Decreasing-Liability Contracts

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ABSTRACT

Like constructing a building, performance on many contracts occurs in phases. As time passes, the promisor sinks more costs into performance and less expenditure remains. For phased performance, we show that optimal liability for the breaching party decreases as the remaining costs of completing performance decrease. In brief, efficiency requires a decreasing-liability contract. To implement such a contract, we recommend deducting past expenditures on incomplete performance from liability. We show that some types of progress-payment contracts are materially equivalent to decreasing-liability contracts. Our analysis should prove useful for elucidating progress-payment contracts and for drafting and litigating phased contracts.

Like constructing a building, performance on many contracts occurs in phases. As time passes, the promisor sinks more expenditure into performance and less expenditure remains. Unless the parties specify otherwise in the contract, the breaching party in a phased contract is liable under positive law for the entire loss suffered by the promisee because

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[*Journal of Legal Studies,* vol. 33 (January 2004)]

of a breach, subject to some well-known limitations.[1] Under this rule, as long as part performance confers no benefits to the promisee, liability for the entire loss remains constant throughout the contract's phases. In contrast, we show that liability for a breach should ideally decrease throughout the phases of a contract, regardless of whether part performance confers benefits to the promisee. Specifically, we show that, compared with constant liability, deducting past expenditures from liability often improves incentives.

The following example illustrates our analysis.

Example 1: Promisor's Sunk Costs. Buyer and Developer make a contract in which Buyer immediately pays Developer 90 for the promise to construct a building that Buyer values at 100. Developer spends 40 on architectural drawings and a concrete foundation that cannot be recovered or reused. Developer defaults. Buyer fails to find an alternative builder and abandons the project without receiving any benefit from it. A breach causes Buyer to lose 100. Should Developer's liability to Buyer equal 100 or 60?

Under positive law, liability for the breach of a phased contract equals the promisee's expected value of performance minus the benefit conferred by part performance (Farnsworth 1999, p. 803; American Law Institute 1981, sec. 347, comment b). In example 1, however, there is no benefit to Buyer,[2] so Developer's liability equals 100. We will show, however, that a liability of 60 often produces better incentives. Instead of deducting benefits conferred, deducting costs incurred often increases the contract's value to the parties by improving their incentives.

The general question that we pose by example 1 is, How does deducting or not deducting past expenditures from the breaching party's liability affect the parties' incentives to maximize the contract's value? Our answer follows from two simple facts about incentives:

First, in many circumstances, the promisor will breach or perform

1. Limitations include unforeseeability, uncertainty, and mitigation of damages. See American Law Institute (1981, secs. 350–52); Farnsworth (1999, pp. 806–35).

2. For simplicity, we assume throughout the paper that part performance created no value to the promisee. Our analysis does not change, however, if part performance created value to the promisee, provided that the value is less than past costs. We could reframe our examples and analysis under the more general (but more complicated) assumption that part performance creates some value that is less than past costs. Under positive contract law, if past costs create value for the promisee, the breaching party's liability will equal the expected value of performance minus the value created. Under our model, the breaching party's liability will equal the expected value of performance minus past costs.

depending on which is cheaper. When performance occurs in phases, less expenditure remains as time passes. Since the cost of completing performance decreases with time, lower damages are typically sufficient to induce performance. This is true regardless of whether part performance created any benefit. Thus, the negative effects on the promisor's incentives from deducing past expenditures tend to decrease with time.

Second, turning from the promisor to the promisee, we note that by assisting the promisor, the promisee can often increase the probability of performance or lower its costs. For example, Buyer in example 1 may assist Developer in obtaining construction permits or reveal useful information after the contract is made. Reducing damages increases the promisee's incentives to assist the promisor's performance.

Combining these two facts, we will show that decreasing liability in the contract's later phases has a large positive effect on the promisee's incentive and a small negative effect on the promisor's incentives. Thus, on balance, a decreasing-liability contract usually increases the contract's value relative to a constant-liability contract.

This proposition is true when performance occurs in phases and the promisee's assistance increases the contract's value. When the promisee's assistance increases the contract's value, the promisor has an interest in the promisee's assistance, which we call the "assistance interest."

Scholars appreciate that explicit terms in contracts often require one party to assist the other, which protects the assistance interest. To illustrate, Buyer may have an obligation to assist Seller by preparing to receive a delivery of goods. Scholars insufficiently appreciate that explicit terms in contracts inadequately protect the assistance interest. For example, explicit terms that require unobservable or unverifiable acts of assistance are ineffective. (Likewise, liquidating damages, which effectively prevent the promisee's overreliance, is an ineffective incentive for the promise's assistance.)[3] In contrast, deducting costs incurred from damages owed provides an effective incentive for the promisee to assist, even for unobservable or unverifiable assistance. Reducing damages is

3. Liquidated damages are invariant with respect to reliance. Consequently, liquidated damages solve the problem of overreliance by making the promisee internalizes the risk of marginal reliance (Cooter 1985). Liquidated damages, however, do not solve the problem of the promisee's assistance. To see this fact, note that the usual formula for optimal liquidated damages sets them equal to the loss that a breach would cause a promisee who relied at the efficient level. Under these conditions, however, the promisee will be fully compensated for a breach, so he has no incentive to reduce its probability by assisting the promisor.

often the most practical way to protect the assistance interest. A decreasing-liability contract protects the assistance interest even when assistance is unobservable or unverifiable.

The problem that scholars neglect and we address is finding the optimal deduction from damages to protect the assistance interest. Liability can decrease at many different rates. For practical reasons that we explain later, we recommend a specific rate of decrease: set the breaching party's liability equal to the promisee's value of performance minus the breaching party's past expenditures on performance. In example 1, this recommendation results in a liability of 60.[4]

Contracts scholars and transaction lawyers do not currently use our phrase "decreasing-liability contract." Many industries, however, use contracts that require Buyer to make payments to Seller for costs incurred in completing each phase of a contract. Sometimes Buyer cannot recover past progress payments when Seller terminates before completing the project's final phases. Nonrecoverable progress payments for costs incurred closely resemble deductions of costs incurred from expectation damages. Progress payments are an important way to protect the assistance interest. Later we explain the circumstances under which nonrecoverable progress payments are materially equivalent to decreasing-liability contracts.

Our paper begins with a general discussion of contractual liability and incentive effects. Section 1 contrasts alternative liability rules, and Section 2 explains the ideal contract for the promisor and the promisee's incentives. These two sections concern contracts in general, including both phased and abrupt-performance contracts. Sections 3 and 4 turn to phased contracts and develop the basic model of decreasing liability. Section 5 extends the basic model to allow for surprises concerning future costs. Section 6 discusses the timing of payments and progress-payment contracts. Section 7 introduces the possibility of renegotiation into the model. Section 8 explains the advantages of decreasing-liability contracts over other legal mechanisms, and Section 9 identifies conditions under which decreasing-liability contracts are best. Section 10 provides perspective and a conclusion about decreasing-liability contracts. Appendix A develops the main example in the paper more explicitly, and Appendix B contains a mathematical model with proofs of our propositions. Our

4. Sometimes the promisee also suffers other losses such as consequential losses, which we do not discuss here. Courts should award damages for those losses under either prevailing contract law or a decreasing-liability legal regime.

model should prove useful for understanding, drafting, and litigating decreasing-liability and progress-payment contracts.

1. FORMS OF LIABILITY

We begin by characterizing some alternative forms of liability. Positive law encompasses three major damage measures: expectation, reliance, and restitution (Fuller and Perdue 1936). Example 2 represents each one.

Example 2: Alternative Damages. Buyer and Developer make a contract in which Buyer immediately pays Developer 90 for the promise to construct a building. In reliance on the contract, Buyer spends 5 preparing to move. Buyer values performance at 100. Developer spends 40 on architectural drawings and a concrete foundation that cannot be recovered or reused. Developer defaults. Buyer fails to find an alternative builder and abandons the project without receiving any benefit from it. What is Developer's liability?

Damages for loss of the contract's expected value, which is the usual legal remedy, require Developer to pay 100 to Buyer. Damages for reliance require Developer to return the payment of 90 and also pay 5 in compensation for Buyer's expenditures on moving preparations. Restitution requires Developer to return only the payment of 90. The axes in Figure 1 represent the promisor's liability to pay damages and the promisee's entitlement to receive damages. Notice that this progression from expectation to reliance to restitution moves downs the 45-degree line in Figure 1 from (100, 100) to (95, 95) to (90, 90).[5]

Figure 1 applies to all contracts, including contracts in which performance is abrupt or phased. Now we explicitly relate Figure 1 to phased contracts. In a phased contract, decreasing liability implies that the contract moves down the 45-degree line as the promisor goes through the phases of performance. For practical reasons, we advocate moving down the 45-degree line at a particular rate. Specifically, we advocate taking expectation damages as the baseline and moving down the 45-degree line according to the extent of the breaching party's expenditures. Expectations are the baseline, and the breaching party's past expenditures are the deduction. To illustrate by example 2, Developer's breach

5. Note that punitive damages and disgorgement damages can move up the 45-degree line past the point (100, 100).

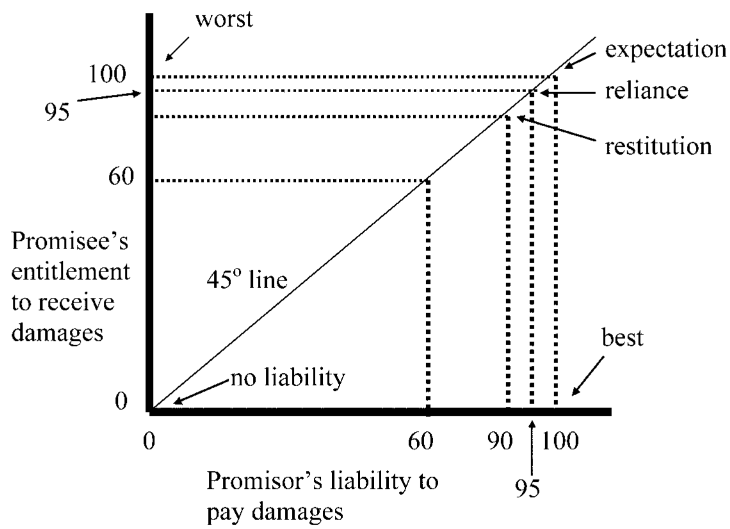

Figure 1. Liability and entitlement

before he makes any expenditures yields liability corresponding to point (100, 100), whereas Developer's breach after he spends 40 yields liability corresponding to point (60, 60). Thus, we propose a liability of 100 or 60 depending on whether the promisor has made the expenditures of 40 by the time of breach.

