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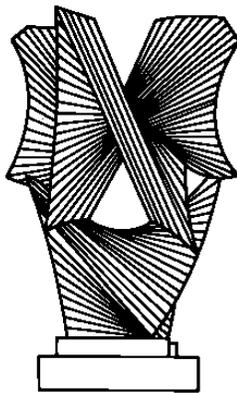
Sequential versus Unitary Trials: An Economic Analysis

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CHICAGO

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I. Introduction

When Polaroid successfully sued Kodak for infringing its patents on instant photography, the question of damages was litigated in a separate trial and before a different judge than the one who found Kodak liable for infringing Polaroid's patents.[1] A bifurcated or "sequential" trial on liability and damages, as opposed to a "unitary" trial on both issues, is the exception rather than the norm. This may appear puzzling since bifurcation can avoid costly litigation over the amount of damages if the defendant is not found liable or if the parties settle damages once liability is established. What explains the infrequency of bifurcated trials on liability and damages? Have courts failed to adopt more efficient methods of litigation, or are there offsetting disadvantages of bifurcation? One possible answer is that evidence on the nature and extent of damages also bears on the question of the defendant's liability so that savings from bifurcation are negligible. Another is that bifurcation may require additional court time and repetition of evidence, resulting in cost diseconomies rather than cost savings. A more subtle explanation is that bifurcation may increase the number of lawsuits brought and reduce the fraction that settle out of court compared to a unitary trial. If so, bifurcation may increase overall litigation costs even though it lowers the cost of litigating a given dispute.[2]

A sequential trial is not limited to separating liability and damages. Any potentially dispositive issue or issues can be separated. More formally, a sequential trial breaks a trial into n (≥ 2) potentially dispositive issues; litigates and decides issue "1"; litigates and decides issue "2" conditional on the plaintiff winning issue "1"; litigates and

[1]See Polaroid v. Eastman Kodak Co., 641 F. Supp. 828 (D. Mass. 1985) and 17 U.S.P.Q. 2d. 1711(D. Mass. 1990) for the liability and damages trials respectively.

[2]With respect to tort suits, another argument advanced against bifurcation is that it may prevent juries from reaching compromise verdicts in which damages are reduced to take account of the victim's negligence even though contributory negligence bars any recovery. I consider this question later when I analyze the relation between bifurcation and the probability the plaintiff wins his suit.

decides issue "3" conditional on the plaintiff winning issues "1" and "2" and so forth.[3] For example, a trial court might first decide at the pleadings stage if the court has jurisdiction over the controversy or defendant; if it does, it next decides whether the statute of limitations bars the plaintiff's suit; if the plaintiff prevails on the latter question, the court then considers the merits of the case. A court might also separate more substantive issues. To illustrate, a court might first decide whether the defendant manufactured the allegedly defective product and whether the product caused the injuries before considering liability and damages. Or in a criminal case, the question whether the defendant committed the crime may be decided before considering an insanity defense.[4] Just as bifurcation of liability and damages creates the possibility of cost savings so does the separation of any dispositive issue before considering evidence on the remaining trial issues.

To avoid confusion, I use the term "bifurcation" to denote a sequential trial that separates liability and damages; the term "separation" to denote a sequential trial on two or more dispositive issues; and the term "unitary" to describe a trial in which all issues are presented before deciding the case. A sequential trial can involve the same or different decision makers on the separate issues. I discuss this briefly when I examine possible diseconomies from bifurcation.

The analysis in this paper builds on and extends the now standard model of the resolution of legal disputes.[5] The simple insight of this paper is that in many instances, *a sequential trial lowers the expected cost of litigation compared to a unitary trial for both the plaintiff and defendant and, therefore (1) increases the plaintiff's incentive to sue; (2) increases the number of lawsuits; and (3) reduces the likelihood that the parties will settle out of court by narrowing the range of mutually acceptable settlements*. Hence, sequential decision-making may increase the aggregate cost of litigation even though it lowers the expected cost of litigating (as opposed to settling) a particular dispute.

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[3]This definition is oversimplified because the plaintiff may claim the defendant has committed several wrongful acts. Hence, even if the plaintiff loses issue "1," that may only dispose of part of his case and thus further issues will still be litigated. To simplify the analysis, I use the definition given in the text.

[4]Trial courts appear to have wide discretion to separate issues. For example, Rule 42(b) of the Federal Rules of Civil Procedure provides, in part, that "The court, in furtherance of convenience or to avoid prejudice, or when separate trials will be conducive to expedition and economy, may order a separate trial" of any claim, counterclaim or issue. Most states have statutes similar to Rule 42(b). See Note, Rule 42(b) — Bifurcation of the Issues of Liability and Damages at Trial, 5 U. Ark.Little Rock L. J. 405, 406 n.50 (1982). For a more complete list of issues suitable for a separate trial see Note, Separate Trial of a Claim or Issue in Modern Pleading: Rule 42(b) or the Federal Rules of Civil Procedure, 39 Minn. L. Rev., 743 (1955) and The Mini-Trial:Bifurcation as an Efficient Device to Promote the Resolution of Civil Cases, 53 Albany Law Review, 19 (1988).

[5]See William M. Landes, An Economic Analysis of the Courts, 14 J. Law & Econ. 61 (1971); John P. Gould, The Economics of Legal Conflicts, 2 J. Legal Stud. 279 (1973); and Richard A. Posner, An Economic Approach to Legal Procedure and Judicial Administration, 2 J. Legal Stud. 399 (1973).

Although there is a voluminous law and economics literature on the resolution of legal disputes, I am unaware of any systematic economic analysis of bifurcation or separate trials.[6] In an insightful paper that predates the economic literature, Warren Schwartz explains how the severance of liability and damage issues can lower the cost of litigation and increase the incentive to litigate rather than settle cases.[7] Schwartz's reasoning is similar to mine although his analysis is less formal. A paper by Bradford Cornell comes closest to the approach taken here.[8] Cornell uses an option-pricing model to analyze the plaintiff's incentive to sue, and shows that the expected value of suing (and hence the incentive to sue) will increase if the plaintiff has the option of terminating the suit without penalty before incurring the full cost of litigation. Similarly, I show that bifurcation or separation increases the expected value of the plaintiff's claim and decreases the expected value of the defendant's liability because it holds out the prospect of saving litigation expenditures. This, in turn, raises the minimum sum the plaintiff will settle for, lowers the defendant's maximum settlement offer, and reduces the likelihood that the parties will settle.

The paper is organized as follows. Part I develops a formal model of a sequential trial. I begin with a simple example where the parties expect to settle damages conditional on the plaintiff winning liability. Next I examine the case where the parties expect to litigate damages conditional on the plaintiff winning liability. I then compare these cases to a unitary trial in which I allow for the possibility that the parties may find it mutually beneficial to stipulate to damages and litigate liability only. Part II examines related questions such as diseconomies of scope from bifurcation; the possibility that bifurcation will prejudice one of the parties; and the possibility of litigating damages before liability. In Part III I analyze a sequential trial that involves many potentially dispositive issues. Here, I look not only at the question of how many issues to separate but also at factors that should determine the sequence in which to separate issues. In Part IV I present some concluding remarks.

I. The Model

A trial involves a sequence of actions. In the case of a bifurcated trial on liability and damages, the sequence is as follows. (1) The plaintiff first decides whether to sue the defendant. I assume he will sue only if the expected value of litigating his claim through

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[6]In their excellent survey article, Cooter and Rubinfeld (see Robert D. Cooter and Daniel L. Rubinfeld, Economic Analysis of Legal Disputes and Their Resolution, 27 J. Econ. Lit 1067 (1989)) do not discuss the subject of bifurcated or separate trials although they survey more than 100 law and economics articles on the subject of legal dispute resolution.

[7]Warren F, Schwartz, Severance—A Means of Minimizing the Role of Burden and Expense in Determining the Outcome of Litigation, 20 Vanderbilt Law Review, 1197 (1967).

[8]Bradford Cornell, The Incentive to Sue: An Option-Pricing Approach, 19 J. Legal Stud. 173 (1990).

trial net of litigation cost is positive.[9] (2) If the plaintiff sues, he and the defendant must decide whether to settle before trial or to litigate the question of the defendant's liability (in the case of a bifurcated trial). I assume that the parties will settle if it is mutually beneficial to do so. That is, if a settlement can make each party better off than his expected outcome from a trial, the parties will settle. (3) Provisionally, I assume that if the parties settle liability, the litigation ends. Later, I consider the possibility of a partial settlement in which the parties stipulate to the defendant's liability but litigate the amount of damages. (4) If liability is tried and the defendant wins, that also ends the litigation although the defendant may still pay something rather than risk losing on appeal. (To simplify, I assume that payment is zero.) (5) If the plaintiff wins, the parties then decide whether to settle or litigate the amount of damages. Again, I assume that the parties will settle damages when it is mutually beneficial.

A. Definitions and Assumptions

Let A and B denote the plaintiff (victim) and defendant (injurer) respectively. Define

p^a, p^b = plaintiff's and defendant's estimates of probability of *plaintiff winning liability*

J^a, J^b = plaintiff's and defendant's estimates of damage award

$J^{s|w}$ = amount parties expect to settle for *conditional on plaintiff winning liability* in a bifurcated trial

$J^{s|u}$ = amount parties stipulate to in a unitary trial. a, b = plaintiff's and defendant's cost of a trial on *both* liability and damages

e^a, e^b = plaintiff's and defendant's expected settlement surplus

c = total cost of trial on both liability and damages (c = a + b)

k = fraction (<1) of a, b and c incurred in liability phase of trial

1-k = fraction of a, b and c incurred in damage phase of

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[9]This is a standard assumption in the literature on legal decision making. It implies that the plaintiff is willing to bring a suit only if he is willing to go to trial if settlement discussions fail. This assumption eliminates the possibility of suits which have a negative expected value to the plaintiff but are brought to extract a settlement. Several recent papers, however, have addressed the question of negative expected value suits (see I.P.L. P'ng, Strategic Behavior in Suit, Settlement, and Trial, 14 Bell J. Econ. 539 (1983), David Rosenberg and Steven Shavell, A Model in Which Suits Are Brought for Their Nuisance Value, 5 Int. Rev. Law Econ. 3 (1985), Lucian Bebchuk, Suing Solely to Extract a Settlement Offer, 18 J. Leg. Stud. 437 (1988), Lucian Bebchuk, The Credibility and Success of Suits Known to be Made Soley to Extract a Settlement Offer (unpublished manuscript, Nov. 1991) and Avery Katz, The Effect of Frivolous Lawsuits on the Settlement of Litigation, 10 Int. Rev. Law Econ. 3 (1990)).

trial.

V^a, V^b = plaintiff's and defendant's estimates of expectedvalue of litigation in a *bifurcated trial*

$V^{a|w}$, $V^{b|w}$ = plaintiff's and defendant's estimates of expected value of litigation in a bifurcated trial conditional on plaintiff winning liability phase

$V^a(u)$, $V^b(u)$ = plaintiff's and defendant's estimates of expected value of litigation in a *unitary trial* in which liability and damages are tried together

$V^a(u|s)$, $V^b(u|s)$ = plaintiff's and defendant's estimates of expected value of litigation in a *unitary trial* in which the parties stipulate to damages

In order to simplify the analysis, I make a number of assumptions none of which are critical to the results. I assume the parties are risk neutral so expected utility equals expected wealth or income. I abstract from the question how the parties determine their litigation expenditures; and the related question how these expenditures influence the likely outcome of the litigation. Instead, I assume that a and b are given and, therefore, that p^a, p^b, J^a and J^b are also given.[10] Consistent with the standard litigation model, I allow the parties to have different expectations of p^a, p^b, J^a and J^b. I also assume that k is the same for A and B or that the distribution of litigation costs between the liability and damage phases of a bifurcated trial is equal for both parties. I also assume that it costs nothing to bring a lawsuit or to settle one as opposed to litigating a lawsuit. One could easily include in the model a cost of filing a complaint and a cost of settling a lawsuit. This would not change the basic results of the paper provided these costs are less than the costs of litigating a trial. I assume further that parties know at the outset whether a trial will be bifurcated or not.

