara's use of the doctrine of *quantum meruit* to justify the shifting of the responder's costs to the requesting party. Because this rule contemplates allocating the task of defining and conducting the search to the requesting party, and letting the costs of these activities lie where they fall, it does not contemplate the requesting party having to reimburse costs borne by the responding party.

86. *Id.* at 778–79 (describing the traditional cost allocation rule).

87. This rule would require the requesting party to be responsible for their attorney's time spent defining and refining the search terms, as well as the cost of the e-discovery vendor used to conduct the testing and subsequent search. Some courts have incentivized litigants to choose a common predictive search vendor. *See* EORHB, Inc. v. HOA Holdings LLC, No. 7409–VCL, 2012 WL 4896670, at *1 (Del. Ch. Oct. 15, 2012). In such cases, the parties would have to be billed in proportion to the resources used for their respective searches.

Federal courts have endorsed use of computer searches where the requesting party provides the search terms,[88] or where the production of search terms is generated through a cooperative process.[89] Indeed, some federal[90] and New York State[91] courts have reasoned that the producing party does not bear the costs of production because its obligation "may be satisfied by telling the party seeking the discovery where the materials are and providing a reasonable opportunity for that party to look at them and make copies."[92] Such a rule would result in the responding defendant granting the plaintiff access to its ESI for the purposes of conducting a computerized search. Under such a rule, the plaintiff would bear, and thus internalize, a significant share of the costs and benefits of expanding the scope of the search. More importantly, as noted above, the requesting party would also bear and internalize the up-front costs and benefits of defining and refining the search terms and improving the search algorithm.

Requiring the requesting party to supply the search terms, however, can result in a low quality document search even in the absence of cross-party agency costs. As some courts have pointed out, the responding party possesses asymmetric information that would allow that party to be more efficient at defining and refining keyword search terms that would increase the precision and recall of the document search.[93] Thus, allocating the task of defining and refining search terms to the relatively uninformed requesting party can also result in a low recall and precision

88. *See The Sedona Conference Best Practices Commentary on the Use of Search and Information Retrieval Methods in E-Discovery*, *supra* note 19, at 200 n.18.

89. *Id.*

90. *See* Zakre v. Norddeutsche Landesbank Girozentrale, No. 03 Civ. 0257(RWS), 2004 WL 764895, at *1 (S.D.N.Y. Apr. 9, 2004).

91. *See* Zegarelli v. Hughes, 814 N.E.2d 795, 797 (N.Y. 2004).

92. *Id.* The model in this Article focuses on the cost of discovery, and abstracts from the critical issues regarding preservation and spoliation. For a discussion of these issues, see Bruce H. Kobayashi, *The Law and Economics of ESI Preservation Standards and Incentives* (GMU Law and Econ. Working Paper Series, Working Paper No. 05–26, 2010); Redish, *supra* note 15; Thomas Y. Allman, *Preservation and Spoliation Revisited: Is it Time for Additional Rulemaking?*, 2010 LITIG. REV. CONF., DUKE L. SCH. 2–3 (2010), http://civilconference.uscourts.gov/LotusQuickr/dcc/Main.nsf/$defaultview/02E441B3AD64B2D9852576DB005D976D/$File/Thomas%20Allman%2C%20Preservation%20and%20Spoliation%20Revisited.pdf. Because preservation decisions and expenditures largely occur prior to litigation, they are sunk with respect to and would not affect the decisions analyzed in this paper. *See, e.g.*, Kenneth J. Withers, "*Ephemeral Data" and the Duty To Preserve Discoverable Electronically Stored Information*, 37 U. BALT. L. REV. 349, 378 (2008) ("By the time the parties sit down at the Rule 26(f) conference, the preservation issues surrounding ephemeral data may be moot . . . and the fate of the responding party may already be sealed, if sanctions are later found to be warranted.").

93. *See* Ralph C. Losey, *Child's Game of 'Go Fish' is a Poor Model for e-Discovery Search*, *in* ADVENTURES IN ELECTRONIC DISCOVERY 209–10 (2011) (noting the low recall and precision of such keyword searches); Peck, *supra* note 26, at 26; *see also* Fordham, *supra* note 47; *see also* Moore v. Publicis Groupe & MSL Grp., 287 F.R.D. 182, 190–91 (S.D.N.Y. 2012); Nat'l Day Laborer Org. Network v. U.S. Immigration and Customs, 877 F. Supp. 2d 87, 109–10 (S.D.N.Y. 2012); William A. Gross Constr. Assocs., Inc., v. Am. Mfrs. Mut. Ins. Co., 256 F.R.D. 134, 135–36 (S.D.N.Y. 2009); Victor Stanley, Inc. v. Creative Pipe, Inc., 250 F.R.D. 251, 262 (D. Md. 2008); Equity Analytics, LLC v. Lundin, 248 F.R.D. 331, 333 (D.D.C. 2008); United States v. O'Keefe, 537 F. Supp. 2d 14, 24 (D.D.C. 2008).

search.[94] Under these circumstances, in the absence of cooperation or effective judicial regulation, the legal system faces a choice of two ineffective alternatives: accepting high-cross party agency costs versus accepting inefficient keyword search due to asymmetric information.