2. ANTI-INSURANCE

How does moving down the 45-degree line affect the contract's value? Before answering this question, we will explain why the ideal point is not on the 45-degree line. To have incentives to maximize the contract's value, each party should internalize the contract's costs and benefits for both of its parties. To supply both the promisor and the promisee with efficient incentives, each of them should bear the full loss that breach causes the other party, as well as his own loss. In example 1, Developer internalizes the costs of breach when liability to pay damages equals 100. In example 1, Buyer internalizes the cost of breach when the entitlement to receive damages equals 0. Consequently, Figure 1 describes the point (100, 0) as "best" with respect to the incentives of the two parties.[6]

In law, one party's liability to pay damages equals the other party's entitlement to receive damages. This is also true for liquidation clauses in contracts that stipulate damages. Thus, the default rules of positive law and two-party stipulations can be represented as points on the 45-degree line. The best incentives for the two parties, however, require the promisor's liability to exceed the promisee's entitlement.[7] Specifically, the point (100, 0) is best for the incentives of both parties.

To get off the 45-degree line, the parties must contract with a third party. In another paper, we propose a mechanism called "anti-insurance" to achieve this result (Cooter and Porat 2002). Anti-insurance is a contract that includes the two parties to the original contract and a third party called the "anti-insurer." In such a contract, the promisee assigns his potential right to damages to the third party before anyone knows whether a breach will occur, and the third party pays for the assignment. If a breach subsequently occurs, the promisor pays expectation damages to the third party, and the promisee receives no damages, which corresponds to the point (100, 0) in Figure 1. Consequently, both the promisor and the promisee internalize the full costs of the breach. By improving incentives, anti-insurance can significantly increase the value of a contract in principle, and the three parties can share in the expected gain. We call such a contract "anti-insurance" because it improves incentives by increasing risk, whereas an insurance contract erodes incentives by spreading risk.

3. BEST CONSTRAINED POINT

Since anti-insurance is unavailable in markets, this paper does not consider the best point in the space of Figure 1. Instead, we confine consideration to alternatives on the 45-degree line where damages paid by the breaching promisor equal damages received by the promisee. We look for the point on the 45-degree line that creates incentives for the two parties to maximize the contract's value. Movement along the 45-degree line involves a trade-off: starting from any point on the 45-degree

6. Conversely, Figure 1 describes the point (0, 100) as "worst" with respect to the incentives of the two parties.

7. Getting off the 45-degree line is called "decoupling" damages paid and received. See Polinsky and Che (1991).

line, moving down the 45-degree line generally worsens the promisor's incentives by externalizing more of the expected harm from a breach. However, moving down the 45-degree line generally improves the promisee's incentives to assist the promisor's performance. The promisee's incentives improve because the promisee internalizes more of the expected gain from assisting the promisor's performance.

As explained, the 45-degree line represents different points of a tradeoff between the promisee's and the promisor's incentives. Expectation damages (100, 100) are an unlikely candidate for the best constrained point. At this point, the promisor has fully efficient incentives to perform, but the promisee has no incentive to assist the promisor. Deducting a small amount from damages paid by the promisor and received by the promisee would decrease the promisor's incentive to perform and increase the promisee's incentive to assist. If the promisee's first dollar spent on assisting increases the contract's value by more than a dollar, then moving slightly down the 45-degree line from the point (100, 100) increases the contract's value. The following proposition, which Appendix B proves, summarizes this argument.

Proposition 1. Assume that the promisor's liability for breach equals expectation damages. Assume that the the promisor's expenditure on performance is positive. If a dollar spent on assistance by the promisee would increase the value of the contract by more than $1, then a small decrease in liability will increase the contract's value.

In the circumstances described by proposition 1, the law's presumption in favor of expectation damages does not maximize the contract's value. Note, however, that the best point on the 45-degree line is usually much closer to expectation damages (100, 100) than to no liability (0, 0), because the promisor's incentives are usually more important to the contract's value than the promisee's incentives. Moving part of the way down the 45-degree line, but much less than halfway, will often improve incentives.

The point labeled "expectation" in Figure 1 represents perfect expectation damages, which put the breached-against the promisee in the same position as performance. In practice, measures of expectation damages used by courts are imperfect. For example, courts tend to substitute objective measures of expectation damages for subjective measures that are difficult to prove. In these circumstances, the error is often in the direction of undercompensation, which corresponds to movement down the 45-degree line in our figure. Thus, imperfections in expectation damages tend to protect the assistance interest.

Replacing expectation damages with reliance or restitution damages also moves down the 45-degree line. Since reliance and restitution damages have this effect, the reader might expect us to advocate them. We accept that reliance or restitution damages often provide better incentives than perfect expectation damages for the two parties. The gain from providing an incentive for the promisee's assistance often exceeds the cost of reducing incentives for the promisor's performance. However, the optimal distance to move down the 45-degree line bears no necessary relationship to reliance or restitution. Advocating reliance or restitution damages would disguise the reason that we regard as most fundamental for reducing damages below the perfect expectation level: protecting the assistance interest.

We have been discussing damages for breach generally. This paper, however, focuses specifically on phased contracts. We will show that in contracts in which the promisor performs in phases and the promisee's assistance matters, deducting the breaching party's past expenditures from expectation damages typically provides better incentives than no deduction. Consequently, the best name for an optimal phased contract is "decreasing-liability contract."

4. BASIC MODEL OF PHASED PERFORMANCE WITH THE PROMISEE'S ASSISTANCE

To develop a model of phased contracts, Figure 2 depicts a promisor with numerous decisions. At time 0, the promisor decides to accept a price p in exchange for a promise whose performance creates v for the promisee. To remain consistent with example 2, Figure 2 sets p equal to 90 and v equal to 100. Expenditure on performance occurs in discrete phases enumerated 1, 2, 3, . . . , T. At any phase, the promisor can choose to default or else make an expenditure that is necessary to go on to the contract's next phase. If expenditure at any time decreases below the necessary level, the promisor defaults. The downward-sloping curve in Figure 2 indicates the promisor's costs that remain to complete performance, with the discrete points connected by a continuous curve. To illustrate concretely, at time 0, the promisor's expected remaining costs equal 80, so we have $C_0 = 80$. In Figure 2, the present time is t. Expenditures before t are in the past, and expenditures after t are in the

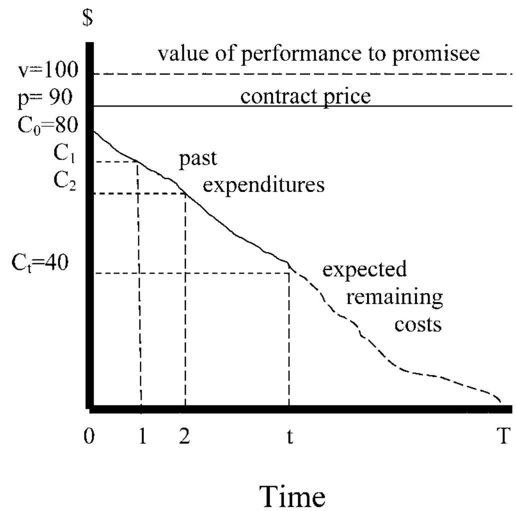

Figure 2. Decreasing expected costs in a phased contract

future. At time *t,* the promisor has already spent 40, and he expects that 40 more remain, so we have $C_t = 40$.

Now we characterize how the promisor makes decisions. At each phase *t,* the promisor defaults or continues performing according to whether the expected remaining expenditures C_t exceed liability L_t, which we write

$$\begin{aligned} C_t \le L_t &\rightarrow \text{ continue performing,} \\ C_t > L_t &\rightarrow \text{ default.} \end{aligned} \tag{1}$$

Consider the promisor depicted in Figure 2 who correctly anticipates future costs of performance. By the decision rule (1), the promisor will perform provided that liability at each point in time exceeds expected future costs C_t. Consequently, we have the following proposition, which Appendix B proves.

Proposition 2. With each phase of the contract, the expected liability required to induce performance decreases.

Thus, the minimal liability sufficient to induce performance at each phase corresponds to a decreasing-liability contract.

Proposition 2 has several important implications. Compared to a constant-liability contract, a decreasing-liability contract can provide

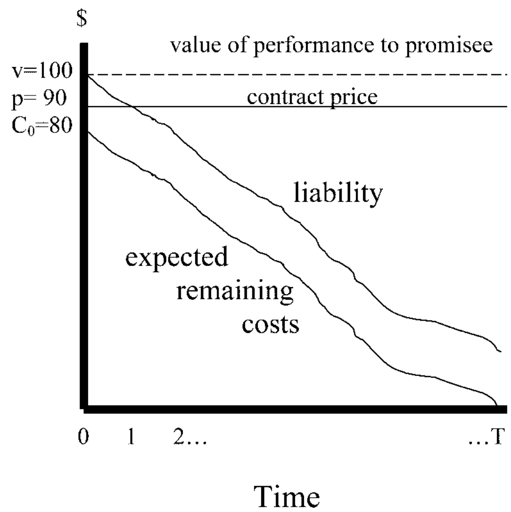

Figure 3. Decreasing liability

sufficient incentives for the promisor to perform, while also providing better incentives for the promisee to assist. Equivalently, a constant-liability contract impairs the promisee's incentives unnecessarily, especially near the contract's final phase when very small damages are sufficient to induce the promisor to perform.

Now we consider a schedule in which liability equals expectation damages minus past expenditures. Figure 3 depicts this liability curve.[8] The fact that the cost curve is below the liability curve everywhere in Figure 3 implies that performance is cheaper than liability at each phase. This observation establishes the following proposition:

Proposition 3. If past expenditures are deducted from expectation damages, and if the promisor correctly estimates future costs of performance, then the promisor performs at every phase of the contract.

Proposition 3 has an important implication: predictability favors deducting past expenditures from liability. When expenditures are pre-

8. The formula is $L_t = v - C_t$ at each point in time t. When the promisor's expectations prove accurate, the liability curve always exceeds the expected future cost of performance by the difference between the promisee's value of performance and the promisor's initial expected cost of performance, or $v - C_0$.

dictable, deducting them provides sufficient incentives for the promisor and better incentives for the promisee.[9]

In this contract, the promisee's incentives to assist increase as the promisor's performance progresses.[10] Thus, the promisee has relatively weak incentives to assist at the contract's beginning and relatively strong incentives at its end. We do not recommend this arrangement because we think that the promisee's incentives are typically more important at the contract's end than its beginning. Rather, we assume that the promisor's incentives are more important than the promisee's incentives, so the promisee's incentive should be improved only when doing so does not undermine the promisor's incentives. At an early stage of the performance, strong promisee's incentives are too detrimental to the promisor's incentives, so the parties cannot afford them. At a later stage, after the promisor incurs past costs, the parties can afford to improve the incentives of the promisee by reducing the incentives of the promisor.