Finally, I assume provisionally that there are no "diseconomies of scope" in litigating liability and damages in a bifurcated compared to unitary trial. That is, if it cost $10 to litigate liability and $10 to litigate damages in separate phases of a bifurcated trial, it cost $20 to litigate them jointly. The absence of diseconomies implies that bifurcation lowers the expected cost of litigation compared to a unitary trial in which both liability and damages are litigated since the probability that the parties will not litigate damages following the liability phase of a bifurcated trial is positive.[11] Not

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[10]An alternative assumption is that A's expenditures increase the probability of winning and the damage award while B's reduce them but that the effects of these expenditures cancel out so that p^a, p^b, J^a and J^b stay the same.

[11]Let E(c) denote the expected cost of litigating a bifurcated trial where E(c) = kc + p(1 - k)c and p equals the probability that A wins liability multiplied by the probability that the parties litigate damages conditional on A winning liability. Since p < 1 and c equals the cost of litigating a unitary trial, E(c) < c.

surprisingly, the conclusions I reach change if there are substantial (but not small) diseconomies of scope. I consider diseconomies in Section III of the paper.

B. The Parties Settle Damages in a Bifurcated Trial

Let J^a and J^b denote the expected damages that both parties believe a court would award A in the damage phase of a bifurcated trial. Consider first whether the parties would litigate the damage phase conditional on B being found liable.[12] A would prefer to settle damages provided B offered A a sum not less than

$$V^{a|w} = J^a - (1 - k)a \qquad (1)$$

where $V^{a|w}$ denotes A's expected damage award conditional on A winning liability net of the cost of litigating damages ($(1 - k)a$). After losing liability, B prefers to settle damages provided he pays no more than

$$V^{b|w} = J^b + (1 - k)b \qquad (2)$$

where $V^{b|w}$ is B's expected losses including litigation costs in the damage phase of a bifurcated trial. If $V^{b|w} \geq V^{a|w}$ or equivalently if $J^a - J^b \leq (1 - k)c$, the parties will always settle the damage phase of a bifurcated trial (conditional on A winning liability) because both parties can be made better off by settling and saving the costs of litigating damages.[13]

Several points should be noted.

1. Even if the parties agree on damages ($J^a - J^b = 0$), I assume the costs of litigating damages is still be positive (i.e., $(1 - k)c > 0$). These costs include court costs, the time and effort of the parties, their attorneys and experts in developing and presenting information on damages.

2. Mutual optimism about damages ($J^a - J^b > 0$) is a necessary but not sufficient condition to litigate damages in a bifurcated trial. In the example above, the degree of mutual optimism is too small to overcome the cost of litigating damages. Therefore, the cost of litigating damages will not enter A's decision to sue or A's and B's decision to settle or litigate the lawsuit.

3. Since a settlement on damages (conditional on A winning liability) will leave both parties at least as well off as if they litigate damages, we can write

$$J^{s|w} = J^a - (1 - k)a + e^a = J^b + (1 - k)b - e^b \qquad (3)$$

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[12]In analyzing this example and others, it is helpful to work backwards from the damage question. That is, I first look at how the parties behave conditional on the plaintiff winning liability, and then ask how the parties act at earlier stages of the litigation.

[13]This statement is true only if $V^{a|w} \geq 0$, otherwise A, by assumption, does not have a credible threat to litigate damages if a settlement fails. If $V^{a|w} < 0$, B will refuse to settle damages conditional on A winning liability. Knowing this, A will not bother to sue B in the first place. I assume throughout the paper that $V^{a|w} \geq 0$ unless otherwise indicated.

where $J^{s|w}$ denotes the conditional settlement, e^a (≥ 0) the gain A receives above the minimum amount A will accept to settle damages after winning liability, and e^b (≥ 0) the gain that B receives from settling for less than his maximum offer after losing liability. Observe that the combined surplus, $e^a + e^b$, equals $(1 - k)c - (J^a - J^b)$ or the joint savings from not litigating damages minus the difference between A's and B's estimate of damages. How the parties divide this surplus from settling damages is uncertain and may depend on the bargaining strategies they employ.

Now consider A's decision to sue B. A will sue if

$$V^a = p^a J^{s|w} - ka \geq 0. \tag{4}$$

Notice that V^a makes no allowance for the costs of litigating damages.[14] Since A expects to settle damages if he wins liability, A will value his claim on the assumption that he will not incur the cost of litigating damages $((1 - k)a)$.

Assuming A sues, he will settle both liability and damages out of court rather than go to trial on the question of liability alone if he is offered a sum at least as great as V^a in equation (4). Thus, V^a also represents the minimum amount A will settle for before trial (i.e., A's minimum demand).

V^b equals what B expects to pay A if the case is tried plus B's litigation costs (limited to his cost of litigating liability since B also expects that damages will not be litigated) as in

$$V^b = p^b J^{s|w} + kb. \tag{5}$$

V^b also equals B's maximum offer to settle before trial because anything lower will leave B better off than if he goes to trial.[15]

A settlement will be mutually beneficial to both parties and will occur when $V^b \geq V^a$ or when

$$kc \geq (p^a - p^b)J^{s|w} \tag{6}$$

or equivalently

$$kc + (1 - k)(p^a a + p^b b) - (p^a e^a + p^b e^b) \geq p^a J^a - p^b J^b. \tag{7}$$

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[14]I adopt the convention that A will sue if V^a is positive or zero. Similarly, I assume that the parties will settle a claim if the gain from settling is positive or zero.

[15]Observe that equations (4) and (5) assume not only that both parties expect to settle damages but that they expect to settle damages for the same amount ($= J^{s|w}$). The latter need not follow from the former because the parties could have different expectations over the likely division of the settlement surplus (conditional on A winning liability). The assumption of identical expectations of the settlement surplus simplifies the notation but does not change the results of the analysis. For example, the maximum disagreement over the surplus would occur in either of two cases: when either A expects to settle for $J^a -(1 - k)a$ and B expects to pay $J^b + (1 - k)b$; or when A expects to settle for $J^b + (1 - k)b$ and B expects to pay $J^a - (1 - k)a$. In the former (maximum settlement pessimism), each party expects the other to receive the full surplus from settling damages; in the latter (maximum settlement optimism), each party expects to receive the full surplus from settling. Although a settlement on liability is more likely in the former case, the conclusions I reach later on the difference between bifurcated and unitary trials remain the same.

Alternatively, a trial on liability will result if

$$kc < (p^a - p^b)J^{s|w}. \tag{8}$$

Conditions (6) and (8) repeat the well known result that mutual optimism ($p^a > p^b$) is a necessary (but not sufficient) condition for a trial to occur, and that a trial is more likely (given mutual optimism), the smaller the cost of litigation (kc), the greater the degree of mutual optimism and the greater the expected damages. Observe that the costs of litigation excludes the costs of litigating damages because if B wins liability, the litigation ends, and if A wins liability, the litigation also ends because the parties settle damages.

C. The Parties Litigate Damages in a Bifurcated Trial

Now assume that the parties are sufficiently optimistic about damages ($J^a - J^b > (1 - k)c$) that they litigate damages if A wins the liability phase of a bifurcated trial. To simplify, I assume that the average of A's and B's estimates of damages remains constant. Thus, J^a increases and J^b decreases by equal but offsetting amounts which now cause the parties to litigate damages if A wins liability.

Under bifurcation, A will sue if

$$V^a = p^a(J^a - (1 - k)a) - ka \geq 0. \tag{9}$$

Assuming A sues and both parties expect to litigate damages conditional on A winning liability, B's expected loss from litigating or his maximum settlement offer equals

$$V^b = p^b(J^b + (1 - k)b) + kb. \tag{10}$$

Whether the parties settle the entire lawsuit before the liability phase depends on whether $V^b \geq V^a$ or

$$kc + (1 - k)(p^a a + p^b b) \geq p^a J^a - p^b J^b. \tag{11}$$

The key difference between (11) and the example in part B is that the parties always avoid the cost of litigating damage in part B whereas here the parties only avoid this cost if A loses liability. How this affects A's incentives to sue and the trial/settlement decision is unclear. Although the cost of litigation rises when the parties expect to litigate damages conditional on A winning liability (compare (7) and (11)) the difference between $p^a J^a - p^b J^b$ also increases (because that is the reason the parties expect to litigate damages).[16]

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[16]Until now I have assumed that the parties act as if they know whether they will settle or litigate damages (conditional on B's liability) in a bifurcated trial. If the parties are uncertain, the analysis of bifurcation remains essentially the same. Suppose A does not have sufficient information to know whether he will litigate or settle damages. Let q^a equal A's estimate of the probability that $J^b \leq J^a - (1 - k)c$ or, equivalently, the probability that the parties will litigate damages conditional on A winning liability. Let $(1 - q^a)$ equal A's estimate of the probability that they will settle damages. Then, the expected value of A's claim is a weighted average of the value of A's claim when A expects to litigate (eq. (9)) and to settle damages (eq. (4)) with the weights equal to q^a and $(1 - q^a)$ respectively. If at the time of the

Another question is whether the parties would ever settle or stipulate to B's liability and litigate damages only.[17] This question doesn't arise when the parties expect to settle damages because then a settlement on liability would end the lawsuit. Clearly, A prefers to stipulate to B's liability because it avoids the prospect of losing liability without affecting the value of A's claim in the damage phase of a bifurcated trial. B might prefer this result as well but only in unusual circumstances. Recall that $V^{b|w}$ denotes B's expected loss if A wins liability (see eq. (2)). If B litigates both liability and damages, V^b is given by equation (10). Hence $V^{b|w} < V^b$ only if

$$(1 - p^b)V^{b|w} < kb \qquad (12)$$

or if B's expected gain from litigating liability (which equals the probability that he wins liability multiplied by the loss he avoids) is less than the cost of litigating liability. Inequality (12) is more likely to hold, the greater the cost of litigating liability relative to damages (i.e., the greater is k), the greater B's estimate of the probability that A will win liability, and the smaller the damages B expects to pay conditional on A winning liability. In these circumstances, B could find it advantageous to accept liability and move on to damages. Observe that in a unitary trial, the parties can also agree not to contest liability and litigate only damages. Hence, if both parties find it advantageous not to contest liability, there is no difference, as a first approximation, between a bifurcated and unitary trial because in both there is only a single disputed issue (damages).[18]

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trial/settlement decision (assuming A sues) neither party knows whether they will settle damages if A wins liability we have

$$V^a = p^a(J^a - (1 - k)a) - ka + p^a(1 - q^a)e^a$$

$$V^b = p^b(J^b + (1 - k)b) + kb - p^b(1 - q^b)e^b$$

where e^a and e^b denote A's and B's estimates of their expected surplus if the parties settle damages conditional on A winning liability. The parties will settle if

$$kc + (1 - k)(p^a a + p^b b) - p^a(1 - q^a)e^a - p^b(1 - q^b)e^b \geq p^aJ^a - p^bJ^b$$ Other things constant, settling liability is *less* likely, the more likely each party believes that damages will be settled (conditional on A winning liability) and the greater each party's estimate of the expected settlement surplus. If after A sues B, the parties acquire enough information to know whether they will settle or litigate damages (conditional on A winning liability), the analysis of whether to settle or litigate liability would follow either the example in part B or part C.