Advanced technologies, such as predictive search, can resolve this dilemma by mitigating the asymmetric information problems generated with a requestor task allocation rule. Use of a predictive search algorithm is not just the initial definition and refinement of keywords, or even a simple Boolean search. Rather, predictive coding is a process where humans are used to review and code (*e.g.*, for relevancy or privilege) a sample of documents.[95] A computer is then used to analyze coding decisions and the documents in the sample in order to identify characteristics of the documents that predict selection/nonselection. An iterative process, including out-of-sample prediction to test and refine the computer algorithm used to select documents, is used to improve the accuracy of the search algorithm. Thus, the accuracy of the predictive coding can be improved through increasing the size of the sample documents and through multiple rounds of testing and refinement. Moreover, the accuracy of the coding is arguably improved when the requesting party is allocated the task of coding the sample documents. Thus, when the requesting party is allocated the task of defining and refining the search algorithm, cross-party agency costs can be eliminated without compromising the efficiency of the search caused by informational asymmetries. As a result, use of predictive coding will result in a higher recall search.

94. *See* Redish & McNamara, *supra* note 10, at 798 (citing CALABRESI, *supra* note 83, at 148) (noting that "inadequate knowledge" may cause the cheapest cost avoider to be someone other than the individual with the maximum degree of internalization of costs).

95. *See* Peck, *supra* note 26, at 27.

FIGURE 10: MANUAL VERSUS COMPUTER SEARCH

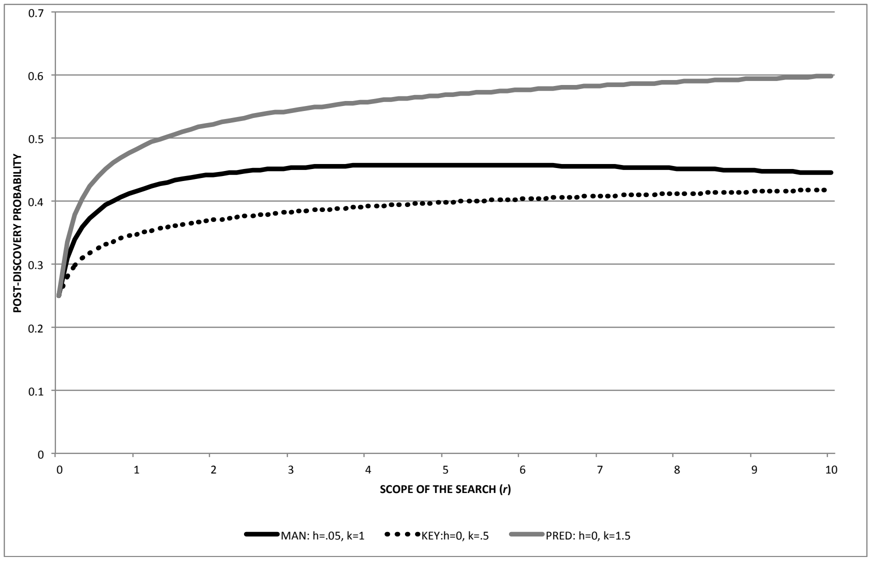


Figure 10 depicts the probability function from equation (5) used in the prior sections to illustrate ideal manual search (with $k_P = 1$ and $h = .05$). Figure 10 also shows an imperfect computerized search (labeled KEY) that has a nondecaying but *lower* recall ($k_P = .5$ and $h = 0$). This example represents the effect of a keyword search under less than ideal conditions, *e.g.*, where the search is plagued by either cross-party agency costs, or, alternatively, when the uninformed requesting party is required to conduct the search.

Figure 10 also depicts a probability function with a search function (labeled PRED) that has a higher and nondecaying recall ($k_P = 1.5$ and $h = 0$). This represents use of a predictive coding algorithm where a task allocation rule is used to mitigate cross-party agency costs, and where this rule does not result in an inefficient search because of asymmetric information problems. The example assumes that the predictive coding algorithm is more accurate than a manual search under ideal conditions, and also that such an algorithm can be used in practice in circumstances close to these ideal conditions (*i.e.*, in the absence of cross-party agency costs and inefficiencies due to information asymmetries).

B. Linear Keyword Search

This Section presents an example of the use of keyword search as a first stage sorting mechanism, and how the use of such a computerized initial search alters the economics of discovery. The example assumes that the task of conducting the search and the costs of the search are allocated to the responding party. The parameters in this example reflect the incentives of the responding party, which is to spend optimally on the privilege search, but to minimize, to the extent possible, expenditures on the relevancy-sorting search. Thus, the responding party's choice of the level of up-front investments in keyword search is small, or L = \$1050. The responding party's misaligned incentives produce a keyword search that, compared to manual search, has a *lower* but nondecaying recall. Specifically, the example assumes that $k_P = .5$ and $h = 0$.[96] Under these conditions, use of keyword search benefits the responding party by lowering the cost of response through eliminating the marginal costs of the relevancy search ($M_{RS} = 0$) and keeping the marginal costs of privilege review low (M_{PR} = \$100).

The low level of up-front investment in the relevancy search results in a low-precision search. As a result, the requesting party's marginal costs of review increase, *i.e.,* αQ = \$700. Thus, the privilege search has a ninety percent cull rate, but the relevancy-sorting search has a cull rate of only thirty percent. In addition, the low k_P in the rent seeking function that determines the plaintiff's probability of recovery reflects the low recall of the relevancy-sorting search.