5. SURPRISES

So far, we have analyzed situations in which the promisor correctly anticipates future costs. In these circumstances, proposition 3 states that performance is induced by a level of liability equal to expectation damages minus past expenditures. Now we consider the consequences of surprises, which we separate into three types: good, bad, and very bad news. News about costs is good if past and remaining costs of performance equal or fall short of the value of performance to the promisee. To illustrate by our example, news is good at time *t* if remaining costs equal or fall short of 60. The "good" news line in Figure 4 depicts the situation in which remaining costs at time *t* equal 40. News is bad if past and remaining costs of performance exceed the value of performance to the promisee. To illustrate, news is bad at time *t* if remaining

9. Note that if remaining future expenditures were observable, then liability could equal remaining future expenditures plus $1. This rule would eliminate the problem of inefficient breach. Unfortunately, remaining future expenditures are usually unobservable, so this liability rule is impractical.

10. Sometimes the pattern is different. It may happen that breach occurs at a point in time when part performance created value to the promisee that equals past costs. In these circumstances, a decreasing-liability contract that deducts past costs from expectation damages fully compensates the promisee, because damages equal the value of full performance minus the benefit received from part performance.

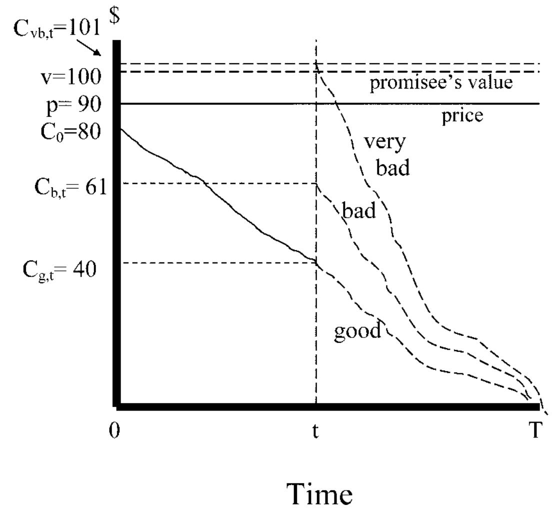

Figure 4. Good, bad, and very bad news

costs exceed 60.[11] The "bad" news line in Figure 4 depicts the situation in which remaining costs at time *t* equal 61. News is very bad if the remaining costs of performance exceed the value of performance to the promisee. To illustrate, news is very bad at time *t* if remaining costs exceed 100. The "very bad" news line in Figure 4 depicts the situation in which remaining costs at time *t* equal 101.

According to these definitions, good or bad news (but not very bad news) implies that remaining costs of performance to the promisor are less than its value to the promisee. Performance, consequently, is efficient. If, however, news is very bad, then remaining costs of performance exceed its value to the promisee, so nonperformance is efficient. The boundary between bad and very bad news thus forms the boundary between efficient performance and efficient nonperformance. To illustrate by our example, whether performance or nonperformance is efficient at time *t* depends on whether the remaining costs of performance exceed or fall short of 100.

Now we turn to the incentive effects of surprises. As we just explained, efficiency requires the promisor to perform in response to good

11. Note that the jump in remaining costs to 61 makes this into a losing contract in the sense that the expected total costs (past and future) equal 40 + 61, whereas the value of performance equals 100.

or bad news and not to perform in response to very bad news. Setting liability for breach equal to expectation damages causes the promisor to internalize the benefits of performance to the promisee as required by efficiency. Consequently, expectation damages cause the promisor to perform in response to good or bad news and not to perform in response to very bad news. To illustrate the effects of expectation damages by our example, if liability at time *t* equals 100, then the promisor performs as long as remaining costs do not exceed 100 and does not perform otherwise.

While expectation damages provide efficient incentives to the promisor, lower damages do not. Specifically, setting liability equal to expectation damages minus past expenditures on performance causes the promisor not to perform in response to bad news, which is inefficient. To illustrate by our example, if liability at time *t* equals $100 - 40$, then the promisor does not perform as long as remaining costs exceed 60. A decreasing-liability contract, consequently, causes the promisor to respond to bad news by not performing, even though efficiency requires performing. Bad news is problematic for the promisor's incentives in decreasing-liability contracts, but very bad news is unproblematic. A decreasing-liability contract causes the promisor to respond to very bad news by not performing, which is what efficiency requires.

Figure 5 summarizes these facts and the resulting problem. The horizontal axis represents remaining costs of performance at time *t,* and the vertical axis represents their probability. The three zones in Figure 5 indicate the probability of good, bad, and very bad news at time *t*. In the left zone, news is good and completing performance is efficient. In the middle zone, news is bad and completing performance is efficient. In the right zone, news is very bad and completing performance is inefficient.

We have explained that liability for expectation damages provides efficient incentives to the promisor, regardless of whether news is good, bad, or very bad. Liability for expectation damages minus past expenditures on performance, however, provides efficient incentives for the promisor who receives good or very bad news and inefficient incentives for the promisor who receives bad news. If the probability is large that remaining costs fall in the middle range of Figure 5, then decreasing-liability contracts risk undermining the promisor's incentives. If the probability is small that remaining costs fall in the middle range, however, then deducting past expenditures from liability runs little risk of undermining the promisor's incentives.

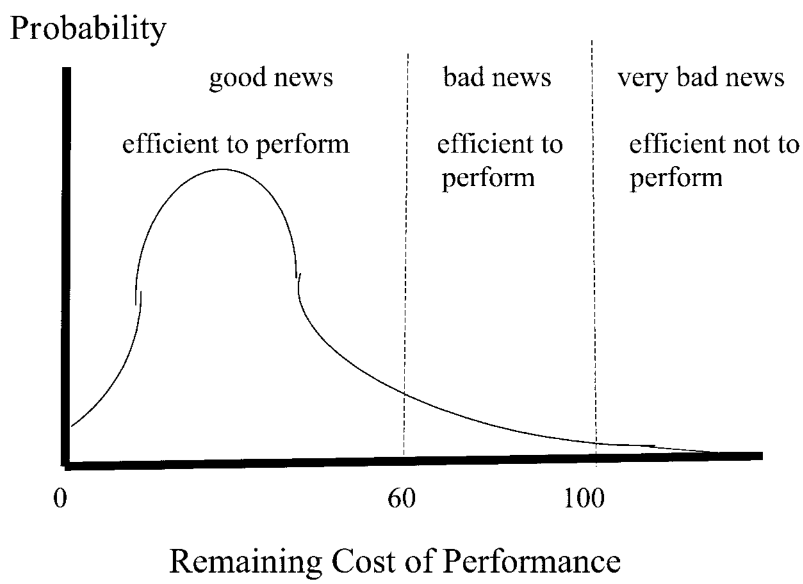

Figure 5. Response to unwelcome surprises

Note that Figure 3 depicts the vertical distance between the liability curve and the expected-remaining-cost curve as equal to 20. In Figure 3, 20 is the amount by which future costs can exceed original expected costs without affecting the promisor's decision to perform. Thus, 20 is the margin for error without harmful incentive effects. If costs remain on their expected course as depicted in Figure 3, the margin for error remains constant in absolute size. However, as the contract progresses through its phases, the margin for error increases as a proportion of expected remaining costs. To illustrate, the margin for error equals 20/80, or 25 percent, at time 0, and it equals 20/40, or 50 percent, at time *t*. Consequently, the magnitude of the error in predicting future costs required to cause a breach increases as the contract progresses.

These observations yield our fourth proposition:

Proposition 4. Assume that liability equals expectation damages minus past expenditures. Also make certain reasonable assumptions about the probability of errors in predictions. Then, the longer the contract progresses as predicted, the lower the probability of breach.

Proposition 4 implies that the probability density in the zone labeled "bad" in Figure 4, which is the problematic area for the promisor's incentives, decreases as the contract progresses as predicted.[12]

Having explained the problem of bad news, we return to the question of why we recommend the particular form of a decreasing-liability contract in which the nonperforming party pays expectation damages minus past costs. Expectation damages are the correct baseline because they cause the promisor to internalize fully the cost of nonperformance. Past costs are the best deduction for two practical reasons. First, past costs provide a sufficient margin for error that the promisor seldom receives bad news that causes inefficient nonperformance. The promisor who has sunk costs in the project usually has sufficient incentives to perform, even without internalizing the full cost of nonperformance. Second, past costs are relatively easy to observe and verify, which is why these terms figure frequently in everyday contracts or legal rules applied to them.

In some circumstances, adjusting the deduction for past costs makes sense. To illustrate, if the parties feel that bad news is likely, they might prefer to stipulate a deduction equal to half of past costs. Instead of adjusting the deduction for past costs, however, the parties might calculate the deduction on an entirely different principle. Fundamentally different principles of deduction are easy to imagine, but, on examination, they usually have practical or theoretical objections. To illustrate, an appealing alternative is to award damages at the amount that is slightly above future costs. In reality, however, future costs are more speculative and easily manipulated than past costs. The practical advantage in drafting contract terms or rules strongly favors past costs rather than future costs.

6. PROGRESS-PAYMENT CONTRACTS AND TIMING OF PAYMENTS

Earlier we mentioned that transaction lawyers use progress payments to protect the assistance interest. Now we will explain how contracts with progress payments can achieve the same incentive effects as decreasing-liability contracts. A decreasing-liability contract could supply the promisor with incentives to complete performance by making the promisor liable for damages that are higher than the future costs required to

12. An implication of proposition 4 that we do not investigate here is not only that, under certain assumptions, the optimal contract provides for decreasing liability with time but also that liability decreases at an increasing rate. For practical reasons, such complicated liability schedules are unlikely to be used.

complete performance. It could also protect the assistance interest by allowing the promisor to deduct costs incurred from expectation damages. Similarly, a progress-payment contract could supply the promisor with incentives to complete performance by securing the promisor a benefit that is higher than the future costs required to complete performance. It could also protect the assistance interest by allowing the promisor to stop performance and withhold payments for costs incurred.

To illustrate numerically, assume that a project occurs in two phases, with Seller incurring costs of 40 in the first phase and 40 in the second phase. Assume that Buyer receives no benefit from the first phase and benefits of 100 from the second phase. Thus, completing the project creates a surplus of 20. A progress-payment contract could require Buyer to pay 40 to Seller for completion of phase 1 to pay additional 40 for completion of phase 2, plus a completion bonus of 20. In addition, the contract could be written so that Seller who terminates after phase 1 can keep the progress payment ("nonrefundable"). Seller who completes phase 1 thus has an incentive to complete phase 2 in order to obtain the bonus of 20, and Buyer has an incentive to assist in order not to lose 40.