[17]In this context, settling liability cannot mean that A and B agree that B is not liable. If so, there would be no litigation on damages. This is equivalent to A deciding not to sue.

[18]I say "as a first approximation" because a defendant *is more willing* to stipulate to liability in a unitary than bifurcated trial. Assuming a unitary trial involves both liability and damages, B will stipulate to liability if $J^b + (1 - k)b < p^bJ^b + b$ or if $(1 - p^b)J^b < kb$. Since $J^b < V^{b|w}$ in (12), B is more willing to stipulate to liability in a unitary than bifurcated trial. The reason is that the benefit to B net of litigation cost from contesting and winning liability in a unitary trial is smaller than in a bifurcated trial because B

D. Unitary versus Bifurcated Trial

When liability and damages are tried together (the unitary trial), one might expect that A will sue only if his expected gain from litigation is equal to or greater than his cost of litigating *both* liability and damages. Similarly, one might expect that the parties would settle a unitary trial if the cost of litigating *both* liability and damages is less than or equal to $p^a J^a$ - $p^b J^b$. This view overlooks the possibility that the parties may find it mutually beneficial to stipulate to an amount of damages in a unitary trial and avoid the cost of litigating damages.[19] Moreover, the same factors (i.e., the cost of litigating damages and the difference in their beliefs about damages) which influence their decision to settle or litigate damages in a bifurcated trial also influence their willingness to stipulate to damages in a unitary trial.

Let $V^a(u)$ equals the expected value of A's claim in a unitary trial when the parties do not stipulate to damages (or to liability).[20] Since litigation costs includes both the cost of litigating liability and damages,

$$V^a(u) = p^a J^a - a. \tag{13}$$

Let $V^a(u|s)$ equal the expected value of A's claim when he stipulates to damages of $J^{s|u}$ where

$$V^a(u|s) = p^a J^{s|u} - ka. \tag{14}$$

Observe that cost of litigation is lower in (14) than (13). A is willing to stipulate to damages in a unitary trial provided $V^a(u|s) \geq V^a(u)$ or, equivalently, where $J^{s|u} \geq J^a$ - (1 - k)a/p^a. Similarly, the expected value of B's liability in a unitary trial is either

$$V^b(u) = p^b J^b + b \tag{15}$$

or

$$V^b(u|s) = p^b J^{s|u} + kb \tag{16}$$

depending on whether the parties stipulate to damages. B is willing to stipulate to damages if $V^b(u|s) \leq V^b(u)$ or where $J^{s|u} \leq J^b$ + (1 - k)b/p^b. Therefore, it will be mutually beneficial to stipulate to damages in a unitary trial if J^b + (1 - k)b/$p^b \geq J^a$ - (1 - k)a/p^a or if

$$J^a - J^b \leq (1 - k)(a/p^a + b/p^b). \tag{17}$$

If (17) holds, both A and B can be made better off by stipulating to damages in a unitary trial.

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incurs the cost of litigating damages in the former but not the latter. This assumes that each party pays his own litigation costs (i.e., the "American" rule).

[19]If the parties are unable to stipulate to damages in a unitary trial, then a unitary trial will always cost more than a bifurcated trial assuming bifurcation does not cause significant diseconomies in litigation.

[20]I assume that the parties estimates of the probability of A prevailing on liability and the amount of damages do not depend on whether liability and damages are tried together or separately. Some evidence suggests that the probability of the plaintiff prevailing may be greater when liability and damages are litigated together.

Recall the parties will settle damages in a bifurcated trial when $J^a - J^b \leq (1 - k)(a + b)$. Since both p^a and p^b are less than one, it follows that the parties are *more likely to stipulate to damages in a unitary trial than to settle damages in a bifurcated trial (conditional on A winning liability).* Put differently, the degree of mutual optimism with respect to damages must be greater in a unitary than bifurcated trial for the parties to litigate rather than settle damages. This result can be given an intuitive explanation. In a bifurcated trial, the parties only incur the costs of litigating damages if the defendant is liable. Thus, the parties discount these costs by the probability that the plaintiff wins liability. In contrast, there is no discounting in a unitary trial because the parties incur these costs before they know whether the defendant is liable. This leads to greater expected savings in costs from not litigating damages in a unitary trial.[21]

Figure 1 illustrates this point. Suppose we have a large number of lawsuits which differ only in the estimates of $J^a - J^b$ (but not in the average of the parties estimates of damages). Since the area to the left of $(1-k)(a + b)$ is smaller than the area to the left of $(1 - k)(a/p^a + b/p^b)$ in Figure 1, a larger fraction of litigants will be willing to stipulate to damages in a unitary than bifurcated trial, other things the same.

frequency

Figure 1

I   II   III

$(1-k)(a+b)$ $(1 - k)(a/p^a + b/ p^b)$ $J^a - J^b$
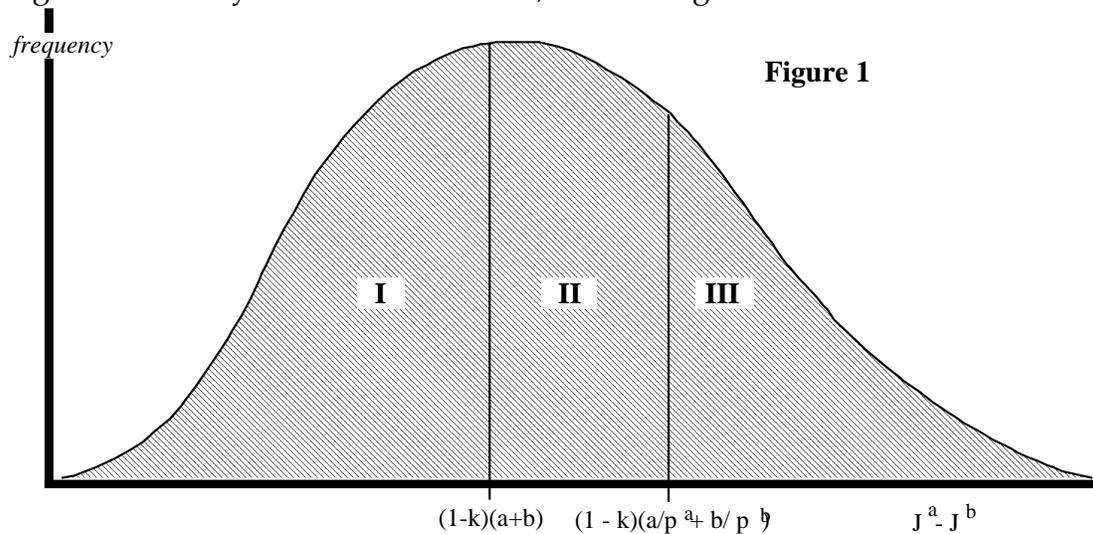
In comparing unitary and bifurcated trials, I consider disputes in each of the three categories shown in Figure 1.

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[21]There are additional complications, however. Although putting off litigation expenditures on damages in a bifurcated trial reduces the incentive to agree to damages, there is a factor working in the other direction. The parties may have an incentive to increase there expenditures on litigating damages in a bifurcated trial once liability is established because such expenditures have a greater payoff (i.e., they are not discounted by the probability of winning liability). I discuss this point later although, as noted earlier, I have not explicitly modeled litigation expenditures in this paper. Another qualification is that in some cases the parties may avoid expenditures on litigating damages even in a unitary trial. For example, the court may direct a verdict in favor of the defendant before either party has put on any evidence on damages. I ignore this possibility and assume instead that a decision in a unitary trial is reached after both parties have completed their case.

Category I: the difference between $J^a - J^b$ is less than both $(1 - k)(a + b)$ and $(1 - k)(a/p^a + b/p^b)$ so that the parties agree on damages in both a unitary and bifurcated trial.

Category II: the difference between $J^a - J^b$ is greater than $(1 - k)(a + b)$ but less than $(1 - k)(a/p^a + b/p^b)$ so that the parties expect to litigate damages in a bifurcated trial (conditional on the plaintiff winning liability) but stipulate to damages in a unitary trial.

Category III: the difference between $J^a - J^b$ is greater than both $(1 - k)(a + b)$ and $(1 - k)(a/p^a + b/p^b)$ so that the parties expect to litigate damages in both a bifurcated (conditional on the plaintiff winning liability) and unitary trial.

In *Category I* there is no systematic difference between a bifurcated and unitary trial. In both, the expected value of the lawsuit to A is $p^a J^i - ka$ (where the subscript "i" denotes either $J^{s|u}$, the expected stipulation on damages in a unitary trial, or $J^{s|w}$, the expected settlement on damages conditional on A winning liability in a bifurcated trial). Since there is no reason to believe that $J^{s|u}$ and $J^{s|w}$ will systematically differ, V^a will equal $V^a(u|s)$ on average and, therefore, the incentive for A to sue will be the same in a bifurcated and unitary trial.[22] Since V^b will equal $V^b(u|s)$ on average, the probability that defendant's maximum offer will be greater than or equal to the plaintiff's minimum demand will be the same in a bifurcated and unitary trial. Therefore, the likelihood that the parties will settle their lawsuit will also be the same. Finally, for lawsuits in *Category I* that go to trial, the costs of a bifurcated and unitary trial will be the same because only liability will be litigated in both.

Category III provides the most striking differences between a bifurcated and unitary trial. (I consider *Category II* later but note here that the effects on A's incentive to sue and the trial/settlement decision are ambiguous in *Category II* .) Recall that *Category III* occurs when the difference between A's and B's estimate of damages is sufficiently large that the parties will neither stipulate to damages in a unitary trial nor settle damages (conditional on A winning liability) in a bifurcated trial. In *Category III* the expected values of A's claim in a bifurcated and unitary trial are given by (9) and (13) respectively. Therefore, the added incentive to sue under bifurcation equals

$$V^a - V^a(u) = (1 - p^a)(1 - k)a > 0. \qquad (18)$$

Bifurcation increases the expected value of A's claim by the savings in the cost of litigating damages weighted by the probability that A loses liability.[23]

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[22]Although the range for stipulating or settling damages will be greater in the case of a unitary than bifurcated trial (between $J^b + (1 - k)b/p^b$ and $J^a - (1 - k)a/p^a$ in the unitary trial and $J^b + (1 - k)b$ and $J^a - (1 - k)a$ in the bifurcated trial), there is no reason to expect the averages to differ. The cost of reaching a stipulation on damages may be different than the cost of settling damages in a bifurcated trial but I have excluded these considerations from the analysis.

[23]If A wins liability, the parties will litigate damages and thus there will be no savings from bifurcation. Hence, savings occur only if A loses liability.

Recall that the parties will settle both liability and damages in a bifurcated trial if $kc + (1 - k)(p^a a + p^b b) \geq p^a J^a - p^b J^b$ (see (11)). In a unitary trial the parties will settle if $c \geq p^a J^a - p^b J^b$. Since bifurcation decreases the expected cost of litigation (i.e., $kc + (1 - k)(p^a a + p^b b) < c$), the incentive to settle will be smaller for a bifurcated than unitary trial.[24] It also follows that the incremental incentive to litigate under bifurcation, other things the same, will be greater the greater the fraction of litigation cost saved (i.e., the greater is $(1 - k)$) if the plaintiff loses liability, and the greater the probability that the plaintiff loses (the smaller are p^a and p^b).

