

# Private Information and the Option to Not Sue: A Re-evaluation of Contract Remedies

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## Abstract

In this paper we study contracts with two-sided incomplete information. Prior literature on contract remedies does not formally account for the non-breaching party's option to *not* sue for damages upon breach, when her expected payoff from suing is negative, given the contractual terms and her private information about her post breach loss. With this option incorporated into the analysis, we show that: First, courts should commit to awarding fixed damages, because awarding flexible damages based on ex post information will distort the incentives to breach. This result is not driven by the information forcing effect of basing damages on ex ante expectations, *à la Hadley vs. Baxendale*. Second, the option of acquiescing to the breach expands the breach set under specific performance, which can be more efficient than other remedies. Third, the efficiency advantage of ex ante expectation damages over ex post actual damages is further enhanced when we account for the possibility of renegotiation. The main results are robust when we account for verification cost of plaintiff's damages and for parties' litigation cost.

**Key Words:** Breach of Contract, Damages Measures, Asymmetric Information, Litigation, Renegotiation

**JEL Classifications:** K0, K12, D82, D86

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## 1. Introduction

Not all broken promises are challenged by the promisees. When the promisee discovers that the promisor's breach made her better off, she would enthusiastically acquiesce. Surprisingly, with only few exceptions<sup>1</sup>, the literature on optimal remedies in contract law has largely ignored this fact. We show in this paper that the option of acquiescing to breach has significant implications for efficiencies of different contract remedies. Specifically, we show that when parties anticipate the arrival of post-contracting private information regarding their profitability under the contract, and even when the promisee's damages are verifiable to the court at no cost, it is counter-productive for the court to seek accuracy in determining the promisee's damages and to take into account the new information. Instead, the court should commit to ignoring the new information and to awarding fixed ex ante expectation damages. Doing so would generate more efficient incentives to breach.

In this paper, we re-evaluate three types of contract remedies commonly used in practice, explicitly taking into account the non-breaching party's option to acquiesce to the breach: (a) specific performance, (b) fixed ex ante expectation damages, and (c) ex post expectation damages, which we call here -- actual damages. Each damages measure is considered in the context of a seller-buyer contract with two-sided incomplete information and costless (or costly) litigation. We expand on work focusing on the effects of various legal rules on parties' incentives to breach a contract (e.g., Goetz and Scott, 1977; Ulen, 1984; Shavell, 2004). The prior work typically assumes some particular remedy will actually be applied once breach occurs; thus, it does not account for the possibility that a privately informed non-breaching party may choose not to file a lawsuit seeking a remedy if the expected payoff from pursuing the remedy is insufficient to make her better off compared to her payoff in the absence of a lawsuit. One important contribution of our paper is to explicitly identify the (privately informed) non-breaching party's embedded option to not seek remedies under various damages measures when comparing their respective efficiencies. In other words, most previous analyses assumed that the promisee's decision to litigate is *exogenously* given, whereas we treat it as an *endogenous* decision the promisee makes based on her post-breach private information about her valuation.

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<sup>1</sup> Che and Schwartz (1995) and Adler (2008) discussed this point while analyzing non-compensatory damages. In a dynamic repeated transaction framework, Ben-Shahar and Bernstein (2000) noticed the aggrieved party's reluctance to file a suit when seeking the available remedy requires disclosure of private information which is against her long-term interest. We distinguish our work from theirs in the literature review section.

In most cases contracting parties learn new (possibly asymmetric) information after signing the contract, and the possibility of breach and litigation may follow. An important question facing the court in such situations is whether, when determining contract damages, to incorporate the new information revealed, or instead to base the damages only on the information available *ex ante*. We rank the efficiency of the remedies accounting for the endogenous decision to litigate the breach, and find that when courts commit to a fixed *ex ante* expectation remedy the joint payoff is higher than when courts adapt damages to the information revealed *ex post*.