Now we describe the equivalent decreasing-liability contract. Buyer pays Seller 100 for the promise to complete the project. The contract stipulates that Seller who breaches after phase 1 must pay expectation damages of 100 with a deduction of 40 for costs incurred. Seller who breaches after phase 1 pays net damages of 60. Alternatively, Seller can complete phase 2 and incur additional costs of 40. The difference between damages of 60 and additional costs of 40 is Seller's incentive to complete the project. The difference between damages of 60 and completion value of 100 is Buyer's incentive to assist. Thus, Seller who completes phase 1 has an incentive of 20 to complete phase 2, and Buyer has an incentive of 40 to assist. We have shown that the progress-payment contract and the decreasing-liability contract are materially identical in this example.

Now we state the generalization underlying this example, which Appendix B proves.

Proposition 5. For any decreasing-liability contract, there exists a progress-payment contract with materially equivalent incentives for the promisor's performance and the promisee's assistance, and vice versa.

To make the two kinds of contracts similar, three conditions should be satisfied. First, the progress payment or the deduction from damages should approximately equal costs incurred. Legal disputes provide evidence of such contracts.[13]

Second, the progress payment should be nonrecoverable. The obstacle to recovery may be legal, as when the contract allows Seller to terminate without breaching. Alternatively, the obstacle to recovery may be practical, as when Buyer bears prohibitive transaction costs of recovery or seller is bankrupt. The legal cases provide ample evidence where seller's bankruptcy precludes recovery of progress payments.[14]

Third, the progress-payment contract should provide for a large completion bonus, which ideally equals the contract's surplus.[15]

Our discussion of progress-payment contracts discloses a need to clarify the timing of payments in decreasing-liability contracts. In example 1, Buyer pays 90 up front for Developer's promise to build the building. Instead of paying up front, assume that Buyer wants to postpone payment until time *T,* when the building is scheduled for completion. Postponing payment until time *T* makes no difference to our analysis so long as Buyer's obligation to pay depends only on time. To illustrate, Buyer in example 1 could pay Developer up front with a bond of 90 that pays off at time *T.* Using a bond shifts Buyer's payment in

13. In legal disputes over progress payments, the parties often agree that the contract entitles the seller to receive progress payments equal to costs incurred, but the parties dispute over their extent. To illustrate, in *U.S. v. Taber Metals Holding, Inc.* (341 F.3d 843 [8th Cir. 2003]), a government contractor with liquidity problems requested progress payments on "pro forma invoices," that is, on invoices to pay for goods that as yet were undelivered. The court "accepted as true, indeed, as undisputed. . .that under the applicable procurement regulations progress payments may only be based upon current obligations (incurred costs)." Instead of requiring progress payments for actual costs, some progress-payment contracts liquidate the costs. One form of liquidation requires the buyer to pay a fixed percent of actual costs. For example, in *Rumsfeld v. Freedom NY, Inc.* (329 F.3d 1320 [Fed. Cir. 2003]), the government agreed to "make progress payments in the amount of 95% of incurred costs."

14. Buyer who anticipates seller's termination for reason of bankruptcy may attempt to withhold progress payments owed under the contract as setoff for expectation damages. Seller may counterclaim that withholding progress payments triggered bankruptcy. See *Johnson v. All-State Construction* (329 F.3d 848 [Fed. Cir. 2003]).

15. With a decreasing-liability contract, the promisor who fails to complete the contract loses his share of the contract's surplus and also pays damages that encompass the promisee's share of the surplus. With a progress-payment contract, a seller who terminates stands to lose the completion bonus. Making the two contracts materially identical thus requires the completion bonus to equal the contract's surplus. In the usual case, the completion bonus will be less than the contract's surplus, which reduces the seller's incentives to complete the project under a progress-payment contract. In practice, however, expectation damages often undercompensate, which reduces the seller's incentive to complete the project under a decreasing-liability contract.

time and leaves the other features of the contract unchanged, including its incentive effects.

The analysis changes, however, if Buyer's obligation to pay depends on Developer's performance. To illustrate, we modify our example so that Buyer promises to pay contingent on Developer completing the building.

Example 3: Buyer's Contingent Payment. Buyer and Developer make a contract in which Buyer promises to pay 90 for Developer's construction of a building that Buyer values at 100. The contract stipulates that the full payment falls due on completion of the building. Developer spends 40 on architectural drawings and a concrete foundation that cannot be recovered or reused. Developer defaults. Buyer fails to find an alternative builder and abandons the project without receiving any benefit from it. A breach causes Buyer to lose 10, which is the difference between Buyer's value of performance and the contract price.

When positive law is applied to example 3, Developer who breaches after phase 1 must pay expectation damages of 10. Expectation damages, however, create an incentive problem that we have already analyzed. Specifically, Developer's liability of 10 makes Buyer indifferent between Developer's performance or breach, so Buyer has deficient incentive to assist Developer's performance.

In contrast, a decreasing-liability contract gives Buyer an incentive to assist Developer. To improve incentives, the parties in example 3 might change their contract into a decreasing-liability contract. To create decreasing liability, the contract should stipulate that breaching Developer pays expectation damages minus past expenditures on performance. Note that Developer who breaches after the contract's first phase owes expectation damages of 10 minus past expenditures of 40, or has liability of −30, which means that Buyer owes 30 to Developer.

Negative liability[16] of 30 seems odd if you think of Developer as getting paid 30 to breach. The result, however, does not seem so odd if you describe Developer as getting 30 if he breaches and 90 if he performs, for a net loss of 60 from nonperformance. The result seems quite normal if you describe Developer as forgoing a completion bonus. We modify our example to become a progress-payment contract.

Example 4: Progress-Payment Contract. Buyer and Developer make

16. Thanks to Barry Adler for suggesting this phrase.

a contract for the latter to construct a building that Buyer values at 100. In the first phase, Developer will spend 40 on architectural drawings and a concrete foundation. After Developer delivers the architectural drawings and pours the concrete foundation, Buyer will make a progress payment of 40. After these steps, Buyer or Developer can terminate the contract with no further consequences. If the contract is terminated, the architectural plans and concrete foundation cannot be recovered or reused. In the second phase (assuming that there is one), Developer will complete the building at an additional cost of 40. Buyer will make another progress payment of 40 plus a completion bonus of 20.

It is straightforward to show that the incentive effects of the progress-payment contract in example 4 and the decreasing-liability contract in example 3 are substantially the same. Although very different in appearance, the appropriate choice of parameters makes these two contractual forms substantively identical.[17]

Progress-payment contracts could be used in a variety of contractual settings that involve interdependence between the parties, where unobservable and unverifiable assistance is required. Examples include making a movie, building a computer program to a buyer's specifications, retaining an attorney in complex litigation, or most complex construction projects.[18]

7. RENEGOTIATION

This section asks whether the possibility for renegotiation increases or decreases the attractiveness of decreasing-liability contracts. Two reasons typically cause parties to renegotiate a contract. First, when circumstances change, modifying the contract can avoid inefficient behavior and increase the contract's expected value. As we will explain, the possibility of avoiding inefficient behavior by renegotiation makes decreasing-liability contracts more attractive.

17. Note this difference in our example: the progress-payment contract in example 4 gives all of the surplus to Developer, whereas the decreasing-liability contract we discussed divides the surplus equally between them ($v = 100$; $P = 90$; $C = 80$). To make example 4 produce an equal division of the surplus, we could add this sentence: "On signing the contract, Developer gives 10 to Buyer as proof of commitment to proceed." In general, payments made at the contract's beginning influence the attractiveness of making the contract but do not necessarily affect future behavior.

18. Victor Goldberg analyzes various complex contracts with some of these features. See Goldberg (1997, 1998).

Second, when bargaining power changes, one of the parties may demand modification to redistribute the contract's value. Demands for redistributive modifications slow performance, waste transaction costs, and distort the parties' ex ante investments incentives. As we will explain, decreasing-liability contracts do not usually change the likelihood of demands for redistributive modifications by rational players who have no future interest in dealing with each other. However, decreasing-liability contracts can increase the effectiveness of threats of nonperformance by irrational promisors and repeat players, which makes decreasing-liability contracts less attractive.

We begin our analysis of renegotiation by discussing commitment. In general, an actor commits to performing an act by increasing his cost of not doing it. Specifically, making an enforceable promise commits the promisor to performing by increasing the cost of not performing.[19] A promise is credible so long as performing costs the actor less than not performing. We have been discussing a contract whose performance occurs in phases. If events unfold as anticipated, the promisor finds that performing is cheaper at each phase than not performing, so the promise to perform is credible and a threat not to perform is incredible. This is true regardless of whether the contract stipulates constant liability or decreasing liability.

What about threats by the promisee not to assist the promisor? If events unfold as anticipated, the promisee finds that assisting is cheaper than not assisting, so a threat not to assist is incredible. As with the promisor's threats, this is also true under both constant liability and decreasing liability.

The situation is different, however, when the promisor receives disappointing news. Figure 5 separates disappointing news into "bad" news and "very bad" news. As explained, very bad news is unproblematic, because performance is inefficient and the promisor will not perform under a constant or decreasing-liability contract. Bad news, however, is problematic, because performance is efficient and the promisor will not perform under a decreasing-liability contract. In other words, bad news gives the promisor a credible threat of nonperformance under a decreasing-liability contract (compare Ayres and Madison 1999).

Our earlier analysis of Figure 5 concluded that parties who make a

19. For an argument that courts should enforce modifications when the threat of breach by the promisor is credible, even if made under circumstances considered by prevailing contract law as "duress," see Bargill and Ben-Shahar (2002).

decreasing-liability contract run a risk that bad news will cause inefficient nonperformance. The possibility of renegotiation and modification can ameliorate this problem. Instead of inefficient breach, the promisor can credibly threaten to breach unless the promisee agrees to modify the contract's terms and pay the promisor more. The parties can presumably agree on terms that give each of them a share of the surplus from performing rather than not performing. Courts should enforce such a value-increasing modification, where bad news motivates renegotiation.

Our analysis of rational behavior and credible threats concluded that the possibility of renegotiation increases the attractiveness of decreasing-liability contracts relative to constant-liability contracts. Now we consider irrational behavior and incredible threats. Choosing the action with higher net costs is ordinarily irrational, but people sometimes do it. For example, experiments in behavioral economics show that people will often reduce their own objective payoffs to prevent someone else from gaining an unfair advantage (Fehr and Gachter 2002). As another example, a repeat player may undertake the more costly action in a particular situation to gain the future advantage of a reputation for toughness. In this situation, the repeat player's local irrationality is globally rational.

A threat is effective, whether rational or not, if the hearer believes that the speaker may act on it. The speaker is presumably more likely to act if the threatened action costs less. Consequently, the promisor's threat against the promisee is presumably more effective if the threatened action costs the the promisor less. To illustrate, assume that not performing costs the promisor 50 and performing costs the promisor 40. Since the promisor loses 10 from not performing, the promisor's threat not to perform is incredible. If the promisor is irrational or a repeat player, however, the promisor's threat may be effective. Presumably the threat would be even more effective if nonperformance causes the promisor to lose 5 rather than 10.