Another way to see why bifurcation increases the incentive to litigate is that the prospect of a bifurcated trial not only increases the expected value of A's claim but simultaneously reduces B's expected liability. That is

$$V^b - V^b(u) = - (1 - p^b)(1 - k)b \ < 0 \qquad (19)$$

where B's gain (i.e., a lower expected loss) from bifurcation is his savings from not litigating damages if A loses liability. Thus, bifurcation lowers B's maximum settlement offer at the same time it increases A's minimum acceptance. This narrowing of the settlement range lowers the likelihood that the parties will find settlement mutually beneficial in a bifurcated compared to a unitary trial.

In short, we have established the following three propositions in the special case where the disagreement on damages is sufficiently large relative to the cost of litigating damages that the parties will neither stipulate nor settle damages.

1. *The expected cost of a bifurcated trial will be less than a unitary trial because bifurcation eliminates the costs of litigating damages if the plaintiff loses liability.*

2. *The incentive to sue will be greater for a bifurcated trial than a unitary trial.*

3. *The incentive to litigate rather than settle will be greater for a bifurcated trial than a unitary trial.*

We can add a fourth proposition concerning the likely range of pretrial settlements assuming that the parties agree on damages and that the type of trial does not affect each party's expectation of the likelihood of prevailing on liability.

4. *The range of settlement payments before trial will be smaller under bifurcation. With bifurcation, a settlement will range between $p^a J^a - ka - p^a(1 - k)a$ and $p^b J^b + kb + p^b(1 - k)b$. In a unitary trial, a settlement will range between $p^a J^a - a$ and $p^b J^b + b$.*

Points 2 and 3 above imply that bifurcation may increase the total cost of litigation for disputes in *Category III*, notwithstanding the cost saving (point 1) that results from the possibility of avoiding the cost of litigating damages. Total litigation cost will increase if the added cost resulting from both the increase in the number of plaintiffs

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[24]A necessary (but not sufficient) condition for a trial in both the bifurcated and non-bifurcated examples is that the $p^a J^a - p^b J^b > 0$. It is possible that even if the parties were mutually pessimistic over liability ($p^a < p^b$), mutual optimism over damages could be large enough to satisfy the necessary condition for a trial.

who sue and the increase in the proportion of suits that are litigated rather than settled is greater than the cost savings from eliminating litigation over damages.[25]

I note a fifth proposition.

5. *Bifurcation benefits all plaintiffs in disputes covered by Category III but harms some defendants and benefits others. All plaintiffs benefit because bifurcation increases the expected value of their lawsuits. This, in turn, implies that some defendants in bifurcated trials would not have been sued in unitary trials (i.e., where $V^a(u) < 0$ but $V^a \geq 0$). Clearly, bifurcation makes these defendants worse off. On the other hand, bifurcation makes all other defendants (those who would have been sued anyway) better off because it lowers their expected losses.*

Finally, I turn to disputes in *Category II*. There, $(1 - k)(a + b) < J^a - J^b \leq (1 - k)(a/p^a + b/p^b)$ so that the parties litigate damages in a bifurcated trial but stipulate to damages in a unitary trial. Observe that whether bifurcation increases or decreases A's incentive to sue in *Category II* is uncertain. This depends on whether $V^a = p^a(J^a - (1 - k)a) - ka$ is greater or less than $V^a(u|s) = p^a J^{s|u} - ka$. Since $J^{s|u}$ can be as low as A's minimum demand $(J^a - (1 - k)a/p^a)$, this implies that $V^a > V^a(u|s)$ for values of $J^{s|u}$ between $J^a - (1 - k)a/p^a$ and $J^a - (1 - k)a$. Alternatively, if $J^{s|u}$ equals B's maximum offer, $V^a(u|s)$ may be greater or less than V^a.[26] Next consider the decision to settle or litigate a lawsuit in *Category II*. Not surprisingly, one cannot say whether bifurcation increases or decreases the incentive to settle. Just as one cannot not show whether $V^a(u|s)$ is greater or less than V^a, one cannot show whether $V^b(u|s)$ is greater or less than V^b. Hence, it is unclear whether bifurcation narrows or increases the settlement range for disputes in *Category II*

Category II , however, probably accounts for only a small fraction of disputes. It is limited to disputes in which $J^a - J^b$ is larger than $(1 - k)(a + c)$ but smaller than $(1 - k)(a/pa + b/pb)$. Thus, it excludes both large and small differences in damages (areas I and III in Figure 1). More importantly, *Category II* is likely to account for even fewer disputes than shown in Figure 1, if one considers the likely effects of bifurcation on litigation expenditures. Both A and B have an incentive to *spend more* on litigating damages in a bifurcated than unitary trial because the returns from such expenditures are larger. In a unitary trial, the return is discounted by the probability that the party expects to prevail

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[25]I make no judgment whether an increase in litigation is "good" or "bad." For example, the observation that bifurcation increases the number of plaintiffs who sue could be deemed beneficial because it leads to greater deterrence of behavior giving rise to the plaintiff's injury. Alternatively, one might argue that it leads to more suits involving less meritorious claims and, therefore, is socially harmful.

[26]$V^a(u|s)$ will be greater than V^a if $(1-k)(a + b/p^b) > J^a - J^b$, which is more likely the smaller is p^b. (Since $(1 - k)(a + b) < J^a - J^b \leq (1 - k)(a/p^a + b/p^b)$ in *Category* II, the closer p^b is to one, the more likely that $V^a(u|s) < V^a$.) Intuitively, the smaller is p^b, the greater the expected savings to B from stipulating to damages (because B believes it less likely that he will have to pay any damages) and, therefore, the greater the amount that B is willing to stipulate to before litigating a unitary trial.

on liability which should lead to lower expenditures. In contrast, no discounting takes place in a bifurcated trial since the parties incur these expenditures only if the plaintiff prevails on liability. This factor shifts to the right the point labelled $(1 - k)(a + b)$ in Figure 1 and narrows area II.[27] A related point is that the defendant in a unitary trial may be unwilling to put on strong evidence on the plaintiff's alleged injury for fear that the jury will construe it as an admission of liability. This factor lowers the defendant's expenditures on litigating damages in a unitary trial, and makes it less likely that the parties will stipulate to damages. Finally, there may be large bargaining cost in a unitary trial which prevents the parties from stipulating to damages notwithstanding that it appears mutually beneficial to do so. Note that the reason for the greater settlement range on damages in a unitary trial is that the cost of litigating damages is divided by the parties estimates of the probabilities that the plaintiff prevails on liability. Pretrial discussions on damages, therefore, may reveal information on the relevant liability probabilities, which in turn lead to strategic considerations that raise bargaining cost. A related point is that a defendant in a unitary trial may reject a stipulation on damages because he believes it will be viewed as a tacit admission of liability. If a stipulation on damages in a unitary trial is ruled out, bifurcation always lowers the expected cost of litigation relative to a unitary trial because damages will not be litigated if either the plaintiff loses liability or if the parties settle damages conditional on the plaintiff winning liability.

E. Social Welfare and Bifurcation.

The formal analysis cannot answer the question whether bifurcation increases or decreases social welfare. First, one does not know the possible social benefit or harm from additional litigation caused by bifurcation in *Category III* type disputes.[28] Second, the model abstracts from such considerations as the costs of settling out of court, possible diseconomies of scope from bifurcation and the relationship between litigation expenditures and outcomes. Without such information one cannot determine how bifurcation affects social welfare. Still, the model point outs various ways bifurcation affects the behavior of potential litigants, and the likely impact this has on the aggregate cost of litigation.

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[27]That is, *Category II* requires $(1 - k) \ (a + b) < J^a - J^b \leq (1 - k)(a/p^a + b/p^b)$. Figure 1 is drawn on the assumption that $= 1$ but the discussion in the text suggests that > 1 which reduces area II.

[28]For *Categories I* and *II*, we showed that there are no systematic differences in the incentive to litigate versus settle between unitary and bifurcated trials. In *Category I* the parties either stipulate to damages or expect to settle damages conditional on the plaintiff winning liability. Hence, the cost of litigation is limited to the cost of litigating liability which, as a first approximation, is the same in a bifurcated and unitary trial. For *Category II* disputes the cost of litigating a unitary trial is lower than a bifurcated trial but the difference in the parties beliefs about expected damages is also likely to be lower. Hence there is no reason to expect the rate of litigation in *Category II* to differ systematically between unitary and bifurcated trials

Bifurcation lowers the expected cost of litigation *per litigated case* for disputes in *Category III*. Expected costs fall because the parties save the cost of litigating damages if the defendant is found not liable. Summing these expected cost savings per case over a large number of litigated cases may yield substantial savings, in part, because defendants are likely to win a significant fraction of litigated cases.[29] To be sure, these cost savings will be offset somewhat by the cost savings from unitary trials in *Category II* disputes but the number of such disputes is likely to be far lower than those in *Category III*.[30] In general, the total cost savings from bifurcation and hence the gain in social welfare will be greater, other things constant, the greater the number of lawsuits in *Category III* relative to *Category II*, the greater the cost of litigating damages, and the greater the fraction of defendants who win liability.

Other things, however, are not constant. In particular, bifurcation produces two effects that tend to raise the number of litigated disputes and thus increase the aggregate cost of litigation. First, bifurcation raises the expected value of each potential plaintiff's expected claim in *Category III*. This factor increases the number of plaintiffs who sue because some potential plaintiffs who would have chosen not to sue when faced with the prospect of a unitary trial now find their expected damage award greater than the expected cost of suing under bifurcation. The number of additional suits depends positively both on the expected cost savings per plaintiff and the number of plaintiffs who are close enough to the critical value for suing that switching from a unitary to bifurcated trial would cause them to sue.

Second, bifurcation reduces the fraction of litigants in *Category III* who settle their entire claim out of court. Since bifurcation increases the value of the plaintiff's claim by lowering expected litigation costs, it raises the plaintiff's minimum demand to settle liability. Less obviously, bifurcation lowers the defendant's maximum offer to settle because it lowers his expected cost of litigation by saving the cost of litigating damages if he wins liability. Bifurcation narrows the possible settlement range and, thereby, increases the likelihood of litigation. The effect of bifurcation on the fraction of cases that are litigated will be greater, the greater the expected cost savings from bifurcation

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[29]George Priest's important studies of dispute resolution (see G. Priest and B. Klein, The Selection of Disputes for Litigation, 13 J. Leg. Stud. 1 (1984), G. Priest, Reexamining the Selection Hypothesis, 14 J. Leg. Stud. 215 (1985) and G. Priest, Measuring Legal Change, 3 J. Law Econ. Org. 193 (1987)) suggest that defendant's win about 50 percent of the cases that go to trial. Other studies suggest that the defendants are successful in more than 50 percent of litigated cases in particular areas of law. (See J. Perloff and D. Rubinfeld, Settlements in Private Antitrust Litigation, in Private Antitrust Litigation. Eds. S. Salop and L. White, MIT Press (1987) and D. Wittman, Is the Selection of Cases for Trial Biased? 14 J. Leg. Stud. 185 (1985) and "Dispute Resolution, Bargaining, and the Selection of Cases for Trial: A Study of the Generation of Biased and Unbiased Data," 17 J. Leg. Stud. 313 (1988)).

[30]In *Category II*, the parties stipulate to damages in a unitary trial but expect to litigate damages in a bifurcated trial. Thus, the cost of litigation is $k(a + b)$ in the former but $k(a + b) + (1 - k)(p^a a + p^b b)$ in the latter.

and the greater the fraction of cases that are close enough to the litigation threshold that bifurcation causes a switch from settlement to litigation.