Figures 11A and 11B depict the scope of linear keyword search under the traditional cost and task allocation rule. The example demonstrates the effect of the low precision and recall keyword search. Figures 11A and B show that costs are lower, but so are the benefits. The expected value of the lawsuit is below \$71,000, and the scope of discovery is limited. The reduced expected recovery and scope of discovery depicted in Figure 11B stem from two sources. The first is the inferior accuracy of the computer search, which in turn results from the responding party's poor incentives to improve the accuracy of the search.

96. *See id.* at 26 (citing a study by Blair and Marion finding keyword search recall rates of twenty percent, and noting the high costs of review due to low keyword search precision rates); *see also* Maura R. Grossman & Terry Sweeney, *What Lawyers Need to Know About Search Tools: The Alternatives to Keyword Searching Include Linguistic and Mathematical Models for Concept Searching,* NAT'L. L.J. (Aug. 23, 2010), www.ned.uscourts.gov/internetDocs/cle/2011-01/National%20Law%20Journal%20(aug%202010).pdf (finding low keyword search recall rates of between twenty and twenty-four percent).

FIGURE 11A: THE EFFECT OF IMPERFECT KEYWORD SEARCH

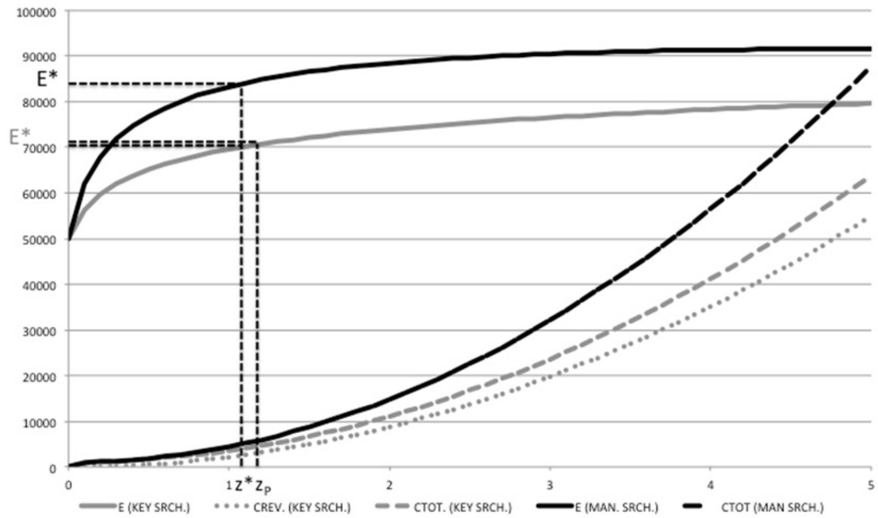
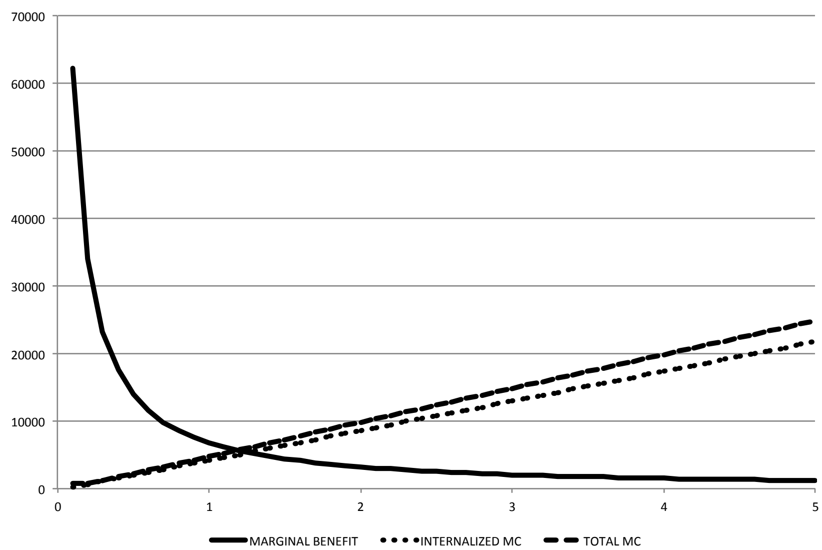


FIGURE 11B: THE MARGINAL COSTS AND BENEFITS OF IMPERFECT KEYWORD SEARCH



The low accuracy keyword search also affects settlement. The model assumes that $r = z$ when a computer search is used. This assumption is made for two reasons. First, the search results are likely to be organized by relevance and not by their location on the disk.[97] Second, the technology, especially when a common vendor is used, can allow the privilege and relevancy search to be conducted simultaneously.[98] This prevents the strategic use of sequencing by the requesting party and allows the responding party to forgo manual review of documents from areas $r > z$.