We present a simple model where a buyer and a seller contract at the *ex ante* stage, Time 1, in which they are symmetrically informed only about the distributions of costs and valuations of a good to be traded at Time 3. In the interim stage, Time 2, the seller privately learns its costs and the buyer privately learns its actual value. At this point the seller decides whether to breach the contract. In the *ex post* stage (Time 3) the buyer either pays the price, if the seller delivered, or decides whether to file a lawsuit if the seller breached. Throughout the analysis we assume that the seller's cost and the buyer's valuations are unobservable to the other party, but the non-breaching party's *ex post* damages are verifiable to the court.<sup>2</sup> We also assume that seller's costs are unverifiable to the court at all times.<sup>3</sup> We vary, however, the extent to which the buyer's valuation is verifiable to the court. We first assume that the buyer's valuation can be verified *ex post* to the court at no cost, then assume it can be verified but only with costs (comparing the English rule of loser pays with the American rule). Furthermore, we account for parties' litigation costs and distinguish between verification costs and litigation costs. Whereas costs of verifying the *ex-post* damages are relevant only when the remedy considered is *ex post* actual damages; parties always bear litigation costs even when the remedies sought by the buyer are specific performance or fixed *ex-ante* damages, which do not require verifying the buyer's *ex-post* harm. Lastly, we repeat our analysis under the assumption that parties can renegotiate the contract.

Our study yielded several findings. First, even when verifying *ex post* damages is costless, the fixed *ex ante* expectation damages remedy is always more efficient than the actual damages remedy and is in fact the *optimal money damages*. This result is surprising because one

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<sup>2</sup> The verifiability of damages makes the actual damages remedy enforceable. We will discuss the effect of the cost to verify *ex post* damages.

<sup>3</sup> Otherwise, trivially, the court would have been able to determine the first-best allocation by verifying the two parties' private values.

would think that from an ex ante perspective the seller's incentives to breach would not be affected by whether the court awards actual damages or fixed ex ante expectation damages. A risk neutral seller should be indifferent, ex ante, to having to pay the mean of the buyer's distribution of valuations or having to pay the actual ex post manifestation of it. What this intuition overlooks, however, is that if a court awards actual damages the buyer would file a lawsuit only when her ex post actual valuation is larger than the contracted price; otherwise the buyer might end up, at least in theory, *paying* damages. Thus, in litigation, the seller never, in fact, faces the entire distribution of buyer's valuations under actual damages remedy. Instead, he faces a truncated distribution which has a higher mean than the ex ante expectation damages. As a result, the seller breaches less often than optimal. Therefore, joint welfare in an actual damages regime is reduced relative to a fixed ex ante expectation damages regime.

In such circumstances courts are better "tying their own hands" and committing to not adapt damages using information revealed ex post. A black-letter rule of simply awarding fixed ex ante expectation damages would provide better incentives for efficient breach. Interestingly, this result does not change when we assume that verifying the buyer's damages is costly, whether these costs are born by the buyer or by the seller. Moreover, while this result (that fixed expectation damages are superior to actual damages) echoes analyses of the *Hadley v. Baxendale* rule, it has nothing to do with the incentives to reveal pre-contractual private information that expectation damages may provide (the so-called information-forcing effect, see Ayres and Gertner, 1989; Bebchuk and Shavell, 1991; Adler, 1999). In our model, neither party has private information at the contracting stage.

Second, we show that specific performance can be more (or less) efficient than any of the other remedies, depending on the distributions of values and costs. The conventional wisdom ranks specific performance below money damages because specific performance strips the seller of the flexibility to breach the contract when his costs are high, whereas money damage remedies allow him flexibility to not perform, which may be efficiency-enhancing. But this argument overlooks the embedded option to breach which exists even under the specific performance remedy. Specifically, as was explained above with respect to actual damages, the non-breaching party will not file a lawsuit when her ex post value from performance is lower than the contracted price. Thus, specific performance actually *does* allow the seller some flexibility to breach as well, and does not lead to 100% performance ex post, even when litigation is costless.

We show that when parties' distributions of costs and value are such that it is more likely that the value from performance exceeds the costs (from the ex ante perspective), specific performance could be more efficient compared to other remedies.

We then check the robustness of our results. Specifically, we explore the robustness of our results as to (1) the existence of positive verification cost of ex post damages; (2) the existence of positive litigation cost and the corresponding cost shifting rule (American versus English rule); and (3) the possibility to renegotiate the contract. We find that, first, when we just account for renegotiation (maintaining the assumptions of costless litigation and verification) all our results remain, and actually the advantage of fixed ex ante expectation damages over actual damages increases. Indeed, under these assumptions, ex ante expectation damages lead to *first best* allocation. The intuition is: Because the buyer's damages are verifiable and she always sues upon breach under the fixed ex ante expectation damages, the seller will always breach to fully extract information and surplus from the buyer through renegotiation. Second, in a web appendix (available from the authors) we analyze the effect of positive verification cost<sup>4</sup> and positive litigation cost (with and without renegotiation), and find that the main results are robust in those scenarios<sup>5</sup>.