In short, the net effect of bifurcation on the aggregate cost of litigation is unclear. Although bifurcation results in expected costs savings per litigated case in *Category III*, it increases the number of plaintiffs who sue and the fraction of cases that go to trial. Moreover, the greater the expected cost savings per case, the greater the importance of these offsetting factors. Two factors suggest that any benefits from additional lawsuits in *Category III* are likely to be small or even negative. Bifurcation is most likely to increase the amount of litigation (1)by increasing the number of cases brought by plaintiffs with the least meritorious claims defined as cases where the probability of the plaintiff winning is relatively low; and (2)by increasing the rate of litigation among cases where the disagreement among parties is relatively small. Litigating rather than settling the latter cases should create smaller precedential benefits than litigating cases where the absence of clear precedents cause widely divergent expectations on trial outcomes.

II. Extensions of the Model

I limit the analysis in Section II to disputes in *Category III* for several reasons. First, the principal difference between a bifurcated and unitary trial occurs for disputes in which each party is sufficiently optimistic about damages that bifurcation holds out the prospect of avoiding litigation on damages if the plaintiff loses liability. Second, damages are never litigated in *Category I* so that a bifurcated and unitary trial are effectively the same. Third, although the expected cost of a unitary trial is less than a bifurcated trial in *Category II*, this leads to no systematic differences in the number of lawsuits and the settlement rate. Fourth, if the parties are unable to agree on damages prior to trial notwithstanding that it would be mutually beneficial to do so, *Category III* represents the relevant comparison between a unitary and bifurcated trial. Finally, it would be tedious to consider each of the three categories in the analysis below.

A. Diseconomies of Bifurcation

Until now I have assumed that the cost of litigation is the same whether liability and damages are tried together or separately.[31] A bifurcated trial might cost more because it requires repetition of evidence, additional time to select a different jury to hear damages and greater travel time of witnesses who testify on both liability and damages.[32]

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[31]I briefly discussed the incentive to spend more on litigating damages in a bifurcated than unitary trial because the expected return is greater in the former than in the latter. Here, I focus on potential diseconomies from bifurcation which means that the cost of presenting identical evidence is greater in a bifurcated than unitary trial.

[32]In the only systematic empirical investigation of bifurcated trials, Zeisel and Callahan (see Split Trials and Time Saving: A Statistical Analysis, 76 Harv. L. Rev. 1606 (1967)) find conflicting evidence on

To be sure, one may be able to minimize these diseconomies by litigating damages before the same judge and jury immediately after the defendant is found liable.[33] This practice, however, would reduce the likelihood that the parties will settle the damage part of a bifurcated trial because it raises k relative to (1 - k).[34] Without delay between the liability and damage phases, the parties will have to be ready to litigate damages even if the defendant is found not liable. Thus, some costs associated with litigating damages will be incurred before or during the liability phase of a bifurcated trial. Delay allows the parties to wait and see if the defendant is liable before incurring these costs. This points out an important distinction between diseconomies and expected cost savings from bifurcation. The former refers to the extra costs, if any, from trying liability and damages separately rather than jointly; the latter to the savings from avoiding the cost of litigating damages multiplied by the probability they will be avoided. A bifurcated trial that litigates the question of damages immediately after finding the defendant liable tends to reduce or eliminate any diseconomies. At the same time, it reduces the expected cost savings from bifurcation because the parties must incur many of the costs associated with litigating damages before concluding the liability phase of a bifurcated trial.

Not surprisingly, large diseconomies can change the conclusions of part I. For example, I noted earlier that bifurcation always lowers the cost of litigating a given case in *Category III* compared to a unitary trial. If diseconomies are sufficiently large, this

diseconomies of bifurcation. On the one hand, they found in bifurcated trials that juries that deliberated on liability and damages took on average 6.1 hours (2.7 hours on liability and 3.4 hours on damages) or 5.6 hours (2.2 hours instead of 2.7 hours on liability when the defendant was found liable and, therefore, the same jury deliberated twice) compared to 3.7 hours for unitary trials (see Table 7 at 1621). This comparison overstates potential diseconomies. Since defendants win liability in a significant fraction of unitary trials (a verdict for the defendant was found in 44 percent of cases decided after a full trial), there may be no deliberation on damages. If we assume the jury spends no time on damages in cases the defendant wins and it takes 2.7 hours on average to litigate liability (the average for bifurcated trials), then a unitary trial on both liability and damages would take 4.5 hours compared to either 6.1 or 5.6 for a bilateral trial. On the hand, Zeisel and Callahan found that it took on average 4.0 trial days for bifurcated trials that litigated both liability and damages compared to 4.7 trial days for unitary trials, suggesting economies not diseconomies from bifurcation. Zeisel and Callahan recognize potential selection problems in the latter figures and, therefore, do not conclude that bifurcated trails on both liability and damages take less time than unitary trials.

[33]Steven Schulhofer has pointed out to me that the main purpose of bifurcation in criminal trials is to prevent prejudice by preventing one decision maker from hearing evidence that is probative to the other decision maker. The classic example is where the jury decides guilt and the judge decides the sentence (in which evidence on past crimes is relevant but may be deemed prejudicial to the jury). Bifurcation may also involve different juries in criminal trials. In this case, there is a trade off between diseconomies (because of delay and repetition of evidence) and the benefits from eliminating prejudice.

[34]Recall that the parties will settle damages (conditional on the defendant's liability) if $(1 - k)c \geq J^a - J^b$. And if k increases, $(1 - k)c$ decreases which increases the likelihood of litigation on damages.

conclusion will no longer hold. To see this, let p equal the probability the parties litigate damages in a bifurcated trial (i.e., p equals the probability that A wins liability) and γ equal an index of diseconomies. When $\gamma > 1$, bifurcation results in cost diseconomies; the greater γ, the greater are the diseconomies. Let E(c) equal the expected cost of litigating both liability and damages in a bifurcated trial where $E(c) = kc + \gamma p (1 - k)c$. Since c equals the cost of litigating a unitary trial, bifurcation will reduce cost only if $\gamma p < 1$.

One can solve for the optimal amount of delay between liability and damages as follows. Let t = the time delay between a trial on liability and damages and assume that $\gamma = \gamma(t)$ and $k = k(t)$ where $\gamma' > 0$ and $k' < 0$ (i.e., diseconomies increase with t but the cost of litigating liability decreases with t as expenditures on litigating damages can be deferred until after the liability trial). Assuming the parties will litigate damages if A wins liability, the expected cost of litigation under bifurcation will equal

$$E(C) = p \gamma(t)(1 - k(t))c + k(t)c \qquad (20)$$

where p equals the probability that A will prevail on liability. Minimizing (20) with respect to t yields either (1) $t^* = 0$ if $p\gamma'(1 - k(t)) + k'(1 - p\gamma(t)) > 0$ for all values of $t > 0$; or (2) $t^* > 0$ where t^* satisfies $p\gamma'(1 - k(t)) = -k'(1 - p\gamma(t))$. Optimal delay is zero if any delay adds more to expected diseconomies than it adds to the cost of litigating liability. Assuming some delay is optimal (and assuming the second-order conditions hold), t will increase until the expected marginal diseconomies equals the marginal increase in litigating liability. Notice that $t^* = 0$ if $p\gamma(t) > 1$. It follows that the greater is p, the shorter the delay. Intuitively, since a greater p increases the likelihood that damages will be litigated, it also will increase the benefit from eliminating diseconomies due to delay.

How do diseconomies affect our analysis? First, consider whether A will sue. As noted, I assume that the disagreement on damages is sufficiently "large" so that the parties neither stipulate nor settle damages. Noting that $V^a = p^a(J^a - \gamma(1 - k)a) - ka$, bifurcation will increase the value of A's claim compared to a unitary trial if $\gamma p^a \leq 1$ for then $V^a - V^a(u) = (1 - k)a(1 - \gamma p^a) > 0$ The latter is more likely, the smaller the diseconomies and the smaller p^a.[35]

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[35]A very crude calculation indicates that diseconomies would not be sufficient to change our prior findings. Suppose we assume that diseconomies are proportional to the amount of time a jury takes to deliberate both liability and damages in a bifurcated relative to a unitary trial. Using the data provided by Zeisel and Callahan (see supra note 32) we have $\gamma = 1.48$ (= 3.4/(4.5 - 2.2)). Provided $p^a < .68$, V^a will be greater than $V^a(u)$. Zeisel and Callahan find that plaintiffs win 38 percent of bifurcated trials (.34/.90 in Table 6) that are not settled before a verdict on liability. On the other hand, Zeisel and Callahan find that plaintiffs win 55 percent of unitary trials (.42/.76 in Table 6). This suggest that defendants do better in bifurcated than unitary trials. If so, then the combination of both diseconomies and different outcomes could lead to the conclusion that the expected value of a plaintiff's claim is greater (not less) under a unitary than bifurcated trial. Thus, there would be fewer lawsuits filed under unitary than bifurcated trials. I look at the effects of different outcomes in a separate section.

Next consider whether the parties will litigate or settle their case. Again, if diseconomies are modest relative to the probability of A winning liability (i.e., if p   , bifurcation will raise A's minimum settlement demand, lower B's maximum offer compared to a unitary trial and, therefore, reduce the likelihood of an out of court settlement. In short, our prior conclusions remain unchanged unless diseconomies and the probability of A winning liability are large (i.e., unless   p > 1).

So far I have considered only the possibility that bifurcation creates cost diseconomies. Bifurcation, however, may create economies. Imagine that A claims that B has infringed its patent. B counterclaims that A has stolen its trade secret which is the basis of A's patent. Assume for convenience that both claims cannot be valid (or invalid). Either the court upholds A's patent or finds that B's trade secret was stolen. Here there are two different damage claims: one for infringing A's patent and the other for stealing B's trade secret. In a unitary trial the parties will incur the cost of litigating both damage claims. By contrast, in a bifurcated trial the parties will litigate only the damage claim that remains after the court decides liability (provided the parties do not settle damages). In this example, there will be net economies (not diseconomies) from bifurcation if the savings from avoiding the cost of litigating one type of damages is greater than the added costs, if any, associated with the extra time and inconvenience of bifurcation.[36] In short, economies from bifurcation can arise whenever a defendant files a counterclaim for damages.[37]

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[36]For example, suppose in the absence of B's counterclaim it cost $20 and $10 to litigate liability and damages respectively in a bifurcated trial but $28 to litigate both issues jointly. Bifurcation would create diseconomies of $2. Now suppose that B counterclaims. The counterclaim increases the cost of litigation. Let a unitary trial cost $40—$22 on liability and $18 on damages. A bifurcated trial, however, will cost $32—$22 on liability and, as before, $10 on damages. Hence, economies from bifurcation equal $8. I add that one cost saving feature of bifurcation is missing in this example. If the parties do not settle damages after the liability phase, they will litigate either A's or B's damage claim. If there was no counterclaim and B was found not liable, there would be no litigation on damages.