FIGURE 12: SETTLEMENT WITH IMPERFECT KEYWORD SEARCH

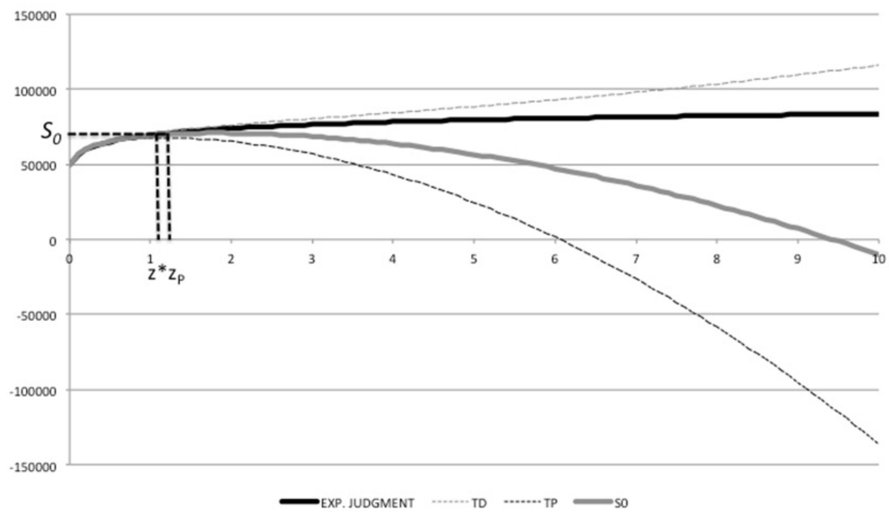


Figure 12 shows the settlement range. The pre-discovery settlement at $r = z_P = 1.8$, which results in a midpoint settlement S_0 = \$69,893. Note that the midpoint settlement falls below the already lowered expected judgment of \$70,724, resulting in a small negative *in terrorem* effect on settlement I that further reduces the value of the lawsuit to the plaintiff.

The results in this Section show that computer search is not necessarily a superior substitute for manual search. One potential change to the example would be to alter the task-allocation rule, and have the requesting party conduct and pay for the search. This would improve incentives to invest in the relevancy search. As noted above, however,

97. *See* Zahre v. Morddeutsch Landesbank Girozentrale, No. 03 Civ. 0257(RWS), 2004 WL 764895, at *1 (S.D.N.Y. Apr. 9, 2004) (defendant's production of text searchable documents on CD was adequate, and further indexing of ESI was not required).

98. *See* EORHB, Inc. v. HOA Holdings LLC, No. 7409–VCL, 2012 WL 4896670, at *1 (Del. Ch. Oct. 15, 2012) (ordering parties, *sua sponte*, to use the same e-discovery firm). Hiring a common e-discovery vendor is conceptually distinct from using a centralized master or inquisitor to conduct discovery. In the former case, the parties use to same vendor to carry out the predictive search. The parties, however, would still control the nature and scope of the search. The latter concept would have a centralized master or inquisitor determine the nature and scope of the search. For an examination of the differing incentives and performance of such systems, see Luke M. Froeb & Bruce H. Kobayashi, *Adversarial versus Inquisitorial Process*, *in* 8 ENCYCLOPEDIA OF LAW & ECONOMICS: PROCEDURAL LAW & ECONOMICS (Chris William Sanchirico ed., 2012); Luke M. Froeb & Bruce H. Kobayashi, *Evidence Production in Adversarial vs. Inquisitorial Regimes,* 70 ECON. LETTERS 267 (2001); Francesco Parisi, *Rent-Seeking Through Litigation: Adversarial and Inquisitorial Systems Compared*, 22 INT'L. REV. L. & ECON. 193 (2002).

such a change may not improve the accuracy of the search due to asymmetric information problems.[99] Indeed, the keyword search presented in this Section illustrates the dilemma facing the legal system: a choice between poor incentives by the responding party to invest in the quality of the search or a low quality search when the uninformed requesting party is allocated the task of defining and refining the search. While the costs of discovery are reduced, so are the benefits.

C. *ESI, Predictive Search, and Search Forward: More Accuracy and Lower Cost*

In this Section, we examine how the use of a better predictive search technology combined with a requestor task-allocation rule enables the alignment of incentives and mitigates asymmetric information problems. As noted above, the use of predictive search is an example of technology that has been adopted by litigants and courts. Predictive search has been shown to outperform manual search and keyword search, both in terms of having better recall and better precision.[100] In addition to reducing the marginal cost of increasing the scope of search, the use of predictive coding with a sensible task and cost allocation rule will also make the costs of discovery more symmetric. As shown above, the existence of a large *in terrorem* effect requires both high and asymmetric discovery costs.[101] The use of predictive search lowers the marginal cost of search for both parties—as both privilege and relevancy sorting can be performed using computerized predictive search. The greater accuracy of these searches can significantly reduce the number of documents produced, thus reducing the number of documents that must be manually reviewed. Moreover, by allocating the task of and costs associated with improving the accuracy of the search to the party with the best incentives does not result in poor search performance due to cross-party agency costs or asymmetric information. Finally, by splitting any fixed costs, costs can be lower and more symmetric. As a result, use of predictive search can improve both the marginal incentives to engage in discovery and reduce any *in terrorem* effect of discovery costs on pre-discovery settlement.

The effect of predictive search on the benefits and costs of discovery is illustrated in Figure 13A. In the example, we adopt the same parameters as in the case of manual search except for the following: first, we assume that predictive search has a nondecaying and higher recall, *i.e.*, $h = 0$ and $k_P = 1.5$;[102] second, in order to capture both the low marginal costs

99. *See supra* note 93 and accompanying text.