The rest of the paper is organized as follows: In Section 2, we briefly discuss the relation of our paper to the previous literature. In Section 3, we present the model and compare the efficiency of various contract remedies. In Section 4, we summarize our results and conclude. In Appendix 1, we provide a survey of the relevant Anglo-American law on contract remedies in Part A; and the proof that the buyer's participation constraint in the seller's optimization problem is binding in Part B. In Appendix 2, we provide the results from the analysis of the case with positive verification cost of damages and/or positive litigation costs.

## **2. Related Literature**

There are four strands of literature that are closely related to our paper: (1) literature that addresses efficiency of various contract remedies; (2) literature that compares the different

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<sup>4</sup> Clearly, positive verification cost of ex post damages would add an additional disadvantage to actual damages remedy since enforcing ex ante expectation damages or specific performance does not require verifying ex post damages. So assuming zero verification cost in fact strengthens our result that actual damages are inferior to ex ante expectation damages.

<sup>5</sup> The only exception is under the English rule when there is renegotiation and the litigation costs are sufficiently high relative to the expected trade surplus, actual damages may be more efficient in limited scenarios.

information disclosure effects of these remedies; (3) literature that addresses the optimal accuracy of damages assessment, and (4) literature that analyzes the embedded options in contract damages.

First, there is a large volume of literature on the comparative advantage of various contract remedies. For example, Birmingham (1970), Barton (1972), Goetz and Scott (1977), Schwartz (1979), Shavell (1980, 1984), Miceli (2004), and Schwartz and Scott (2008), among many others, have studied various damages measures for breach of contract and compared their efficiency. Edlin and Schwartz (2003) and Mahoney (2000) provide excellent surveys of this literature. Almost without exception these studies assume that the non-breaching party will always pursue a remedy for the contract breach regardless of her post-breach valuation. As a result, these studies ignore the endogenous option of the non-breaching party to *not* litigate the case if her post-breach valuation is smaller than the contracted price. In contrast, our model incorporates the embedded option to rationally acquiesce to a breach and demonstrates that this has important efficiency implications. For example, many papers naturally assume that under the specific performance remedy, the breach set is empty.<sup>6</sup> But actually even under specific performance, the breach set is non-empty and includes the set of situations under which the non-breaching party chooses to not pursue a remedy for breach because her expected payoff from litigation might be negative.

The second strand of literature analyzes the incentives the various remedies provide to disclose private information (see Ayres and Gertner, 1989; Bebchuk and Shavell, 1991; and Adler, 1999). Bebchuk and Shavell (1991) showed that awarding *ex ante* expectation damages motivates more information disclosure from the privately informed party at the contracting stage and thus makes the estimation of expectation damages more accurate, leading to more efficient breach decisions. In contrast, in our framework, parties to the contract have no private information at the *ex ante* (contracting) stage, thus no information disclosure incentives need to be created at that stage. The advantage of *ex ante* expectation damages over actual damages in our model emerges because the seller has distorted incentives to breach under actual damages due to the non-breaching party's option to *not* file a lawsuit.

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<sup>6</sup> See, e.g., Shavell (1984, p. 132). Because he assumes the non-breaching party's value is fixed, thus breach is always litigated, leading to performance in all contingencies under the remedy of specific performance.

Ayres and Talley (1995) argue that untailed liability rules facilitate more efficient trade than tailored liability rules, with an approach similar to that of Johnston (1995) that bargaining under uncertain standards rather than under fixed rules can improve bargaining efficiency. Ayres and Talley reach the conclusion by proving that untailed liability rule obscures the boundary between "buyer" and "seller" of the entitlement during bargaining, and consequentially induces more credible signaling of private information, thus facilitating Coasean trade. Scott and Triantis (2006) explore how parties optimally tradeoff the "front end" costs of writing contracts and "back end" costs of enforcing contracts in contract design, especially when parties would write vague terms (standards) rather than specific terms (rules) in contracts. They argue that the equilibrium incompleteness (vagueness) of contracts (e.g., whether to write fixed liquidated damages at ex ante or to leave the court to determine default expectation interest at ex post) depends on the relative informational advantage of parties (at ex ante) versus of the court (at ex post). We, however, show the efficiency advantage of ex ante expectation damages over actual damages by focusing on the non-breaching party's option to not sue for damages upon breach, and in particular assuming that parties at the ex ante stage have no informational advantage vis-a-vis the court.