[37]To my knowledge the effect of counterclaims on litigation has not been modelled. Although it is tangential to this paper, it is useful to set out briefly the analysis of counterclaims, in part, because the results are not obvious. Consider first the unitary trial and assume that there is no stipulation on damages. Let K^a and K^b equal A's and B's estimate of B's damages, a_1 and b_1 equal A's and B's cost of litigating A's claim, and a_2 and b_2 their costs of litigating B's counterclaim. I assume $J^a > K^a$ and $J^b > K^b$. We can write the expected values of A's and B's claims as follows:

$$V^a(u) = p^a J^a - (1 - p^a)K^a - a_1 - a_2$$
$$V^b(u) = p^b J^b - (1-p^b)K^b + b_1 + b_2.$$

Obviously, the possibility of a counterclaim reduces A's incentive to sue since it lowers $V^a(u)$ by the expected value of the counterclaim and the added cost of litigation. (To simplify I assume that B will not independently sue A unless A sues B — i.e., $V^b(u) > 0$.) If A decides to sue, the parties will settle if

$$c_1 + c_2 \geq p^a(J^a + K^a) - p^b(J^b + K^b) + (K^b - K^a)$$

B. Bifurcation Lowers the Probability that Plaintiff Prevails

A widely held view is that plaintiffs are less successful in bifurcated than unitary trials.[38] In part, this rests on the belief that a jury is more likely to sympathize with and therefore favor a plaintiff when it also hears evidence on damages.[39] A related argument is made for tort cases in which the defendant is negligent, the plaintiff contributorily so, and contributory negligence bars any recovery. In a unitary trial, a jury may still find for the plaintiff but discount the award to reflect his contributory negligence. In effect, the jury substitutes comparative negligence for negligence.[40] In contrast, a jury deciding liability but not damages has less leeway to behave in this manner, particularly if a different jury decides damages.[41]

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where $c_1 = a_1 + b_1$ and $c_2 = a_2 + b_2$. Mutual optimism is still a necessary condition for litigation. Interestingly, a counterclaim is equivalent to an increase in the stakes of litigation (unless $K^b - K^a < 0$ and is sufficiently large to offset the addition of the counterclaim to expected damages). Hence, given mutual optimism, the presence of a counterclaim will reduce the likelihood of an out of court settlement provided the the cost of litigating the counterclaim (= c_2) is less than $p^a K^a - p^b K^b + (K^b - K^a)$. Note that if a settlement occurs, B pays A because I have assumed that $V^a(u)$ is ≥ 0 and $V^b(u) > 0$. Using the same assumptions, the results for a bifurcated trial are as follows. Although the expected value of A's claim falls, it is still greater than its value in a unitary trial since $V^a - V^a(u) = (1 - k)[(1 - p^a)a_1 + p^a a_2]$. If A decides to sue the parties will settle if

$$k(c_1 + c_2) + (1 - k)[(p^a a_1 + (1 - p^a)a_2) + (p^b b_1 + (1 - p^b)b_2)] \geq p^a(J^a + K^a) - p^b(J^b + K^b) + (K^b - K^a)$$

Hence a bifurcated trial reduces the likelihood that parties will settle compared to a unitary trial.

A more general way to look at counterclaims allows for four possible outcomes: both parties can lose; both can win (i.e., A's damages are offset by K); and the two outcomes described above. One can show that differences between a bifurcated and unitary trial continue to hold for this more general model of counterclaims.

[38]Zeisel and Callahan, supra note 30, find in their sample of cases that plaintiffs win 42 percent of bifurcated trials compared to 55 percent of unitary trials. Some experimental evidence also suggest this to be the case. (See Irwin A. Horowitz and Kenneth Bordens, An Experimental Investigation of Procedural Issues in Complex Tort Trials, 14 Law and Human Behavior 269 (1990).) Several short papers also claim that juries are more likely to favor defendants in bifurcated trials. (See Doyle W. Curry and Rosemary T. Snider, Bifurcated Trials: How to Avoid Them—How to Win Them, TRIAL 47 (March 1988) and R_X for the Defense: Bifurcation of Trial to Prevent Prejudice, FOR THE DEFENSE 2 (April 1984).)

[39]Indeed, one of the reasons Rule 42b of the Federal Rules of Civil Procedure gives for bifurcating liability and damages is to avoid prejudice. Here, it would be to avoid prejudice to the defendant who has to overcome jury bias in favor of a plaintiff who is able to present evidence on his damages.

[40]See Wittman, The Price of Negligence Under Differing Liability Rules, 29 J.Law & Econ.151 (1986). Wittman found that juries substituted comparative negligence for negligence (the governing liability standard) in 1974 and 1975 in California in deciding rear end automobile accidents.

[41]There is another possible outcome, however. The jury deciding liability in a bifurcated trial may be more likely to reject the defense of contributory negligence because it knows that otherwise the plaintiff will receive nothing. Then a different jury deciding damages may award full damages. Hence the net effect of bifurcation could be favorable to plaintiffs.

Assume these arguments are true and let the probability the plaintiff wins be greater in a unitary than bifurcated trial (i.e., $p^a < p^{a(u)}$ where p^a and $p^{a(u)}$ denote A's estimate of winning liability in a bifurcated and unitary trial respectively) but let damages remain the same.[42] First consider A's decision to sue. We have $V^a - V^{a(u)} = (p^a - p^{a(u)})J^a + (1 - k)a$. Thus, a potential plaintiff will be more likely to sue in a bifurcated than unitary trial, the greater the cost savings from not litigating damages, the smaller the difference in probabilities of winning and the lower damages.[43] Obviously if the difference between $p^{a(u)}$ and p^a offsets the cost savings of bifurcation, $V^{a(u)}$ will be greater than V^a and bifurcation will reduce the number of lawsuits.

The decision whether to litigate or settle out of court is unaffected by the assumption that $p^{a(u)} > p^a$. Assuming also that $p^{b(u)} > p^b$, bifurcation lowers both the plaintiff's minimum demand and the defendant's maximum offer. As a first approximation, therefore, the decision to litigate or settle is unaffected. Since bifurcation still lowers the expected cost of litigation, it reduces the incentive to settle and should lead to a greater frequency of trials than a system of unitary trials.

C. Reverse Bifurcation

Although reverse bifurcation (litigating damages before liability) may seem bizarre, a closer look reveals that in some circumstances it will save more than litigating liability first. Such a result might appear counter intuitive because liability is a dispositive issue whereas damages is not. If A loses liability, the suit ends and the parties save the cost of litigating damages; if damages are decided first, the parties must still resolve liability. Litigating damages, however, may also be dispositive because once damages are known, A may choose to drop his lawsuit or settle rather than litigate liability.

Under reverse bifurcation A will estimate the expected value of his claim as follows. Consider first how A would proceed *after* damages are decided. I assume provisionally that the parties are mutually optimistic about liability ($p^a > p^b$) and, therefore, that a trial on liability is possible. To simplify, assume that A believes that damages can take one of three values:

J^0:   where $p^a J^0 - ka < 0$ or $J^0 < ka/p^a$. That is, $p^a J^0$ is so low that A will be unwilling to incur the cost of litigating liability.

J^1:   where $(p^a J^1 - ka) \geq 0$ but $p^b J^1 + kb \geq p^a J^1 - ka$, or $J^1 \leq kc/(p^a - p^b)$. A maintains his claim against B but expects to settle liability.

J^2:   where $(p^a J^2 - ka) \geq 0$ but $p^b J^2 + kb < p^a J^2 - ka$, or $J^2 > kc/(p^a - p^b)$. A maintains his claim but expects to litigate liability

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[42]This assumption differs from the example in the text where the damages are also affected by the type of trial. That is, the plaintiff was more likely to win a unitary trial but the damages were lower in those circumstances in which the plaintiff would have lost if the trial had been bifurcated.

[43]The lower is damages the less likely the plaintiff will sue in both a bifurcated and unitary trial. The effect of lower damages, however, is greater in a unitary trial assuming $p^{a(u)} > p^a$.

Let r^{a0}, r^{a1} and r^{a2} denote the probabilities that J will equal J^0, J^1 and J^2 respectively in the damage (and first) phase of a bifurcated trial, and let J^s denotes A's expected settlement on damages after litigating damages.[44]

A will sue B if

$$V^a = r^{a1}J^s + r^{a2}(p^aJ^2 - ka) - (1 - k)a \geq 0 \qquad (21)$$

or if the expected value of A's claim *prior* to litigating damages is ≥ 0. Observe that A expects to drop his lawsuit and lose $(1 - k)a$ if damages are set at J^0; to settle the entire lawsuit for $J^s \geq p^aJ^1 - ka$ if damages are J^1; and to litigate liability if damages are J^2. A will sue if the expected value of the latter two outcomes are greater than the cost of litigating damages, the price A must pay to learn what damages are.

Recall that in a unitary trial (where there is no stipulation on damages), A will sue if $V^a(u) = p^aJ^a - a \geq 0$ where J^a is A's estimate of expected damages. In this example, $J^a = r^{a0}J^0 + r^{a1}J^1 + r^{a2}J^2$. It follows that

$$V^a - V^a(u) = - r^{a0}(p^aJ^0 - ka) + r^{a1}(J^s - (p^aJ^1 - ka)) > 0 \quad (22)$$

because (1) the expected value of litigating liability is negative when damages equal J^0 and (2) $J^s \geq p^aJ^1 - ka$.[45] This result has an intuitive explanation. Under reverse bifurcation, A has the option to drop his suit and cut his losses if damages turn out to be too small to make liability worth litigating. A also expects that for some range of damages, he will settle and save the cost of litigating liability. Both factors raise the expected value of A's claim under reverse bifurcation compared to a unitary trial.

Next consider the choice between litigating and settling both liability and damages. Since expression (22) is positive, A's minimum demand is greater under reverse bifurcation than under a unitary trial. The difference between B's maximum settlement offer under reverse bifurcation and a unitary trial equals

$$V^b - V^b(u) = -r^{b0}(p^bJ^0 + kb) - r^{b1}(p^bJ^1 + kb - J^s) < 0. \qquad (23)$$

Not surprisingly, reverse bifurcation reduces B's maximum offer because B anticipates that A will drop his claim if damages equal J^0 which saves B $p^bJ^0 + kb$, and that the parties will settle liability for an amount less than $p^bJ^1 + kb$ if damages equal J^1.[46] Since

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[44]To simplify I assume that the parties split the difference when they settle. Since litigation costs are identical $J^s = (p^a + p^b)J^1/2$.

[45]If the parties are mutually pessimistic ($p^a < p^b$), they will not litigate liability even if damages equal J^2. Then,

$$V^a - V^a(u) = - r^{a0}(p^aJ^0 - ka) + r^{a1}(J^{s1} - (p^aJ^1 - ka)) + r^{a2}(J^{s2} - (p^aJ^2 - ka)) > 0 \qquad \text{where } J^{s1}$$

and J^{s2} equal the settlement if damages turn out to be J^1 and J^2 respectively. Since each of the settlements is $\geq$ A's expected claim if liability is litigated, all three terms above are positive.

[46]Under reverse bifurcation, B's expected loss or maximum settlement offer equals

$$V^b = r^{b1}(J^s) + r^{b2}(p^bJ^2 + kb) + (1 - k)b$$

In a unitary trial, B's expected loss equals

$$V^b(u) = p^b(r^{b0}J^0 + r^{b1}J^1 + r^{b2}J^2) + b.$$

B's maximum offer falls while A's minimum demand increases, the likelihood of settling will be less under reverse bifurcation than a unitary trial.

In short, although reverse bifurcation reduces the cost of litigating a particular case, the overall cost of litigation may rise because the number of lawsuits will increase and the settlement rate will decrease. The added incentives to sue and to litigate under reverse bifurcation will be greater, the greater is r^{a0} and r^{b0}, the greater the potential savings to A and B from A's dropping his law suit when $J = J^0$, and the greater the gains from settling when $J = J^1$.