With these observations in mind, we compare the effectiveness of the promisor's threats in constant and decreasing-liability contracts. In terms of Figure 1, a constant-liability contract is a point on the 45-degree line, and a decreasing-liability contract is a movement down the line. Lower liability makes the threat of nonperformance less costly for the promisor, which increases its effectiveness. Similarly, lower damages make the threat of nonassistance more costly for the promisee, which decreases its effectiveness. So starting from any constant liability level, decreasing liability below that level increases the effectiveness of the promisor's threat not to perform and decreases the effectiveness of the promisee's threat not to assist.

To summarize our analysis, the possibility of renegotiation makes decreasing-liability contracts more attractive by reducing the probability of inefficient nonperformance and less attractive by increasing promisees' vulnerability to threats of nonperformance by repeat players and irrational promisors. Our analysis assumes that the promisee has accurate information about the promisor's cost of performance, and a complete analysis would require relaxing this assumption.[20]

8. MECHANISMS IN CONTRACT LAW TO GIVE EFFICIENT INCENTIVES TO BOTH PARTIES

We recommend that transaction lawyers use decreasing-liability contracts for conditions in which both parties need incentives to increase the contract's value. The law has legal mechanisms to induce the promisee's assistance and the promisor's performance. Unlike decreasing-liability contracts, however, these mechanism cannot reach unobservable or unverifiable forms of effort. We cannot discuss all of these mechanisms, but we will discuss some of them. Specifically, we will discuss stipulating a duty to assist, a defense of comparative negligence, and limiting damages to reliance damages or some other measure of damages smaller than expectation damages. We will not discuss mitigation of damages and liquidated damages, which reduce the promisee's overreliance without improving the promisee's incentives to assist in performance.[21]

8.1. Stipulating an Explicit Duty to Assist in Performance

When assistance by the promisee is observable and verifiable, stipulating a duty to assist (or making assistance by the promisee a precondition to performance) is a possible choice to improve the promisee's incentives.

20. If the promisor can effectively threaten to breach even if he knows he would not carry out the threat, decreasing liability would make the threat even more convincing. Note, however, that decreasing liability would work in the opposite direction with regard to the promisee's threat not to assist: since under decreasing liability his failure to assist would cost him a lot, his threats not to assist would be less credible to the promisor than under constant liability.

21. The mitigation-of-damages defense is effective only after breach (or anticipatory breach) and therefore does not affect prebreach reliance. As to liquidated damages, see note 3.

Besides being possible, this is a good choice when the transaction costs of drafting the relevant terms are moderate. However, this mechanism is ineffective when drafting is too costly or the promisee's assistance is unobservable or unverifiable. In these circumstances, a decreasing-liability contract is desirable because it does not suffer from these limitations.

8.2. Comparative Negligence Defense

The comparative negligence (or fault) defense, which is generally not recognized by American contract law, is a second mechanism that can give efficient incentives to both parties to the contract.[22] Under the comparative negligence rule, the promisee's unreasonable failure to assist performance may reduce damages from breach.[23] Like the previous mechanism, however, the comparative negligence defense suffers from one main drawback: it is effective only when assistance is observable and verifiable.

8.3. Limiting Liability

A third mechanism is limiting liability to reliance damages or to any other measure of damages that is below expectation damages.[24] To illustrate by example 1, the contract could stipulate that liability equals 80 instead of 100. In contrast to the preceding mechanisms, limiting liability will improve the promisee's incentives to assist, even if his behavior is unobservable and unverifiable. This mechanism, however, is generally inferior to decreasing liability for phased contracts. In phased contracts, the optimal damage schedule is dynamic and adapts the level of damages to changed circumstances. The changed circumstances are the changing amount of past costs, which cannot be recovered or reused. As more costs sink into performance, the efficient level of damages, taking into account both parties' incentives, decreases. Consequently, for any constant damage measure, a superior decreasing damage measure exists.

22. Although it gained some recognition in warranty cases, probably because of their affinity to tort cases. See White and Summers (2000, pp. 410–13).

23. For comparative negligence in contracts, and for various attitudes toward it in various jurisdictions, see Porat (1994, 1997). For a comparative negligence approach in contracts, see *S. J. Groves Co. v. Warner Co.* (576 F.2d 524 [3d Cir. 1978]).

24. For the argument that reliance damages supply better incentives to the promisee to cooperate than expectation damages or liquidated damages, see Che and Chung (1999).

9. IDENTIFYING CONTRACTS IN WHICH EFFICIENCY REQUIRES DECREASING LIABILITY

The preceding model identified two factors that determine the efficiency of decreasing liability: the benefit of improving the promisee's incentives and the cost of undermining the promisor's incentives. In this section, we elaborate on these two factors and characterize contracts in which decreasing liability is best.

9.1. Improving the Incentives of the Promisee

The promisee can often assist performance and take precaution against breach in various ways. Sometimes courts recognize the importance of assistance by the recipient of performance, and even imply comparative-negligence-like principles or contractual duties of cooperation.[25] Note, however, that to the extent that these efforts to assist are unobservable or unverifiable, a legal duty to perform them is unenforceable, regardless of whether the duty is stipulated in the contract or inferred from a legal doctrine such as contributory or comparative fault.[26] In such circumstances, however, undercompensation gives the promisee an incentive to assist, and the incentive increases as damages decrease. To illustrate by

25. See Sections 8.1 and 8.2.

26. See *AMPAT/Midwest v Illinois Tool Works, Inc.* (896 F.2d 1035, 1041 [7th Cir. 1990]), where Judge Richard A. Posner said, "The parties to a contract are embarked on a cooperative venture, and a minimum of cooperativeness in the event unforeseen problems arise at the performance stage is required even if not an explicit duty of the contract." Similarly, in *Market Associates v. Frey* (941 F.2d 588, 595–96 [7th Cir. 1991]), Judge Posner maintained, "It is true that an essential function of contracts is to allocate risk. . . . But contracts do not just allocate risk. They also (or some of them) set in motion a cooperative enterprise . . . which may to some extent place one party at the other's mercy. . . . At the formation of the contract the parties are dealing in present realities; performance still lies in the future. As performance unfolds, circumstances change, often unforeseeably; the explicit terms of the contract become progressively less apt to the governance of the parties' relationship . . . and the scope and bite of the good faith doctrine grows." For a case in which the court reduced damages owing to the noncooperation of the plaintiff, see *Groves* (576 F.2d 524). Groves was a subcontractor for the replacement of a bridge's concrete decks parapets. Groves contracted with Warner for the delivery of concrete to the site. Because of defaults of Warner in performance, Groves had to remove and replace defective slab from the site. Groves sued Warner for his losses. It was proved that Groves's crew also functioned inefficiently and that weather conditions were extremely unfavorable. The district court found Warner liable for breach of contract, but awarded Groves only one-fourth of the losses associated with the slab. The Federal Court of Appeals for the Third Circuit affirmed the trial court decision, reasoning that since both parties contributed to the loss, "The action of the trial judge in dividing the loss between the parties was a fair solution to a difficult problem." For another case of the same type, see *Lesmeister v. Dilly* (330 N.W. 2d 95 [Minn. 1983]).

example 1, undercompensation gives Buyer an incentive to help Developer to obtain building permits and to reveal information necessary for performance after the contract is made, even if the efforts are unobservable or unverifiable. This example exemplifies a wide category of cases in which the promisee's assistance in performing the contract could prevent a breach or reduce its likelihood.

Next we describe some forms of the promisee's assistance where observation or verification is difficult.

Example 5: Developing a Computer Program. Programmer promises Buyer to develop a computer program adapted to Buyer's idiosyncratic needs. Developing the program requires intensive, costly cooperation between them. Programmer breaches the contract by failing to develop the program as promised. Programmer argues that if Buyer had cooperated, Programmer would not have breached the contract. Since most efforts of Buyer in cooperation are unverifiable, Programmer cannot invoke any kind of defense based on Buyer's noncooperation.

Expectation damages in example 5 do not give Buyer strong incentives for expensive cooperation. An explicit or implicit duty to cooperate is unverifiable and therefore ineffective. The only effective way to provide Buyer with strong incentives to cooperate is to undercompensate him significantly if Programmer breaches the contract. Deducting past expenditure from expectation damages produces this outcome. Realizing all that in advance, the parties may adopt a decreasing-liability contract.

Now we turn to an example of revealing information at the performance stage.

Example 6: Revealing Information Necessary for Performance. Developer promises to build a building for Buyer. After partly performing, Developer encounters difficulties in completing performance owing to geological obstacles to construction and breaches the contract. Buyer easily could have acquired information concerning those obstacles, but refrained from doing so.[27] Buyer's lack of effort is unobservable and

27. Alternatively, Buyer refrained from obtaining the information for fear that Developer would accuse him of possessing it when the parties originally contracted. Generally, courts are not willing to recognize one party's implied duty to provide the other with information during the performance of contract. See Collins (1992). Compare *Bank of Nova Scotia v. Hellenic Mutual War Risks Association (Bermuda) Ltd., The Good Luck* ([1989] 3 All E.R. 628, 664 et seq. [C.A.]).

unverifiable. Had Buyer acquired the information and disclosed it to Developer, Developer would not have breached the contract.

Expectation damages from breach in example 6 give Buyer no incentive to acquire or disclose information concerning geological difficulties. The situation changes when damages decrease below the expectation level. Each reduction in damages gives Buyer stronger incentives to acquire and disclose the information. Foreseeing these facts, the parties might recognize that a decreasing-liability contract improves incentives relative to a constant-liability contract.

Finally, we turn to an example of misunderstandings.

Example 7: Clarifying Misunderstandings. Seller mistakenly renders defective or delayed performance, thus breaching the contract. Buyer knew or could easily have known about Seller's misunderstanding but did not take any steps to prevent it. Had Buyer clarified the misunderstanding, Seller would not have breached the contract. Proving that a misunderstanding caused Seller's breach or that Buyer knew or could easily have known about Seller's misunderstanding is difficult or impossible.[28]

By assumption, stipulating a duty by Buyer to clarify misunderstandings in example 7 is ineffective. Undercompensating Buyer, however, would encourage him to prevent misunderstandings.[29]

9.2. Undermining the Efficient Incentives of the Promisor to Perform

By our definitions, news is "bad" (but not very bad) when the total costs of performance modestly exceed its value, and bad news distorts the promisor's incentives. Thus, a low probability that the cost of perfor-

28. In *Market Associates* (941 F.2d 588), the Court of Appeals of the Seventh Circuit (Judge Posner) decided that there was a duty for the contracting party not to take advantage of the other party's oversight to the contract concerning rights and duties under the contract. For a thorough discussion of this case, see Eisenberg (2002).