The third strand of related literature deals with the accuracy of damages assessment and its incentive effects on parties' primary behavior. (See Spier (1994), and Kaplow and Shavell (1996)). These studies analyzed the incentive effect of the accuracy of a court's assessment of damages on an injurer's precaution effort, information acquisition, and evidence production. Their analysis focuses on a unilateral-care tort model, where, under most reasonable conditions (and ignoring litigation costs), the victim would always sue for damages. Conversely, in our contract-based model, the victim might choose to not sue for damages, when her post-breach valuation is low. As a result the breaching party's performance incentives are distorted. Friehe (2005) extends Kaplow and Shavell (1996) to a bilateral-care model and finds that courts should utilize the information available to assess accurate damages. In addition Friehe proposes using payments as an incentive to screen different types of victims and reduce the burden of assessment by inducing self-selection. However, even Friehe ignores the option to not sue and assumes that the filing of a lawsuit is exogenously given.

Lastly, some authors realize the embedded options in contract damages. For example, Che and Schwartz (1999) discussed the solvent party's option to exit from a contract when the

other party is bankrupt, and identified a problem of truncated distribution of damages driven by court's errors and manager's pursuit of private benefit from inefficient projects, albeit in a narrower context of the ipso facto clause in bankruptcy law. We, however, show that truncated distribution of damages exists in every contract even when damages are verifiable to the court without costs (and therefore there are no court's errors). In a dynamic repeated transaction framework, Ben-Shahar and Bernstein (2000) identified the "secrecy interest" as standing behind the aggrieved party's reluctance to file a suit when the available remedy requires disclosure of private information which might hurt her competitive position in the long run. Interestingly, Ben-Shahar and Bernstein also argue that flat damages may be more efficient than fully compensatory damages after taking into account the strategic value of hiding private information (secrecy interest). We, however, formally rank the efficiency of various contract remedies showing that even in a static framework, where parties only care about the current payoff and there is no strategic loss in the future from information disclosure, the privately informed aggrieved party's option not to sue is embedded in all contract remedies.

In a recent paper Adler (2008) provides an analysis of potential benefit from removing the restriction of negative damages (paid by the non-breaching party to the breaching party) in contract law. Our analysis, in contrast, takes the disallowance of negative damages as given, and then formally compares the efficiency of various remedies in light of the embedded option to not sue.

### 3. The Model

#### 3.1 Set Up

At Time 1 a risk-neutral seller (he) and a risk-neutral buyer (she) enter a contract for the sale of a single widget. The seller receives the payment upon performance at Time 2. Uncertainties exist at Time 1 for both the seller's cost (or alternative bids for the widget he receives after contracting) and the buyer's valuation of the widget. Specifically, the seller's cost,  $c \in [0, \bar{c}]$ , is drawn from a distribution  $F(c)$  with density  $f(c)$ .  $f(c) > 0, \forall c \in [0, \bar{c}]$ . The buyer's valuation,  $v \in [0, \bar{v}]$ , is drawn from a distribution  $G(v)$  with density  $g(v)$ .  $g(v) > 0, \forall v \in [0, \bar{v}]$ . The commonly known distributions  $G(\cdot)$  and  $F(\cdot)$  are independent, continuous and differentiable. Both  $\bar{c}$  and  $\bar{v}$  are finite<sup>7</sup>, with  $\bar{c} > E(v)$ , and  $\bar{v} > E(c)$ . Between Time 1 and

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<sup>7</sup> Here we do not consider the circumstances where performance is impossible or prohibitively costly.