Let me turn briefly to a comparison of ordinary bifurcation (where liability rather than damages is litigated first) and reverse bifurcation. Assume that A would sue under either form of bifurcation. Since reverse bifurcation holds out the prospect of saving the cost of litigating liability while bifurcation holds out the prospect of saving the cost of litigating damages, the cost advantage of one over the other depends on (1) the relative cost of litigating damages relative to liability and (2) the likelihood of achieving these cost savings. In the case of reverse bifurcation, (2) depends on the sum of (a) the probability that a trial on damages will yield damages below the minimum amount A requires to maintain his suit and (b) the probability that damages will be below the threshold that induces the parties to litigate rather than settle assuming mutual optimism on liability.[47] In the case of ordinary bifurcation, (2) depends positively on (a) the probability that the plaintiff loses liability and (b) the lower the degree of mutual optimism with respect to damages (given that the plaintiff wins liability).[48]

Although both types of bifurcation lead to expected cost savings compared to a unitary trial, the same factors that create these cost savings also increase the aggregate cost of resolving disputes because they increase the likelihood that plaintiffs will sue and that the parties will litigate rather than settle their claim. In sum, the choice between ordinary and reverse bifurcation is not obvious. Superficially, one might think the choice should be driven by a comparison of the expected cost savings in a particular lawsuit, which depends on a comparison of the cost of litigating damages versus liability and the likelihood that these costs will be avoided. Such an approach ignores the positive relationship between the expected cost savings in a particular suit and the aggregate increase in the number of law suits and decrease in the proportion of settlements caused by the reduction in expected cost per suit. Indeed, if the latter two

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The difference is given by equation (23) in the text.

[47]If the the parties are mutually pessimistic with respect to liability, they will never incur the cost of litigating liability. After litigating damages, A will either drop his suit or the parties will settle liability. Thus, the probability of avoiding the cost of litigating liability equals one.

[48]The less the degree of mutual optimism on damages, the more likely the parties will settle damages (conditional on A winning liability) and the greater the probability that the cost of litigating damages will be avoided.

effects dominate, the type of bifurcation that produces the greatest cost savings per case could produce the greatest increase in aggregate cost.

III. Sequential Trials on Many Issues

I noted in the introduction that bifurcation or separation applies to any dispositive issue that can be litigated first, where other issues will be litigated subsequently only if the first is decided in a particular way. Imagine, a copyright infringement suit in which the court first decides whether the statute of limitation bars the plaintiff's suit. If the plaintiff prevails on this issue at summary judgment, the court will then hear evidence on the merits of the suit. Or consider a tort suit claiming that a manufacturer's product causes birth defects in children of parents exposed to the product. By first deciding whether the product caused such injuries, issues such as negligence and damages will be litigated only if causation is found.[49]

Limiting a sequential trial to a single issue (e.g., liability) simplifies the presentation but restricts the kinds of questions one asks. Since the boundaries of an issue are sometimes arbitrary, one may be able to separate one issue into several narrower

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[49]Separating a single liability issues (in which the remaining liability issues and damages are jointly litigated conditional on the plaintiff winning the separated issue) has the same effects on the incentive to sue and the choice between settling and going to trial as bifurcating liability and damages. To see this let $p^a = p^{a1}p^{a2}$ and $p^b = p^{b1}p^{b2}$ where "1" and "2" denote the two liability issues, and assume there is no disagreement on damages ($J = J^a = J^b$). In a sequential as opposed to a unitary trial, the court will decide issue "1" before hearing evidence on issue "2". Working backwards, assume A wins issue "1." The expected value of A's claim (conditional on winning issue "1") equals $p^{a1}J - (1 - k)a$ which also represents the minimum that A will settle for if he wins issue "1" but before issue "2" has been litigated. Let $p^{b2}J + (1 - k)b$ equal B's expected liability or maximum settlement offer conditional on losing issue "1." The parties will settle issue "2" provided $p^{b2}J + (1 - k)b \geq p^{a2}J - (1 - k)a$ or $(1 - k)(a + b) \geq p^{a2}J - p^{b2}J$. Let J^s denote the settlement. Then, $V^a = p^{a1}(p^{a2}J - (1 - k)a) - ka$ or $p^{a1}J^s - ka$ depending upon whether A expects to litigate or settle issue "2." (If A is uncertain about whether "2" will be litigated, then V^a is a weighted average of the last two expressions.) In a unitary trial (where the court decides the case after hearing evidence on both issues) the parties will stipulate to "2" provided $(1 - k)(a/p^a + b/p^b) \geq p^{a2}J - p^{b2}J$. Let J^s also denote the stipulated agreement. Then, $V^a(u) = p^{a1}J^s - ka$ or $p^{a1}p^{a2}J - a$ depending on whether the parties stipulate or litigate issue "2" in a unitary trial. Similarly, B's expected liability is either $V^b(u) = p^{b1}J^s + kb$ or $p^{b1}p^{b2}J + b$ depending on whether the parties stipulate or litigate issue "2" in a unitary trial. Just as in our analysis of bifurcation, we can divide disputes into three categories (see Figure 1). In *Category I*, there is no difference between a unitary and separate trial because issue "2" is not litigated; in *Category II*, the parties expect to litigate issue "2" in a separate trial (conditional on A winning issue "1") but stipulate to issue "2" in a unitary trial; in *Category III*, the parties litigate issue "2" in both a separate and unitary trial. As we showed earlier, there are no systematic differences with respect to A's incentive to sue and the number of trials for disputes in the first two categories. In *Category III*, a sequential trial increases the expected value of A's claim and reduces the expected liability of B compared to a unitary trial. Hence a sequential trial increases the number of lawsuits and reduces the settlement rate.

issues.[50] Consider the above copyright example. In addition to the statute of limitations issue, suppose B argues that A's copyright is invalid; that he did not copy from A even if the copyright is valid; that even if he did copy, he did not copy protected expression but took ideas; and even if he copied expression, it was a fair use. Now there are five potentially separable liability issues for if the defendant wins on any of them, he wins the lawsuit. Separation, therefore, raises several questions. How many issues should be separated in a sequential trial? Which issues should be separated? And in what sequence should issues be decided?

A. The Number of Issues to Separate

Suppose there are n potentially separable (and, therefore, dispositive) issues and society desires to minimize the cost of litigation per case without prejudicing either party (i.e., without affecting the probability the plaintiff or defendant prevails in the litigation).[51] How many of the n issues should be decided separately before litigating the remaining issues together? And given the number of issues decided separately, what is the optimal sequence in which to litigate them?

Let p_i = the probability the plaintiff prevails on the ith issue (i = 1,...,n); c_i = the cost of the ith issue when it is litigated *jointly* with other issues; and f_i = the additional cost when the ith issue is litigated separately where $f_i \geq 0$ measures diseconomies from separation. If $f_i = 0$, there are no diseconomies so it cost the same to litigate an issue separately or jointly with other issues. If there are additional costs associated with deciding an issue separately (e.g., such as the cost of repeating evidence or the extra cost of deliberating and deciding an issue separately compared to the cost of deciding it with other issues), then $f_i > 0$ and it costs more to litigate an issue separately. For example, suppose c_1, c_2 and c_3 each equal \$1, and it cost \$.10 to decide each issue separately but

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[50]Indeed, one may be able to subdivide issues ad infinitum although the restriction that each issue be dispositive may limit this process. In this section, therefore, I am not addressing the case of the plaintiff who brings multiple claims against the defendant where the claims may be separated and one or more disposed of (say on summary judgment) without disposing of the remaining claims. I focus on separating issues in a given claim where each issue is dispositive (i.e., if the plaintiff loses an issue, he loses the case). I add, however, that separating claims can be dispositive in some instances. For example, the plaintiff may choose to drop his entire suit if certain claims are thrown out on summary judgment. This is analogous to my analysis of reverse bifurcation where litigating damages may be dispositive because if damages turn out to be low, the plaintiff drops his case.

[51]I put to one side the effects that lower litigation costs per case has on the number of lawsuits and the choice between settling and litigating. Obviously, the effects are similar to our analysis of bifurcation since a sequential trial on n issues tends to increase the value of the plaintiff's claim and reduce the settlement rate. I add that the cost savings from a sequential trial that includes issues that go to the merits of the case may be small. Once a trial begins, there is unlikely to be sufficient delay between many of the issues to defer the costs of preparation. Then, minimizing total litigation costs is roughly consistent with maximizing social welfare since the number of suits and the settlement/trial choice may remain approximately constant.

only \$.10 to decide them jointly. Then f_i = .10 and it costs \$3.10 to litigate the three issues together (\$.10 + \$3.00), \$3.20 to litigate one issue separately and the other two together (\$1.10 + \$2.10), and \$3.30 to litigate each separately.[52]

Initially, I assume that the plaintiff has an equal probability of prevailing on each issue and that the cost of litigating and deciding each issue is identical (i.e., $c_i = c$ and $f_i = f$ for all issues). This assumption allows me to abstract from the question of the optimal sequence in which to litigate different issues (since I show later that the probability and cost affect the sequence) and to focus on how many issues to separate.[53]

Assume we separate m issues ($m \leq n - 1$).[54] Expected litigation costs equal

$$C(m) = (1 - p^m)(f + c)/(1 - p) + p^m[f + (n - m)c] \qquad (24)$$

where p^m is the probability of the plaintiff prevailing on m issues (and, therefore, the probability the plaintiff wins the case).[55] C(m) is increasing in p (provided m > 0) because the greater is p, the greater the likelihood that each issue will be litigated. Separating an additional issue affects cost as follows:

$$C(m + 1) - C(m) = p^m[pf - (1 - p)(n - m - 1)c]. \qquad (25)$$

If separation creates no diseconomies (i.e., f = 0), the term in brackets in (25) will be negative (since $m - 1 < n$) and C(m) will decline as m increases. Since it costs the same to litigate an issue separately and jointly, the only effect of separating an additional issue is to increase the probability that the remaining issues will not be litigated (because there is a positive probability (1 - p) that the plaintiff will lose that issue) which lowers

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[52]One cannot litigate two issues separately and the third jointly because there are only three issues.

[53]By assuming there are n dispositive issues, I am implicitly assuming that each issue cannot be subdivided into additional dispositive issues for possible separation.

[54]If all n issues are separated, m will equal (n - 1) because separating (n - 1) issues leaves one additional issue which, if litigated, must be tried separately since all prior issues have been litigated. Hence the maximum value for m is (n - 1)

[55]We can derive (24) as follows. Suppose m issues are separated. The expected cost of litigating the first issue is f + c; the expected cost of the second issue is p f + c (i.e., its cost multiplied by the probability it will be litigated); the expected cost of third issue is p^2 f + c and so forth. Thus, the expected cost of m separate issues equals f + c $(1 + p + p^2 + .. + p^{m-1})$. Multiplying and dividing by (1 - p) yields the first term in equation (24). The second term equals the expected cost of litigating the remaining issues jointly which equals the probability (p^m) that these issues will be litigated multiplied by their cost which equals (n - m)c plus f. I am assuming, therefore, that the cost of deliberating and deciding a single issue is identical to the cost of deciding a group of issues — i.e., if it costs \$.10 to decide a single issue, it costs \$.10 to decide a group of issues. Although unrealistic, this assumption simplifies the analysis. Alternatively, I could allow the cost of deciding issues to increase with the number of issues jointly decided but at a decreasing rate so that there are still diseconomies from separation — e.g., it cost \$.10 to decide a single issue, \$.19 to decide two issues jointly but \$.20 to decide them separately, \$.27 to decide three issues jointly but \$.30 to decide them separately, etc. This would complicate the analysis without changing the basic results. Note that if all issues are separated (m = n - 1), the term in brackets in (24) equals the cost of the nth issue (or the m + 1 issue) which is [f + c] or the same cost as any other separated issue.

expected litigation costs. Differently stated, when f = 0, expected litigation costs are minimized by litigating each dispositive issue separately. Not surprisingly, diseconomies (f > 0) explain why fewer than n issues are separated. Then, the greater f and the greater m, the more likely that separating an additional issue will increase expected litigation cost. C will be minimized at m* when separating one more or one less issue increases C (i.e., $C(m* + 1) > C(m*)$ and $C(m* - 1) > C(m*)$). As a first approximation, this occurs when $pf - (1 - p)(n - m - 1)c \quad 0$ for then the marginal cost of separating an additional issue (i.e., the probability an additional issue will be litigated times the added cost of litigating it separately) approximately equals its marginal benefits (i.e., the probability that the remaining issues will not be litigated times their cost).[56]

B. The Ordering of Issues

Now consider the ordering of issues in a sequential trial. In the prior example, ordering was irrelevant because all issues had identical costs and identical probabilities of the plaintiff winning. Now suppose issues j and k are both separated but their costs and probabilities differ. Which should be litigated first? One can show that if

$$(f_j + c_j)/(1 - p_j) < (f_k + c_k)/(1 - p_k) \qquad (26)$$

expected litigation cost will be lower if issue j is litigated before k. If inequality (26) is reversed, k should be litigated before j.[57] Inequality (26) is more likely to hold the lower

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[56]Two corner solutions should be noted. If pf is everywhere less than $(1 - p)(n - m - 1)c$, diseconomies are so small that all n issues should be separated. If pf is everywhere greater than $(1 - p)(n - m - 1)c$, diseconomies are so great that all issues should be litigated together.