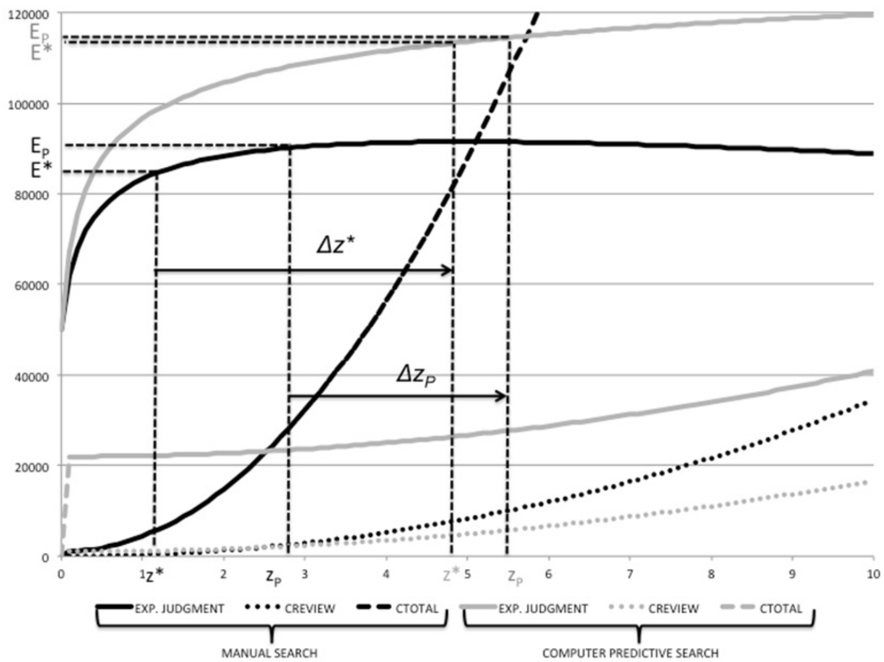
100. *See* Grossman & Cormack, *supra* note 26, at 16 (reporting experimental tests where computerized predictive search had higher F1 scores).

101. *See supra* text accompanying notes 42 and 44.

102. As noted in the discussion accompanying Figure 2, we assumed that $h = .05$, to take into account the fact that expanding manual search is likely to reduce the recall of such a search. The assumption of a lower h in the case of computerized predictive search is to take into account the higher

of applying a computerized predictive search to a broader set of information and the higher precision of computerized predictive search, we assume that $M^{RS} = 0$, $\alpha Q = 50$, and $\Upsilon M^{PR} = 10$;[103] finally, we also assume that the parties incur significant fixed (with respect to r and z) search costs of L = \$10,000 each. These are the costs associated with defining and refining search terms, and other expenses incurred when testing and optimizing the search algorithm.

FIGURE 13A: THE EFFECT OF PREDICTIVE SEARCH



Examining Figure 13A, the expected value of a discovery with computerized predictive search is higher for any given z when compared to a less accurate manual search. This results from the higher and nondiminishing recall of computerized predictive search, and the cost internalization rule that gives each party incentives to invest in training the algo-

and scope invariant recall associated with computerized predictive search. The parameter k_P was increased from 1 to 1.5 in order to take into account the superior recall of predictive search.

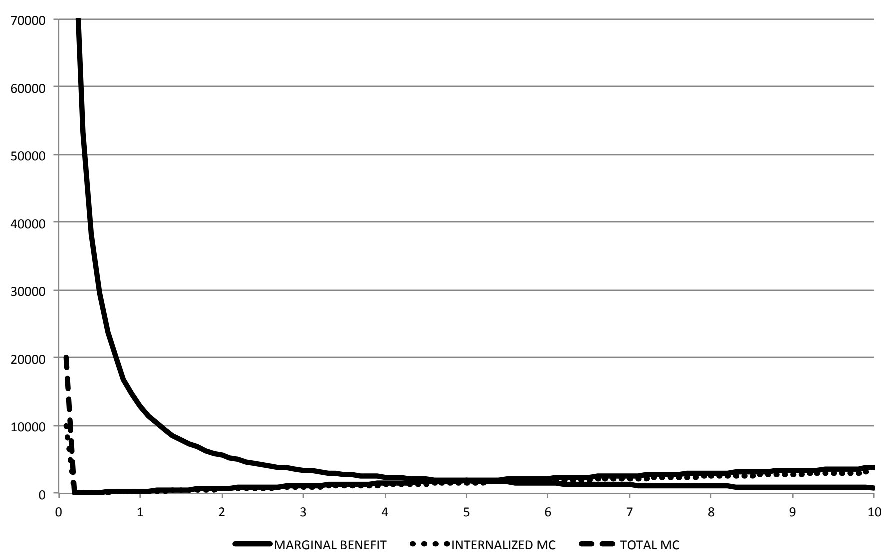
103. Indeed, we assume that the marginal cost of conducting the computerized search is zero, and that the low marginal costs of expanding r or z comes from the manual review of the drastically reduced number of documents produced by the computerized predictive search. Compared to manual search with M = \$1000, this assumption is equivalent to assuming a ninety-five percent cull rate with predictive coding for the relevancy search, and a ninety-nine percent cull rate for the privilege search. *See* Bill Tolson, *Technology: Predictive Coding Cost Savings and Return on Investment* (Nov. 5, 2013), www.insidecounsel.com/2013/11/15technology-predictive-coding-cost-savings-and-retu?ref=hp (discussing sample cull rates in this range).

rithm in order to lower the marginal costs of the privilege and relevancy search.[104]

Moreover, as shown in Figure 13B, the marginal costs of expanding the computerized predictive search are lower than with manual search, as low marginal cost computerized sorting of documents for relevance and privilege replaces the resource intensive and high marginal cost human sorting of documents. The scope of the remaining manual review of produced documents is also reduced by the higher precision of computerized search.