29. Compare Goetz and Scott (1983), Porat (1994), Eisenberg (2002). In legal systems that do not adopt the foreseeability test regarding the remoteness of damages, we do find a larger group of cases in which the negligent failure of the promisee to warn the promisor about a large potential loss is considered to be contributory (or comparative) negligence. Such is the case in the German legal system, where the remoteness-of-damage test is one of "adequate cause." Article 254 of the German civil code (Bürgerliches Gesetzbuch (BGB)), which establishes the contributory negligence defense in torts as well as in contract law, makes it clear that the defense also applies "if the fault of the injured party consisted only in an omission to call the attention of the debtor to the danger of unusually high damage which the debtor neither knew nor should have known" (*German Civil Code* 1975).

mance modestly exceeds its value favors decreasing-liability contracts. For this result, the following considerations are usually decisive:

Length of Performance. When the time needed for performance is short, the risk that costs of performance will exceed its value is typically low. In these circumstances, a decreasing-liability contract is a good way to induce unverifiable assistance in performance by the promisee.

Stable Markets. Performance often requires the promisor to purchase inputs. Stable markets for inputs reduce the probability of bad news. To illustrate, when the price and supply of working materials and manpower is predictable, decreasing-liability contracts pose little risk of creating incentives for inefficient breach. Conversely, unstable markets for inputs create risk that an increase in costs will cause the promisor to breach inefficiently.

In some circumstances, the parties can solve the problem of unstable markets for inputs without abandoning the advantages of a decreasing-liability contract. To solve the problem, the promisee may assume the risk of market fluctuations. To illustrate, Buyer might agree to reimburse seller for an increase in the cost of construction materials.[30] In these circumstances, the risk that input costs will increase need not prevent the parties from adopting a decreasing-liability contract.

The risk that a decreasing-liability contract will cause inefficient breach relates to the time pattern of market fluctuations. News of rising costs is more likely to cause the promisor's breach when received in an early phase, because more inputs remain to be purchased. When breach occurs early enough that the promisor has made little or no expenditures, the deductibility of expenditures makes little or no difference to liability. Consequently, early receipt of bad news does not cause a significant difference in decreasing-liability contracts as compared with constant-liability contracts.

Conversely, news of rising costs is less likely to cause the promisor's breach when received in a later phase, because few inputs remain to be purchased. Consequently, late receipt of bad news is unlikely to cause inefficient breach of a decreasing-liability contract.

The greatest risk that a decreasing-liability contract will cause inef-

30. A stipulation in the contract that burdens the promisee with any increase in the cost of performance would create a moral hazard problem with regard to the promisor's incentives to reduce costs of performance. In the context of the present discussion, however, we assume that the market fluctuations that increase costs of performance could not be affected by the parties to the contract.

ficient breach occurs when the promisor receives bad news in the middle phases of the contact. When drafting the contract, the parties should keep this fact in mind when they compare the time pattern in the contract's phases to possible market fluctuations.

We have discussed the potential problem that unstable input prices pose for decreasing-liability contracts. A similar problem concerns unstable output prices. When output prices are unstable, a third party may appear and offer Seller more than Buyer promised to pay in the contract. To illustrate by our first example, Developer might get a bid from a third party during performance that he can accept only if he defaults on the original contract with Buyer.

The third party presents an opportunity to Developer that will be lost by performance on the contract. The cost of performing includes the cost of inputs and the lost opportunity. Consequently, the analysis of unstable input and output prices is essentially the same. When the output price is predictable, decreasing-liability contracts pose little risk of creating incentives for inefficient breach. Conversely, unstable output markets create risk that an increase in output prices will cause the promisor to breach inefficiently. As with unstable input prices, the parties can solve the problem of unstable output prices without abandoning the advantages of a decreasing-liability contract by having the promisee assume the risk. To illustrate, Buyer might agree to reimburse Seller for loss of an opportunity to sell to a third party.

Correlated Costs and Value of Performance. The cost of performance and its value are sometimes correlated. The correlation often exists because an increase in production costs causes an increase in the product's value. To illustrate, an increase in the cost of construction may increase the value of the existing stock of buildings.

Consider the consequences for a contract stipulating liability equal to expectation damages minus actual costs. As long as expectation damages increase by the same amount as remaining costs, the former offsets the latter, so the change in prices does not induce the promisor to breach. Consequently, as long as the value of performance increases by at least as much as the remaining costs of performance, the decreasing-liability contract does not create a problem of inefficient breach. In these circumstances, the parties can stipulate decreasing liability without fear that price changes will cause inefficient breach.

The Promisor's Inefficient Investment in Performance. In our model, the promisor must make expenditures in an early phase of performance in order to go on to the next phase. Furthermore, our model assumes that expenditures in each phase are binary—either expenditures are sufficient to go to the next phase, or expenditures are insufficient and the promisor cannot perform. Our model allows no time shifting of expenditures on performance. The real world, however, usually permits some time shifting. In most phased contracts, higher expenditures in a later phase can make up for lower expenditures in an earlier phase. Also, in the real world, higher expenditures in any phase often increase the probability of completing performance later.

A less tractable and more realistic model than ours would allow a flexible time pattern of expenditures on performance. We make no attempt to construct such a model, but we mention a new problem for decreasing-liability contracts that we anticipate. In a constant-liability contract with expectation damages, the promisor internalizes 100 percent of the costs of breach, regardless of when it occurs. However, in a decreasing-liability contract, the promisor internalizes a variable percentage of the costs of breach, depending on when it occurs. With a flexible time pattern of expenditures on performance, a decreasing-liability contract may enable the promisor to shift expected costs to the promisee by shifting expenditures forward in time. The promisor who expects to gain from shifting expenditures forward in time will not take account of negative effects on the promisee, which are the reduction in damages the promisee expects to receive in the event that the promisor breaches early in the contract.[31] Even in these circumstances, however, a contract specifying decreasing liquidated damages might solve the problem.[32]

31. To illustrate, assume that the contract in example 1 stipulates that Developer who breaches at time t pays expectation damages $V = 100$ minus expenditures on part performance C_t. If Developer breaches at time t after expenditures of 40, Developer's liability equals 60. Consequently, breach at time t results in Developer's total costs of $40 + 60 = 100$. Now assume that technology changes and allows Developer to shift costs of 30 from after time t to before time t. Consequently, a breach at time t results in Developer's total costs of $70 + 30 = 100$. Since Developer's costs of breach are constant regardless of whether he shifts costs forward in time, he will decide whether to make the shift purely on the basis of whether his costs of performance increase or decrease. Thus, he will shift costs forward in time if he saves 1 in costs of performance. When he shifts costs forward in time, however, Buyer's damages from breach decrease by much more than 1. Specifically, Buyer's damages from Developer's breach at time t decrease from 60 to 30. If the probability of breach is significant, shifting costs forward in time is inefficient, but Developer gains an advantage by doing so.

32. Instead of stipulating that the breaching promisor can deduct actual expenditures, the contract might stipulate the exact deduction in dollars allowed after breach at each phase. The parties might try to liquidate damages equal to expectation damages minus

Litigation Costs. We will briefly discuss litigation costs. In any decreasing-liability contract, the promisor's liability for breach decreases with time, so the promisee's recovery also decreases with time. In the decreasing-liability schedule that we recommend, the promisee's recovery equals the promisee's value of performance minus the promisor's costs. As performance approaches completion, the promisee's recovery approaches the promisee's value of performance minus the promisor's cost of performance, which is the value created by the contract. Our recommended decreasing-liability schedule thus gives a credible threat to sue throughout a contract's life so long as the contract's value exceeds litigation costs. If, however, plaintiff's costs of litigation exceed the contract's value, then the contract no longer has a credible threat to sue the nonperforming promisor, and the contract becomes ineffective. If the parties foresee that these circumstances are likely, they gain by making a different contract with damages that decrease at a slower rate.

To illustrate by Figure 3, the promisee's damages decrease from 100 at time 0 to 20 at time *T.* The promisee in Figure 3 has a credible threat to sue for nonperformance throughout the contract's life so long as his litigation costs do not exceed 20. If, however, the promisee's cost of litigation exceeds 20 and equals, say, 30, then the credibility of his threat to sue the nonperforming promisor disappears when damages decrease to 30. Foreseeing this fact, the parties should stipulate a liability schedule that decreases more slowly so that damages always exceed 30.

10. CONCLUSION

The economic analysis of contracts clarified debates over alternative liability rules, especially by demonstrating that ideal expectation damages cause the promisor to internalize the cost of breach to the promisee. Relying on this insight, most law and economics scholars have commended expectation damages as more efficient than any alternative. This conclusion, however, loses sight of the promisee's incentives to assist the promisor's performance. The economic analysis of contracts has discussed the problem of the promisee's reliance, but not the promisee's assistance.[33]

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optimal expenditure, regardless of actual expenditures. Liquidated decreasing liability requires a lot of information. Also, it may not solve the problem of time shifting to lower the probability of breach, as opposed to time shifting to lower the cost of performance.

33. See note 3.

The standard argument for expectation damages is not justified in contracts in which the promisee's unverifiable assistance significantly affects performance. In these circumstances, efficient incentives for both parties require the promisee to assign the right to expectation damages to a third party (the anti-insurer). In the absence of such an assignment, reducing liability below the level of expectation damages usually increases efficiency. To be precise, reducing liability below expectation damages increases efficiency when the promisor's last dollar spent on performing increases the contract's value less than the promisee's first dollar spent on assisting.

For this reason, we advocate reducing damages below the expectation level whenever the promisee's unverifiable assistance significantly affects performance. Reliance or restitution damages typically achieve such a reduction, but we do not advocate them. Instead, we advocate a damage measure whose justification relates directly to the goal of improving the promisee's incentives to assist the promisor. For phased contracts, the promisor's remaining costs of performance ordinarily decrease as each phase is completed. Consequently, the level of liability required to induce performance also decreases. A contract that stipulates decreasing liability can provide sufficient incentives for the promisor to perform while motivating the promisee to assist.

To implement such a contract, we recommend deducting past expenditure on incomplete performance, either actual or stipulated, from liability. (We omit the related question of deducting from liability other losses suffered by the breaching party.)[34] The justification for this form of decreasing liability over possible alternatives is practical. Specifically, this form produces good incentives by using variables that parties have experience writing into contracts and courts have experience adjudicating.