We compare the contracted price, the incentives to breach, and the parties' joint expected payoff under various contract remedies and varying costs of verification<sup>9</sup>. We are particularly interested in comparing the efficiency of two specific remedies: fixed *ex ante* expectation damages and actual damages (sometimes called *ex post* expectation damages), where the former commits to a fixed damages, not incorporating into the damages determination the new information learned by the parties after contracting; while the latter seeks accuracy, fully incorporating the new information into the damages determination. To emphasize the difference between the two approaches, we assume that the buyer's valuation is verifiable in litigation through the discovery process, thus actual damages are totally assessable. The breaching party's private information is unverifiable.<sup>10</sup>

### **3.2 Efficiency of Contract Remedies with No Renegotiation**

In this subsection, we analyze the efficiency of various contract remedies, assuming that the parties cannot (or can commit not to) renegotiate the contract after they learn new information. At Time 3 the court enforces the single remedy that the parties contracted for at Time 1. We assume that the seller's costs and the buyer's valuation are private information and non-observable to the other party throughout the entire transaction, but that the buyer's damages are verifiable *ex post* in court through discovery. For the moment we assume that there are no costs to verify *ex post* damages, later we consider the case with positive verification cost.<sup>11</sup>

#### ***A. Specific Performance***

Under the regime of Specific Performance (SP), the court is assumed to always enforce specific performance that the parties contracted for if the buyer files a lawsuit. We solve the equilibrium by backward induction. At Time 3, upon breach the buyer will file a lawsuit only if

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<sup>9</sup> We recognize that the contracted price, the incentives to breach, and the joint welfare are influenced by several factors. First, the default legal damages remedy a court will apply at Time 3 if a lawsuit is filed upon breach. Second, the anticipated cost of verifying damages, as well as whether the English rule or American rule of litigation cost shifting applies when litigation is costly.

<sup>10</sup> Otherwise, if both values are verifiable at low cost, it would be trivial for the court to determine a first best allocation, no matter what remedies the parties had contracted for.

<sup>11</sup> Assuming no cost to verify the *ex post* damages removes a disadvantage of actual damages remedy relative to other remedies, since only actual damages remedy requires accurate damage assessment to enforce the contract. We showed in the paper that even with no verification cost, actual damages are less efficient than the fixed *ex ante* expectation damages. So the assumption of no verification cost strengthens our result. See the details of the case with positive verification cost in Appendix 2.

$v > p$ . So the seller's expected payoff from breach is  $\int_p^{\bar{v}} (p - c) dG(v)$ ; and he will breach if  $c > p$ . The seller (with full bargaining power) chooses a price to maximize his expected payoff subject to the buyer's participation constraint. (Notations:  $\pi$  denotes parties' expected payoff, while  $j\pi$  denotes joint expected payoff; subscripts  $B$  and  $S$  denote buyer and seller, respectively; and the superscripts denote the remedy applied to the breach).

$$\begin{aligned} \text{Max}_p \pi_S^{SP} &= \int_0^p (p - c) dF(c) + \int_p^{\bar{c}} \int_p^{\bar{v}} (p - c) dG(v) dF(c) \\ \text{s. t. } \pi_B^{SP} &= \int_0^p (E(v) - p) dF(c) + \int_p^{\bar{c}} \int_p^{\bar{v}} (v - p) dG(v) dF(c) \geq 0. \end{aligned}$$

The first term of  $\pi_S^{SP}$  represents the seller's payoff if he voluntarily delivers, whereas the second term represents his payoff when he is forced to deliver by court. It can be shown that in equilibrium the constraint is binding (i.e., the buyer's expected surplus is fully extracted by the seller, see proof in Appendix 1),  $\pi_B^{SP} = 0$ . Therefore the equilibrium price and the expected joint payoff under SP are given by:

$$\begin{aligned} (1) \quad p^{SP} &= E(v) + \frac{1 - F(p^{SP})}{F(p^{SP})} \int_{p^{SP}}^{\bar{v}} (v - p^{SP}) dG(v). \\ (2) \quad j\pi^{SP} &= \int_0^{p^{SP}} (E(v) - c) dF(c) + \int_{p^{SP}}^{\bar{c}} \int_{p^{SP}}^{\bar{v}} (v - c) dG(v) dF(c). \end{aligned}$$

It is obvious from equation (1) that the contracted price under specific performance will always be higher than the buyer's expected valuation, i.e. that  $p^{SP} > E(v)$ . This might look counterintuitive as it means that the contracted price is too high for the buyer to breakeven. However, in ex post the buyer enjoys some "desirable breaches" (when her ex post valuation turns out to be lower than the contracted price, and the seller breaches) and can therefore afford accepting a contract with a higher price than the ex ante breakeven price.

**Lemma 1**  $p^{SP} > E(v)$ .

As will be discussed below, Lemma 1 implies that the seller would attempt to breach *less often* under specific performance than under the remedy of ex ante expectation damages.