Considering all of the costs of search, the total benefits of the search are maximized at $z^* = 4.9$. The expected judgment will equal $E^* = \$113,470$, and total costs of discovery will equal $C^* = \$6523$ in variable costs and \$20,000 in fixed costs. Figure 13A shows that, compared to manual search, the lower marginal costs and higher efficiency of predictive search results in more information and higher expected values. It is optimal for the litigants to increase the scope of the search in this example so that total costs are higher even though the marginal costs of expanding the search are lowered.

FIGURE 13B: THE MARGINAL BENEFITS AND COSTS OF PREDICTIVE SEARCH



Note that when each side bears its own review costs, the scope of the search z_P is still larger than the scope of search z^* that would maximize the value of information net of total costs. Thus, cost externalization is not eliminated. Rather, discovery costs are more akin to other types of

104. *See infra* Model Appendix.

litigation expenditures.[105] When each side bears its own costs of search and review, the plaintiff will rationally ignore the defendant's marginal cost of search when choosing the scope of the search. The plaintiff, however, does not gain from raising his adversary's costs, as the increase in his own costs will have an offsetting effect on the pre-discovery settlement.

Moreover, due to the low marginal cost of search, the total cost of search is less than half of the total costs of manual search under the same circumstances, even though the scope of the search is nearly doubled. The plaintiff will set the scope of the search at $z_P = 5.4$, and total costs C = \$7493 in variable costs and \$20,000 in fixed costs. In addition, the value of the discovery process is greater under predictive search, as more information is obtained because of the broader search and the diminishing recall of the computerized predictive search. The expected judgment rises to E_P = \$114,353.

FIGURE 14: SETTLEMENT WITH PREDICTIVE SEARCH

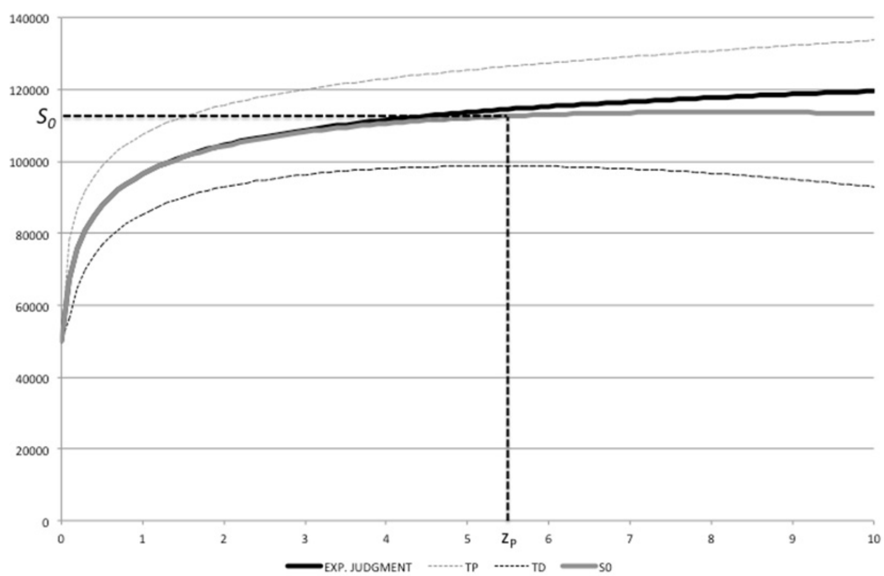


Figure 14 shows how predictive search affects settlement. If the two parties divide the fixed cost of search, the settlement range with $z_P = r_P =$

105. *See, e.g.*, Gordon Tullock, *Optimal Procedure*, *in* TRIALS ON TRIAL: THE PURE THEORY OF LEGAL PROCEDURE (1980) (discussing that the characteristics of a desirable court include accuracy and low cost); Emanuela Carbonara & Francesco Parisi, *Rent-Seeking and Litigation: The Hidden Virtues of the Loser-Pays Rule* (Univ. of Minn. Law Sch. Legal Studies Research Paper Series, Working Paper No. 12–39, 2012) (discussing the English rule's potential to reduce total litigation costs); Bruce H. Kobayashi & John R. Lott Jr., *In Defense of Criminal Defense Expenditures and Plea Bargaining*, 16 INT'L. REV. L. & ECON. 397 (1996) (arguing that disparities in criminal defense expenditures are central to ensuring that the guilty—not the innocent—are punished); Gordon Tullock, *On the Efficient Organization of Trials*, 28 KYKLOS 745 (1975) (maintaining that the Anglo-Saxon adversary court system breeds overinvestment of resources in trial); Shavell, *supra* note 50(discussing litigation and cost externalization generally).

5.4 is [\$106,859, \$114,353], with a midpoint S_0 = \$110,606 < E_P = \$114,353. Because of the relative symmetry of costs, the settlement will approximately track the expected judgment. As a result, the *in terrorem* effect of discovery costs on settlement in this example is small relative to the expected recovery and negative, with I = -\$3747.