An alternative formulation of (25) assumes that there are n issues of unit length but each can be continuously subdivided so that n is a continuous function over the interval [0,n]. Then (25) becomes

(i) $\quad C(m) = \int_{x=0}^{m} p^x(f + c + c)dx + p^m[f + (n - m)c]$

Minimizing C with respect to m yields the equivalent of (25) or

(ii) $\quad \partial C(m)/\partial m = p^m(f + c) + p^m \log p[f + (n - m)c] - p^m c = 0.$

Since $\log p \quad - (1 - p)$, (ii) can be rewritten as

(iii) $\quad \partial C(m)/\partial m = p^m \quad pf - (1 - p)(n - m)c] = 0$

which is nearly identical to (25) and the condition for minimizing expected cost in the discrete case described in the text. Although the continuous case yields an optimal number of issues (of unit length) to separate, it leaves indeterminate the question of subdividing each unit length issue into further issues.

[57]Suppose m issues are separated, j and k are adjacent issues and neither is the last issue separated. (The last separated issue raises an additional problem that I examine shortly.) Let $C(m)_{jk}$ and $C(m)_{kj}$ denote respectively expected litigation cost when j is litigated before k and k before j. We can write

(i) $\quad C(m)_{jk} = (f_1 + c_1) + p_1(f_2 + c_2) + p_1p_2(f_3 + c_3) + ... + p_1p_2......p_{j-1}(f_j + c_j) + p_1p_2..p_{j-1}p_j (f_k + c_k) + p_1p_2..p_{j-1}p_jp_k(f_{k+1} + c_{k+1}) + ...$

(ii) $\quad C(m)_{kj} = (f_1 + c_1) + p_1(f_2 + c_2) + p_1p_2(f_3 + c_3) + ... + p_1p_2......p_{j-1}(f_k + c_k) + p_1p_2..p_{j-1}p_k (f_j + c_j) + p_1p_2..p_{j-1}p_kp_j(f + c_{k+1}) + ...$

Canceling common terms yields $C(m)_{jk} < C(m)_{kj}$ if

is the cost of issue j relative to k, and the greater is the probability of losing issue j relative to losing k. By making pair wise comparisons among separated issues one can determine the sequence that minimizes litigation costs. Intuitively, expression (26) implies that issues that are less costly and have the greatest probability of ending the litigation should be litigated earliest. At least with respect to the first component ($f_i + c_i$), this seems roughly consistent with practice. Procedural issues, which are likely to be less costly to litigate and decide, are often separated and disposed of at the pleading stage.[58]

Deciding which should be the last issue separated raises a special problem because if the plaintiff loses that issue, the cost saving is not just the cost of the next issue (as in the case of ordering issues j and k in (26)) but the cost of all issues litigated jointly.[59] Suppose we plan to separate m + 1 (< n - 1) issues; m have already been selected and ordered according to their values ($f_i + c_i$)/(1 - p_i); and we want to separate one more issue from the remaining n - m issues.[60] Suppose j and k have not yet been separated. We would separate j rather than k if

$$(f_j + c_j) + p_j(f + C_{n-m} - c_j) < (f_k + c_k) + p_k(f + C_{n-m} - c_k) \qquad (27)$$

where C_{n-m} denotes the sum of the cost of the n - m remaining issues (which includes both c_j and c_k) and f denotes the cost of jointly deciding (n - m - 1) issues.[61] assuming that cost does not depend on whether j or k is decided jointly. Observe that the cost of the last issue separated has two components: a direct cost (either ($f_j + c_j$) or ($f_k + c_k$)) and an expected cost equal to the probability the plaintiff prevails on this issue times the cost of jointly litigating the remaining issues.

I add several further points.

1. Suppose litigating j before k satisfies inequality (26) when both j and k are separated. If only one but not both of the issues is separated, it is possible that separating k rather than j will yield lower costs. A switch can occur because greater weight is given to the probability the plaintiff loses in selecting the last issue than in selecting earlier issues . To see this, rewrite (26) as ($f_j + c_j$)+ $p_j(f_k + c_k) < (f_k + c_k) + p_k(f_j + c_j)$

(iii) $(f_j + c_j) + p_j(f_k + c_k) < (f_k + c_k) + p_k(f_j + c_j)$

Rearranging terms yields inequality (26) in the text.

[58]Just as in the analysis of bifurcation, I note that the disposing of cases at the pleadings stage increases the incentive of the plaintiff to sue and reduces the incentives to settle out of court at the outset. Whether these factors would be sufficient to offset the effect of separation on lower the cost per litigated case is unclear.

[59]When neither j or k is the last issue separated, the probability of litigating the nonseparated issues equals $p_1p_2...p_jp_k...p_m$ when j comes before k, and $p_1p_2...p_kp_j...p_m$ when k comes before j. Given the assumption of independence, the two probabilities are equal.

[60]Note that ($f_m + c_m$)/(1 - p_m) is less than the corresponding value for each of the n - m remaining issues.

[61]I assume that f is the same whether j or k is decided jointly.

and note that $(f + C_{n-m} - c_j) > f_k + c_k$ and $(f + C_{n-m} - c_k) > f_j + c_j$ provided two or more issues are litigated jointly and $f \geq f_j$ and f_k. Therefore, even if $f_j + c_j < f_k + c_k$ but $p_k < p_j$, issue j could come first when separating both because $f_j + c_j < f_k + c_k$ dominates; yet k could come before j when separating only one because the probability difference (which is weighted by the cost of litigating the remaining issues jointly) dominates.

2. Imagine there are many potentially dispositive issues but only a single issue is separated while the others are jointly decided (providing the plaintiff wins the separated issue). Rewriting (27), one finds that expected litigation costs are minimized by separating the issue which yields the lowest value for

$$E(C_i) = (f_i + c_i)(1 - p_i) + p_i(f_i + f + C) \qquad (28)$$

where $C = \sum c_i$ where $i = 1,...n$. Note that (28) is an average of the two possible cost outcomes, $(f_i + c_i)$ if the plaintiff loses i and $(f_i + f + C)$ if the plaintiff wins i, weighted by their respective probabilities. Since $C > c_i$, the issue most likely to satisfy (28) is one where both c_i and p_i are low relative to the other issues.

3. One can determine the optimal number (m^*) of issues to separate when their costs and probabilities differ by comparing expected litigation costs for different values of m assuming that issues are optimally ordered for each value of m. Similar to the example where all issues have identical p's and c's, m^* would occur where both $C(m^*+ 1)$ and $C(m^*- 1) > C(m^*)$.

4. I have greatly simplified the analysis of separation by assuming that both the probability the plaintiff prevails on an issue and its cost are independent of the ordering of issues or whether they are separated. This is a useful approximation for it allows one to focus on the importance of probabilities and costs in determining the optimal sequence and number of issues to separate. Since these factors are critical determinants of expected litigation cost and the potential cost saving from separation, they are likely to play a similar role in a more complicated model of separation.

IV. Concluding Remarks

In this paper I first analyze the effect on litigation of a sequential or bifurcated trial on liability and damages as opposed to a unitary trial on both issues. Bifurcation is a special case of the more general problem of separating issues for trial. Thus, I also analyze the effects of a sequential trial on many dispositive issues in which each issue is decided after it is argued rather than at the end of the case. The main findings of my analysis are as follows.

1. Bifurcating liability and damages tends to lower the expected cost of litigating a given dispute compared to a unitary trial because the cost of litigating damages will be saved if the plaintiff loses liability. This expected cost reduction increases the expected value of each potential plaintiff's claim which increases both his incentive to sue and the minimum sum he will accept to settle rather than litigate his case. Less obviously,

bifurcation reduces the defendant's expected loss from litigation and so reduces his maximum settlement offer. In short, the net effect of bifurcation on total litigation costs is uncertain. Although bifurcation lowers the expected cost of litigating a given dispute, it increases the number of plaintiffs who sue and the fraction of cases that go to trial. If the first factor dominates, bifurcation will lower aggregate costs; if the latter two factors dominate, bifurcation will increase aggregate costs.

2. These findings are subject to several qualifications. First, if differences in the parties' estimates of damages is less that the relevant cost of litigating damages, the parties will find it mutually beneficial to stipulate to damages in a unitary trial and settle damages (conditional of the plaintiff winning liability) in a bifurcated trial. In this case, a unitary trial approximates the outcome of a bifurcated trial because, in both, only liability is litigated. Thus, the added incentive to sue and to litigate under bifurcation occurs for those disputes in which the parties neither stipulate or settle damages. Second, if bifurcation causes cost diseconomies that are larger than the expected cost savings described above, then it can lead to fewer suits and a higher settlement rate than for unitary trials. Bifurcation, however, may sometimes create economies not diseconomies. For example, if the defendant brings a counterclaim for damages, bifurcation may eliminate litigation on one of the damage claims compared to a unitary trial that litigates both claims. Economies from bifurcation would reinforce the conclusions in "1" above. Third, bifurcation may lower rather than raise the expected value of the plaintiff's claim if it lowers the plaintiff's probability of prevailing (weighted by expected damages) by more than it lowers his expected litigation cost . This might arise if a jury is more favorably disposed to a plaintiff's liability claim when it hears evidence on damages that would be excluded in the liability phase of a bifurcated trial. Then, bifurcation would lead to fewer (not more) lawsuits but a lower settlement rate than for unitary trials.

3. Reverse bifurcation—where damages are tried before liability—has similar effects as ordinary bifurcation. Damages may be a dispositive issue because if a court finds low damages, the plaintiff may drop his case or be more willing to settle liability. Hence, reverse bifurcation creates expected cost savings which lead to more suits and a lower settlement rate. The net effect of reverse bifurcation (compared to unitary trials) on aggregate litigation costs depends on the importance of the latter two factors relative to the expected cost saving per litigated case.

4. A sequential trial may involve many potentially dispositive issues. This leads to two related questions. How many dispositive issues should be separated? And which issues should be separated and in what order? With respect to the first question, litigation costs (per case) will be minimized when the marginal cost of separating an additional issue (which equals the probability the issue will be litigated multiplied by the added cost of deciding it separately) equals its marginal benefit (which equals the reduction in the probability that the remaining issues will be litigated times their cost).

With respect to the second question, issues should be ordered by comparing the cost of deciding an issue separately and the probability that the plaintiff wins the issues. The lower the cost and the lower the probability, the greater the benefits from separating that issue and the earlier it should be litigated.

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