## ***B. Ex Ante Expectation Damages***

Here the court is assumed to commit itself to awarding ex ante expectation damages. Even if new information about the buyer's valuation is revealed during litigation, the court will not revise the damages award. We call this regime *Ex Ante Expectation Damages (ED)*. The equilibrium price under this regime must be no greater than  $E(v)$ , otherwise the buyer's expected payoff (either from the seller's performance or from litigation over breach),  $E(v) - p$ , would be negative, and she will never sign such a contract. Thus,  $p \leq E(v)$ , which implies that the buyer always sues upon breach. As a result, the seller breaches only if  $c > E(v)$ . Seller's optimization problem is:

$$\begin{aligned} \max_p \pi_S^{ED} &= \int_0^{E(v)} (p - c) dF(c) + \int_{E(v)}^{\bar{c}} (p - E(v)) dF(c), \\ \text{s.t. } \pi_B^{ED} &= E(v) - p \geq 0. \end{aligned}$$

Obviously,  $p^{ED} = E(v)$ , and the joint expected payoff is:

$$(3) \quad j\pi^{ED} = \int_0^{E(v)} (E(v) - c) dF(c).$$

It turns out that *ED is the welfare-maximizing money damages remedy*. To see this, suppose that in response to the anticipated court-imposed money damages, the seller's optimal breach threshold is  $a$ . Then the joint expected payoff is  $j\pi = \int_0^a (E(v) - c) dF(c)$ . A welfare-maximizing court will choose the money damages such that the induced breach threshold  $a$  will maximize the joint expected payoff. Simple calculus gives us:  $a^* = E(v)$ , which is exactly the breach threshold that ex ante expectation damages would induce. Therefore, among all *money* damages, ex ante expectation damages turns out to be the welfare-maximizing remedy.

Recall that under specific performance the seller breaches whenever  $c > p^{SP}$ , which from Lemma 1 we know is greater than  $E(v)$  from Lemma 1. This implies that the seller would breach less often under specific performance than under the ex ante expectation damages remedy. Notice, however, that this does not imply that under *SP* there will be fewer "final" non-deliveries than under *ED*, because under *SP* the buyer may decide to file a lawsuit which would guarantee her a court order for specific performance so the good would be eventually delivered.

Comparing the joint payoffs under ED versus under SP yields:

$$\begin{aligned}
j\pi^{ED} - j\pi^{SP} &= \int_0^{E(v)} (E(v) - c) dF(c) - \int_0^{p^{SP}} (E(v) - c) dF(c) - \int_{p^{SP}}^{\bar{c}} \int_{p^{SP}}^{\bar{v}} (v - c) dG(v) dF(c) = \\
&\quad \underbrace{\left[ \int_0^{E(v)} (E(v) - c) dF(c) - \int_0^{p^{SP}} (E(v) - c) dF(c) \right]}_{\text{Difference in efficiency from voluntary performance}} \\
&\quad - \underbrace{(1 - F(p^{SP}))(1 - G(p^{SP}))[E(v|v \geq p^{SP}) - E(c|c \geq p^{SP})]}_{\text{Potential efficiency gain from involuntary performance under SP}}.
\end{aligned}$$

Denote

$$(4) \quad \Delta_1 := \int_{E(v)}^{p^{SP}} (c - E(v)) dF(c)$$

as the difference in efficiency between ED and SP due to the different incentives that the two remedies provide for *voluntary* performance. Since  $E(v)$  is the ex-ante optimal breach threshold,  $\Delta_1$  is always positive. Denote

$$(5) \quad \Delta_2 := (1 - F(p^{SP}))(1 - G(p^{SP}))[E(v|v \geq p^{SP}) - E(c|c \geq p^{SP})]$$

as the potential efficiency gains emerging from the seller's *involuntary* performance under SP. When the buyer's conditional expected value is higher than the seller's conditional expected cost, this forced performance under specific performance creates efficiency gains (from the ex ante perspective). The comparison of joint payoffs stipulates that if  $\Delta_1 \geq \Delta_2$ , then SP is inferior to ED; otherwise, SP becomes superior, as the efficiency gain from forced performance under SP more than offsets the potential efficiency loss from the inferior breach incentives it provides.<sup>12</sup>