Table 2 summarizes the litigation outcomes under the different rules and technologies. Compared with discovery under manual search, computerized predictive search results in an optimal amount of search that is more expansive. Total costs are higher, but the value of information gained in discovery increases by more.

Looking at the private incentives for search, computerized predictive search results in more information than traditional manual search. The low marginal costs of expanding search results in a more expansive search when discovery occurs, but at comparable cost. Moreover, computerized predictive search mitigates the *in terrorem* effect of the costs of discovery on settlement, but does so in a way that does not anticipate suppressed information gathering and reduced expected judgments and settlements that result from cross-party agency costs generated under manual or keyword search, or the reverse *in terrorem* effects under a requestor pays cost-allocation rule.

		Scope of Search ®	Cost of Discovery ©	y Expected Judgment (E)	Net Value of Discovery (E-C)	e Discovery Settlement (S0)	In Terrorem Effect (I)
A. NO DISCOVERY		0	0	50000			
B. MANUAL SEARCH/NO AGENCY							
1. Traditional Responder Pays Cost Allocation							
	Max Net Value	1.1	5184	84080	28896	85787	1708
	Max Private Value	2.7	26241	90023	13782	100293	10270
	Settlement Only	10	316209	90023	-276186	245277	155254
2. Requestor Pays Cost Allocation							
	Max Private Value	1.1	5184	84080	28896	81488	-2592
	RC Best Rule	1.1	5184	84080	28896	84080	0
C. MANUAL SEARCH/AGENCY							
	Max Private Value	1.3	5844	73468	17624	70546	-2922
	Settlement Only	10	192060	73468	-168592	166338	92870
	Requestor Pays Cost Allocation	0.9	3800	71255	17455	69855	-1400
D. KEYWORD SEARCH/AGENCY							
	Max Net Value	1.1	4090	70164	16074	69549	-615
	Max Private Value	1.2	4667	70724	16057	69893	-831
	Settlement Only	1.8	9188	73314	14126	70786	-2528
E. PREDICTIVE SEARCH							
	Max Net Value	4.9	26523	113470	36947	111962	-1508
	Max Private Value	5.4	27493	114353	36860	110606	-3747

VII. CONCLUSION

There is great interest in how legal innovation, including technology, might affect the market for legal services. This Article contributes to that inquiry by applying the general insights of this work to the problem of procedural reform. The model presented in this Article shows how existing technology can provide a solution to one of the most vexing issues—the costs of discovery and their affect on *in terrorem* settlements. This Article shows that *in terrorem* settlements are the result of high and asymmetric discovery costs. Technology, such as predictive search, results in costs that are lower and more symmetric. In addition, the use of predictive search allows use of a task-allocation rule that serves to mitigate the effects of cost externalization, cross-party agency costs, and asymmetric information. The end result is more information, better incentives, and lower costs.

VIII. MODEL APPENDIX

In this Appendix, we present the details of the model used in the body of this Article. Section (a) presents the details of the rent-seeking function used to determine the post-discovery probability of judgment for the plaintiff. Section (b) details the derivation of the post-discovery and pre-discovery settlements, S_1 and S_0.

A. The Effect of Discovery on the Post-Discovery Probability of a Judgment for the Plaintiff

The model adopts a standard rent seeking function to illustrate the effect of discovery on the probability that the plaintiff will recover.[106] Specifically, we adopt the following specification:

$$p_1 = p(z_P, z_D) = \frac{\gamma_P(z_P)k_P * \ln(\frac{z_P}{\delta_D} + 1) + \omega_P}{\gamma_P(z_P)k_P * \ln\left(\frac{z_P}{\delta_D} + 1\right) + \omega_P + \gamma_D(z_D)k_D * \ln(\frac{z_D}{\delta_P} + 1) + \omega_D}$$

Here, the term ω_P and ω_D control the shared priors of the two parties, which would determine the probabilistic outcome of the case in the absence of discovery. That is, if no discovery is undertaken, the probability that the plaintiff will recover will equal $p_0 = p(z_P = 0, z_D = 0) = \frac{\omega_P}{\omega_P + \omega_D}$. If, for example, $\omega_P \geq (<) \ \omega_D$, then $p_0 = \geq (<) .5$. In the example presented in this Article, we assume that $\omega_P = 6$ and $\omega_D = 2$, so that in the absence of discovery, $p_0 = .25$.

The terms δ_D and δ_P denote the extent to which the data to be discovered is organized. A less organized disk will have a higher δ, and flattens out the function $k_P * \ln(\frac{z_P}{\delta_D} + 1)$. The terms $\gamma_P(z_P)$ and $\gamma_D(z_P)$ represent the effectiveness of a discovery request in yielding relevant information. We assume that both $\gamma_P(z_P)$ and $\gamma_D(z_D)$ are positive but decreasing in z_P and z_D respectively. That is, these functions assume diminishing returns to searching further away from the center of the disk for reasons unrelated to the organization of the data on the disk. This as-

106. *See supra* note 105.

sumption follows from the fact that as the scope of the request increases, the efficacy of the search of a given area decreases. For example, the search of the first meter from the center of the disk will yield fewer relevant documents when that search is part of a larger search than an exclusive search of the first meter. Under this assumption, $\gamma_P'(z_P) < 0$ and $\gamma_D'(z_P) < 0$. The model also assumes that the parties will voluntary disclose information that positively affects their case prior to discovery so that the effect of discovery is to increase the probability that the requestor will prevail.[107]