Decreasing liability, or its material equivalent through progress payments, is the only practical way for a contract to motivate a promisee whose assistance is unobservable or unverifiable. Transaction lawyers who appreciate the problem of the promisee's unverifiable assistance will understand better when to use progress payments and how to set their magnitude and timing. In some circumstances, transaction lawyers

34. Thus, the promisor could suffer reliance losses, lost profits, or nonlegal sanctions imposed by third parties. Like expenditures on phases of performance, the presence of such losses decreases the level of liability required to induce the promisor to perform, so a case could be made for deducting these losses from liability. We leave this problem to another paper.

may find that switching language from "progress payments" to "decreasing liability" increases the contract's clarity. In addition, courts that understand the purpose of decreasing liability and progress payments will interpret and enforce contracts better. Perhaps in the future, when decreasing liability becomes common, courts will adopt it as the default rule for damages in some circumstances.

APPENDIX A: ANALYSIS OF EXAMPLE 1

This appendix is a more elaborate version of example 1 that models the promisee's assistance more explicitly. To keep the analysis of example 1 simple, we did not explicitly model how the promisee's assistance affects the contract's expected value. In general, the promisee's assistance lowers the expected cost of performance. Here we use a numeric example to model the promisee's assistance and depict the contract's phases explicitly as a tree in Figure A1.

Example 8. A construction contract occurs in five phases.

Phase 1. Formation. Buyer pays Developer a price $p = 90$ for the promise to construct a building. Buyer values the completed project at $v = 100$. In event of Developer's default at any phase, Buyer will abandon the project without receiving any benefit from it.

Phase 2. Developer Spends. Developer either breaches or else spends $c_2 = 40$ on architectural drawings and a concrete foundation. Breach terminates the process, whereas spending $c_2 = 40$ moves to phase 3.

Phase 3. Buyer Assists. Buyer either does not assist Developer's performance or assists by helping to obtain the necessary construction permits. Assisting costs Buyer 5. Developer cannot observe whether Buyer assists, so the contract is silent on this matter, and Buyer has no contractual obligation to assist Developer.

Phase 4. Nature Acts. Unpredictable forces outside the parties' control, which we call "nature," determine Developer's remaining costs of completing the project. The state of nature is good, bad, or very bad. The probabilities are denoted q_g, q_b, and q_{vb}, respectively. If Buyer does not assist, the probabilities are $(q_g, q_b, q_{vb}) = (.6, .3, .1)$. If Buyer assists, the probabilities shift in favor of a better state. Specifically, if Buyer assists, the probabilities are $(q_g, q_b, q_{vb}) = (.9, .06, .04)$.

Phase 5. Developer Spends. The variable c_5 denotes the expenditures required to complete performance at phase 5, which depends on the state of nature. Developer observes the state of nature, and then he either defaults or completes performance by spending c_5:

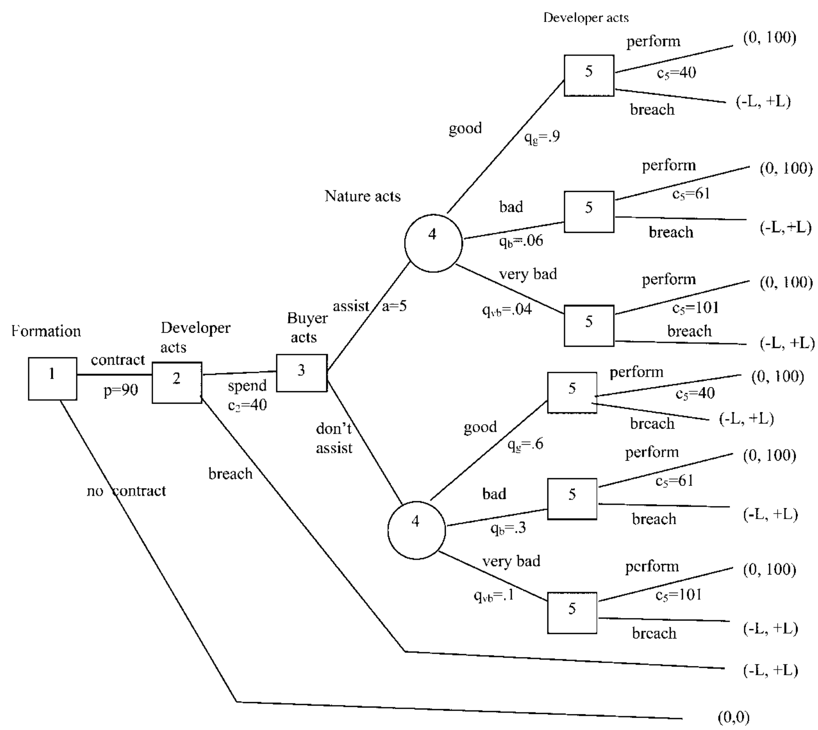

Figure A1. Example 8 as a tree

1. A good state of nature results in low remaining costs; specifically, $c_5=40$.
2. A bad state results in high remaining costs; specifically, $c_5=61$.
3. A very bad state results in very high remaining costs; specifically, $c_5=101$.

Assume that the parties want to maximize the expected value of the contract in example 8 when it is formed. When forming the contract, the parties anticipate the possibility that Developer receives bad news at phase 5 and defaults. We show that the expected value of the contract is higher at the time of formation when Developer's liability for breach at phase 5 equals 60 rather than 100.

Consider the effects of deducting or not deducting past expenditures on Developer's incentives to perform and Buyer's incentives to assist. At phase 5, Developer applies the decision rule:

$$c_5 \leq L \rightarrow \text{perform},$$

$$c_5 > L \rightarrow \text{breach}.$$

Depending on whether the state of nature is good, bad, or very bad at phase 5, the remaining costs of performance equal 40, 61, or 101, respectively.

Consider Developer's incentives with deduction of costs from liability. Expectation damages, written $L = v$, equal 100. Consequently, expectation damages without deduction exceed the cost of performance in a good state or a bad state, but the cost of performance in a very bad state exceeds expectation damages. Thus, expectation damages without any deduction cause Developer to perform when the state of nature is good or bad and to breach when the state of nature is very bad.

Developer's behavior differs in one respect when liability equals expectation damages minus past expenditures, written $L = v - c_2$. At phase 5, expectation damages of 100 minus Developer's past expenditures of 40 equal 60. As a result of the deduction, the cost of performance in a bad state, which is 61, exceeds liability. Deduction changes Developer's performance when the state of nature is bad, but not otherwise, as depicted in Figure 5.

Now we relate Developer's behavior to the contract's value. Maximizing the contract's value at phase 5 requires Developer to perform if the value of performance to Buyer exceeds the remaining cost of performance to Developer. The value of performance exceeds the remaining cost of performance in a good state or a bad state, but not in a very bad state. So maximizing the contract's value requires Developer to perform in a good or bad state and to breach in a very bad state. Expectation damages produce incentives for efficient behavior by Developer in all three circumstances, whereas expectation damages with a deduction of past expenditures create efficient behavior in good or very bad states, but not in bad states.

Next we turn from Developer's to Buyer's incentives. We show that expectation damages with no deduction cause Buyer not to assist in example 8, and expectation damages with deduction of past expenditures cause Buyer to assist. Consider each damage measure. With expectation damages and no deduction, Buyer receives 100 from performance of the contract and 100 in damages from breach. Consequently, Buyer gains nothing from spending 5 to assist Developer. While expectation damages give Buyer no incentive to assist, the situation is different when Developer deducts past expenditures of 40 from expectation damages of 100. With deduction, Buyer receives 100 from performance of the contract and 60 in damages from breach. By spending 5 to assist performance, Buyer expects to gain by increasing the probability of receiving 100 instead of 60. The expected gain exceeds the cost of 5.[35] Consequently, the deduction motivates Buyer to assist.

Note that nature's random influence prevents Developer from inferring from

35. Specifically, the expected gain equals $(.9 - .6)(100 - 60) = 12$, whereas the cost equals 5.

his costs whether Buyer assisted. Buyer's assistance is thus unobservable directly or by inference.

We have explained that deducting Developer's expenditures on performance from liability for breach causes Buyer to assist and Developer sometimes to breach inefficiently. It is easy to show that the gain from improving the promisee's incentives exceeds the expected loss from worsening the promisor's incentives. Specifically, with deduction the contract's expected value equals 9, and without deduction the contract's expected value equals 7.7.[36]

APPENDIX B: MATHEMATICAL APPENDIX

Appendix B provides mathematical proofs of the propositions. Section 3 in the main text is based on a model without phased performance. Sections 4 and 5 extend this model to encompass phased performance. We develop each model in turn.

Model without Phased Performance Used in Section 3

Definition

v = the promisee's value of performance,
c = the promisor's expenditure on performance,
a = the promisee's expenditure on assistance,
q = probability of performance equals $q(c, a)$,
L = the promisor's liability for breach, and
D = the promisee's entitlement to damages for breach.

Behavioral Assumptions. The promisor chooses c to minimize $-(1 - q(c, a))L - c$. Let the solution be given by $c = c(L)$, where we assume $c' > 0$.

The promisee chooses a to maximize $vq(c, a) + D(1 - q(c, a)) - a$, where $a \geq 0$. Let the solution be given by $a = a(D)$, where we assume that $a' < 0$. Note that $D = v$ implies the solution $a = 0$.

Proposition 1. Assume that the promisor's liability for breach equals expectation damages ($L = D = v$). Assume that the promisor's expenditure on performance is positive ($c > 0$). If a dollar spent on assistance by the promisee would increase the contract's value by more than \$1 ($vq_2 > 1$), then a small decrease in liability L will increase the contract's value.

36. With deduction, the expected value of the contract equals .9(100 − 40) + .06(0) + .04(0) − 5 − 40 = 9. Without deduction, the expected value of the contract equals .6(100 − 40) + .3(100 − 61) + .1(0) − 40 = 7.7.

Proof.

1. The behavioral assumption on the promisor is $q_1 L - 1 \geq 0$. By the assumption $v = L$ and $c > 0$, the behavior assumption reduces to $vq_1 - 1 = 0$.

2. The contract's net expected value equals $vq(c, a) - c - a$. Fully differentiate to obtain the change in net expected value from changing liability L:

$$[(vq_1 - 1)c']dL + [(vq_2 - 1)]a'dL.$$

3. By step 1, the first term in square brackets is zero, so the change in net expected value from changing liability L is

$$[(vq_2 - 1)]a'dL.$$

4. The assumption $vq_2 > 1$ and the assumption $a' < 0$ imply that decreasing L will increase the contract's net expected value.