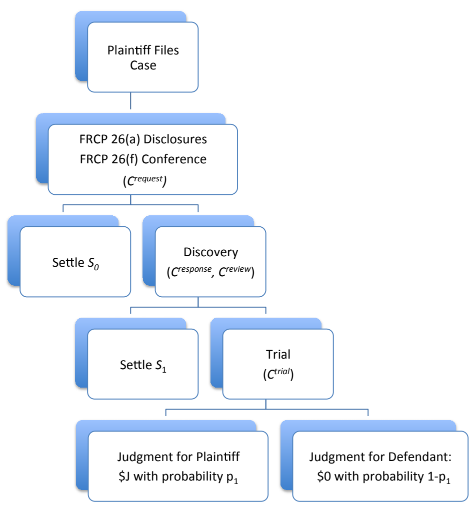
To highlight the effects of asymmetric costs, we assume that only one side has discoverable information. In terms of the model, $\gamma_D(z_D) = 0$ so that $z_D = 0$. In addition, the example in this Article assumes that $\gamma_P(z_P) = e^{-hz_P}$. Under these assumptions, the probability function will be given by:

$$p_1 = p(z_P, 0) = \frac{e^{-hz_P} k_P * ln(\frac{z_P}{\delta_D} + 1) + \omega_P}{e^{-hz_P} k_P * ln(\frac{z_P}{\delta_D} + 1) + \omega_P + \omega_D}$$

B. Post and Pre-Discovery Settlement

The figure below illustrates the stages of litigation.

STRUCTURE 1: THE STRUCTURE OF LITIGATION



107. *See, e.g.*, FED. R. CIV .P. 26(a)(1) (requiring voluntary disclosure, without awaiting a discovery request, of all relevant information that supports a party's claims or defenses).

The model assumes that the litigants do not disagree on the post-discovery probability of a judgment for a plaintiff. Thus, post-discovery, both parties will anticipate that the plaintiff will be awarded a judgment J with probability p_1. Let $TT_P^{max} = p_1J - C_P^{trial}$ denote the plaintiff's minimum acceptable settlement (based on the trial payoff for the plaintiff) and $TT_D^{max} = p_1J + C_D^{trial}$ denote the defendant's maximum acceptable settlement offer (the trial exposure for the defendant).[108] Under these conditions, an mutually acceptable settlement S_1 exists, where $TT_P^{min} < S_1 < TT_D^{max}$. If the plaintiff's split of bargaining range $TT_D^{max} – TT_P^{min}$ is denoted by ϕ_1, the pre-trial settlement equals:

$$S_1 = TT_P^{min} + s_1(TT_D^{max} - TT_P^{min}) = p_1J + \phi_1 C_D^{trial} - (1- \phi_1)C_P^{trial}.$$

For example, if the parties' trial costs are the same and they split the bargaining surplus equally (ϕ_1 = ½), the post-discovery/pre-trial settlement will equal the expected judgment:

$$S_1 = p_1J.$$

During pre-discovery settlement, $TI_P^{min} = \mathrm{E_P}(p_1)J - C_P^{discovery}$ represents the plaintiff's threat point, where $\mathrm{E_P}(p_1)$ equals the plaintiff's pre-discovery estimate of the expected post-discovery probability that the plaintiff will prevail. TI_P^{min} determines the minimum amount the plaintiff would accept to settle the case.[109] $TI_D^{max} = \mathrm{E_D}(p_1)J + C_D^{discovery}$ represents the defendant's threat point, thus determining the maximum amount he would pay to settle the case.

Letting ϕ_0 denoting the plaintiff's split if a pre-discovery bargaining range exists, the size of the pre-discovery settlement will equal:

$$S_0 = TI_P^{min} + \phi_0(TI_D^{max} - TI_P^{min})$$
$$= \phi_0(\mathrm{E_D}(p_1)J + C_D^{discovery}) + (1- \phi_0)(\mathrm{E_P}(p_1)J - C_P^{discovery}).$$

108. *See* Posner, *supra* note 3, at 611–12.
109. *Id.*

For simplicity, the model assumes that both parties anticipate and agree upon $E(p_1)$, so that $E_D(p_1) = E_P(p_1) = p_1$ at the time of pre-discovery settlement.[110] Under these conditions, the parties will choose to settle the case prior to discovery for:

$$S_0 = p_1 J + \phi_0 C_D^{discovery} - (1- \phi_0) C_P^{discovery}.$$

Assuming an even split of the bargaining surplus ($\phi_0 = ½$):

$$S_0 = p_1 J + (C_D^{discovery} - C_P^{discovery})/2.$$

110. Because of the Article's focus on the effect on settlement, we do not consider the effects of uncertainty, or disagreement, which can lead to the parties continuing on to discovery. For example, even if the parties would agree on p_1 post-discovery, divergent and optimistic estimates of this probability can cause $TI_D^{max} < TI_P^{min}$, which will lead the parties to choose to engage in discovery and forgo pre-discovery settlement of the case. For consideration of these issues in the context of discovery, see Cooter & Rubinfeld, *supra* note 15, at 457–59.