Model of Phased Performance Used in Sections 4 and 5

Additional Definitions

p = contract price,
t = present time,
T = number of phases in the contract,
k_i = actual expenditures in the past at time i, where $i \leq t$ and $k_i \geq 0$,
K_j = total past expenditures as of time j, where $K_j = \sum_{i=1}^{j} k_i$,
e_i = expenditures necessary in phase i to continue on to phase $i + 1$, where $e_i \geq 0$,
$q_{t,t+i}$ = the probability at time t that expenditures necessary in phase $t + i$ to go on to phase $t + i + 1$ will equal e_{t+i}, where $q_{t,t+i} = q_{t,t+i}(e_{t+i})$,
$c_{t,t+i}$ = the expectation at time t of expenditures necessary in phase $t + i$ to continue on to phase $t + i + 1$, where $c_{t,t+i} = \int q_{t,t+i}(e_{t+i})e_{t+i}de_{t+i}$,
$C_{t,t+i}$ = the expectation at time t of total expenditures remaining at time $t + i$ to complete performance, where $C_{t,t+i} = \sum_{j=1}^{T-t-1} c_{t,t+i+j}$,
TC_t = past expenditure plus expected remaining expenditures as well as expected total costs of performance at time t, where $TC_t = K_t + C_{t,t}$,
L_t = liability for breach at time t,
$L_t = v$ equals expectation damages, and
$L_t = v - K_t$ equals expectation damages minus past expenditures on performance.

Behavioral Assumptions

1. Formation. The parties form a contract if the expected cost of performance to the promisor is less than its value to the promisee:

$$C_{0,0} \leq v \Rightarrow \text{form contract.} \quad \text{(B1)}$$

2. Bargain. The contract price lies between the promisor's expected cost of performance and the promisee's value of performance:

$$C_{0,0} \le p \le v. \tag{B2}$$

3. Performance. At each phase *t,* the promisor decides whether to default or spend the amount necessary to go forward according to whether the expected remaining expenditures exceed liability, which we write

$$\begin{aligned} &C_{t,t} \le L_t \Rightarrow \text{continue performing,} \\ &C_{t,t} > L_t \Rightarrow \text{default.} \end{aligned} \tag{B3}$$

Proposition 2. With each phase of the contract, the expected liability required to induce performance decreases.

1. The expected change in expected future costs between time t and $t+1$ equals $C_{t,t+i} - C_{t,t+i+1}$.

2. By definition of variables, $C_{t,t+i} - C_{t,t+1+1}$ equals $c_{t,t+i}$, where $c_{t,t+i} \ge 0$.

3. Consequently, $C_{t,t+i} \ge C_{t,t+i+1}$.

4. By decision rule (B3), the smallest expected liability necessary to induce performance at any stage t equals the expected remaining costs.

5. The two preceding steps prove the conclusion.

Proposition 3. If past expenditures are deducted from expectation damages, and if the promisor correctly estimates future costs of performance, then the promisor performs at every phase of the contract.

1. According to the bargain condition in expression (B2), we have $C_0 \le p \le v$.

2. By assumption, costs sunk as of i are the same as anticipated at 0, so C_0 equals $K_j + C_{i,j}$, for all i, j.

3. Combining the two preceding expressions yields $K_j + C_{i,j} \le v$, which implies $C_{i,j} \le v - K_i$.

4. By assumption that liability equals expectation damages minus past expenditures, we have $L_j = v - K_j$.

5. Combining the two preceding expressions yields the condition for the promisor to decide to perform rather than breach: $C_{i,j} \le L_j$. This is true for all times i, j.

Proposition 4. For any decreasing-liability contract, there exists a progress-payment contract with materially equivalent incentives for the promisor's performance and the promisee's assistance, and vice versa.

Proof.

1. Consider a contract requiring phased expenditures by the promisor designated $(c_1, c_2, \ldots, c_T)$, whose completion has value V to promisee.

Table B1. Comparison of Contract Types

Party and Contract	Future Payoff from Completing Performance (1)	Future Payoff from Terminating Performance (2)	Difference between (1) and (2) (3)
Promisor in DLC	$-C_{t,T}$	$-(V - C_{1,t})$	$V - C_{1,T}$
Promisee in DLC	V	$(V - C_{1,t})$	$C_{1,t}$
Promisor in PPC	$P_{t,T} - C_{t,T}$	0	$P_{t,T} - C_{t,T}$
Promisee in PPC	$V - P_{t,T}$	0	$V - P_{t,T}$

Note. DLC = decreasing-liability contract; PPC = progress-payment contract.

2. Let $C_{m,n}$ denote the sum of costs between m and n, or $(c_m + c_{m+1} + c_{m+2} + \ldots + c_n)$, for any m and n between 1 and T.

3. Let $P_{m,n}$ denote the sum of periodic payments the promisee makes to the promisor between m and n, or $(p_m + p_{m+1} + p_{m+2} + \ldots + p_n)$, for any m and n between 1 and T.

4. A decreasing-liability contract and a progress-payment contract are defined as a stream of net payoffs to the promisee and the promisor. Columns 1 and 2 in Table B1 define these two contracts by representing net payoffs at arbitrarily chosen time t.

5. Column 1 represents future payoffs expected at time t from completing performance, and column 2 represents future payoffs expected at time t from terminating performance at time t. Column 3 depicts the difference, which determines the promisor's incentives to complete performance and the promisee's incentives to assist.

6. Choose the periodic payments in period 1 to $T - 1$ to equal costs: $p_i = c_i$ for $i = 1, 2, \ldots, T - 1$. Choose the periodic payment in period T to equal cost in period T plus a completion bonus equal to the difference between the value of performance to the promisee and contracts total cost: $p_T = c_T + V - C_{1,T}$.

7. By definition, c_T equals $C_{1,T} - C_{1,T-1}$. From this fact and the preceding step, the sum of all past costs $C_{1,t}$ and future payments $P_{t,T}$ equals value V of performance: $V = C_{1,t} + P_{t,T}$. This is the condition under which the difference in the promisee's incentives given in column 3 are the same under a decreasing-liability contract and a progress-payment contract.

8. Total past costs as of t, denoted $C_{1,t}$, equal total costs of the project $C_{1,T}$ minus future costs of completion $C_{t,T}$. Substitute this fact into step 7 to obtain $V = -C_{t,T} + C_{1,T} + P_{t,T}$. This is the condition under which the difference in the promisor's incentives given in column 3 are the same under a decreasing-liability contract and a progress-payment contract.

9. If the difference in net payoffs given in column 3 for the promisor and the promisee is same under the two contracts, their incentive effects are equivalent.

Proposition 5. Assume that liability equals expectation damages minus past expenditures. Also make certain reasonable assumptions about the probability of errors in predictions. Then the longer the contract progresses as predicted, the lower the probability of breach.

1. Assume that the contract progresses as predicted to time $t-1$. If the contract progresses another period as predicted, then expectations are confirmed: $C_{t-1,t} = C_{t,t}$.

2. If, however, the promisor receives bad news that causes him to revise his cost estimate upward, then $C_{t-1,t} < C_{t,t}$.

3. The increase in expected future costs due to the bad news equals $C_{t,t} - C_{t-1,t}$.

4. By assumption, the liability rule is $L_t = v - K_t$, and the breach condition at time t is $C_{t,t} > L_t$. So breach will occur if $C_{t,t} > v - K_t$. (Note that this is the condition for a losing contract.)

5. Subtract $C_{t-1,t}$ from both sides of the preceding inequality: $C_{t,t} - C_{t-1,t} > v - K_t - C_{t-1,t}$.

6. Substitute $TC_{t-1} = K_t + C_{t-1,t}$ into the preceding inequality to obtain $(C_{t,t} - C_{t-1,t}) > v - TC_{t-1}$. The term $v - TC_{t-1}$ is the margin of error, which, if exceeded by expected future costs, causes breach.

7. Using the definitions,

$$C_{t,t} - C_{t-1,t} = \sum_{j=1}^{T-t} c_{t,t+j} - \sum_{j=1}^{T-t} c_{t-1,t+j}$$

$$= \sum_{j=1}^{T-t} \int [q_{t,t+i}(e_{t+i}) - q_{t-1,t+i}(e_{t+i})] e_{t+i} de_{t+i}.$$

For larger t, the sum is over fewer phases. Under reasonable assumptions about the distribution of errors, the cumulative effect of bad news is smaller for fewer phases. Hence, the longer the contract proceeds as expected, the lower the probability of future breach.

REFERENCES

American Law Institute. 1981. *Restatement of the Law, Second: Contracts*. Philadelphia: American Law Institute.

Ayres, Ian, and Kristin Madison. 1999. Threatening Inefficient Performance of Injunctions and Contracts. *University of Pennsylvania Law Review* 148: 45–108.

Bar-Gill, Oren, and Omri Ben-Shahar. 2002. The Law of Duress and the Economics of Credible Threats. Olin Discussion Paper No. 2002–017. University of Michigan Law School, Ann Arbor.

Che, Yeon-Koo, and Tai-Yeong Chung. 1999. Contract Damages and Cooperative Investments. *Rand Journal of Economics* 30:84–105.

Collins, Hugh. 1992. Implied Duty to Give Information during Performance of Contracts. *Modern Law Review* 55:556–62.

Cooter, Robert. 1985. Unity in Tort, Contract, and Property: The Model of Precaution. *California Law Review* 73:1–51.

Cooter, Robert, and Ariel Porat. 2002. Anti-insurance. *Journal of Legal Studies* 31:203–32.

Eisenberg, Melvin A. 2002. The Duty to Rescue in Contract Law. *Fordham Law Review* 71: 647–94.

Farnsworth, Allan E. 1999. *Contracts*. 3d ed. New York: Aspen Law & Business.

Fehr, Ernest, and Simon Gachter. 2002. Altruistic Punishment in Humans. *Nature* 415:137–40.

Fuller, Lon L., and William R. Perdue. 1936. The Reliance Interest in Contract Damages. *Yale Law Journal* 46:52–96.

The German Civil Code. 1975. Translated by Ian S. Forrester, Simon L. Goren, and Hans-Michael Ilgen. Amsterdam and Oxford: North-Holland.

Goetz, Charles J., and Robert E. Scott. 1983. The Mitigation Principle: Toward a General Theory of Contractual Obligation. *Virginia Law Review* 69: 967–1024.

Goldberg, Victor P. 1997. The Net Profits Puzzle. *Columbia Law Review* 97: 524–50.

———. 1998. Bloomer Girl Revisited or How to Frame an Unmade Picture. *Wisconsin Law Review,* no. 4, pp. 1051–84.

Polinsky, A. Mitchell, and Yeon-Koo Che. 1991. Decoupling Liability: Optimal Incentives for Care and Litigation. *Rand Journal of Economics* 22:562–70.

Porat, Ariel. 1994. Contributory Negligence in Contract Law: Toward a Principled Approach. *University of British Columbia Law Review* 28:141–69.

———. 1997. *Comparative Fault in Contract Law* (in Hebrew). Jerusalem: Institute for Legislative Research and Comparative Law.

White, James J., and Robert S. Summers. 2000. *Uniform Commercial Code*. 5th ed. St. Paul, Minn.: West Publishing Co.