### C. Actual Damages

Here the court is assumed to award actual damages (usually called *ex post* expectation damages). In this case, which is the usual remedy under US law, the court is tuned towards accuracy; it incorporates ex post information attempting to compensate the victim of breach as accurately as possible; we call this regime *Actual Damages* (AD). At Time 3 the buyer will sue for actual damages only if  $v > p$ . Anticipating the buyer's litigation decision, the seller's expected payoff if he breaches the contract is:  $\int_p^{\bar{v}} (p - v) dG(v)$ . Therefore, the seller will breach when

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<sup>12</sup> For example, when  $c$  is uniformly distributed over  $[0,1]$ ; and  $v$  is uniformly distributed over  $[0,3/2]$ , we have  $j\pi^{SP} = 7/23 > 9/32 = j\pi^{ED}$ . In this case SP is more efficient than ED.

$$c > p + \int_p^{\bar{v}} (v - p) dG(v) = E(v) + \int_0^p (p - v) dG(v).$$

We denote

$$(6) \quad Br(p) := E(v) + \int_0^p (p - v) dG(v)$$

as the seller's breach threshold given the contracted price,  $p$ . The seller's optimization problem is:

$$\begin{aligned} Max_p \pi_S^{AD} &= \int_0^{Br(p)} (p - c) dF(c) + \int_{Br(p)}^{\bar{c}} \int_p^{\bar{v}} (p - v) dG(v) dF(c) \\ s. t. \pi_B^{AD} &= \int_0^{Br(p)} (E(v) - p) dF(c) + \int_{Br(p)}^{\bar{c}} \int_p^{\bar{v}} (v - p) dG(v) dF(c) \geq 0. \end{aligned}$$

It can be shown that in equilibrium the constraint is binding, and the price and joint surplus are given as follows:

$$(7) \quad p^{AD} = E(v) + \frac{1 - F(Br(p^{AD}))}{F(Br(p^{AD}))} \int_{Br(p^{AD})}^{\bar{v}} (v - p^{AD}) dG(v).$$

$$(8) \quad j\pi^{AD} = \int_0^{Br(p^{AD})} (E(v) - c) dF(c).$$

From the definition of  $Br(p)$ , it is obvious that  $Br(p) > E(v)$  and  $Br(p) > p$ . Since the breach threshold under AD is larger than the breach threshold under ED (i.e.,  $Br(p) > E(v)$ ), in expectation there will be fewer breaches under AD than under ED.  $Br(p) > p$  implies that sometimes the seller voluntarily performs at a loss. The reason will be discussed below.

The joint (ex ante) payoff under AD may be smaller or larger than the joint (ex ante) payoff under SP:  $j\pi^{AD} - j\pi^{SP} = \Delta_3 - \Delta_2$ , where  $\Delta_2$  represents potential efficiency gain from forced performance under SP as defined in equation (5), and

$$(9) \quad \Delta_3 := \int_{p^{SP}}^{Br(p^{AD})} (E(v) - c) dF(c).$$

$\Delta_3$  is similar to  $\Delta_1$ , it represents the payoff difference emerging from different incentives to voluntarily perform that AD and SP regimes provide to the seller. The ranking between AD and SP depends on the size of  $\Delta_3$  versus  $\Delta_2$ .

Lemma 2 summarizes the results:

**Lemma 2** Assume that the parties commit to not renegotiate the contract after learning new information, and that verifying damages by the court is costless, then the following hold (" $<$ " means "is less efficient than"):

(i)  $AD < ED$ , which is the welfare-maximizing money damages remedy;

(ii)  $AD < SP$  iff  $\Delta_3 < \Delta_2$ ;

(ii-a)  $AD < SP < ED$  iff  $\Delta_3 < \Delta_2 < \Delta_1$ ;

(ii-b)  $AD < ED < SP$  iff  $\Delta_3 < \Delta_1 < \Delta_2$ ;

(iii)  $AD$  induces the seller sometimes to voluntarily perform at a loss.

(i) stipulates that seeking ex post accuracy in damages (AD) is inferior to awarding fixed ex ante expectation damages (ED), even when the victim's ex post damages can be verified without cost. The reason is that the expectation damages are ex-ante optimal: the seller will breach if and only if his costs are higher than the buyer's expected valuation,  $E(v)$ , which is, from the ex ante perspective, an efficient breach. In contrast, under actual damages, the breach threshold,  $Br(p^{AD})$ , is higher than the buyer's expected valuation,  $E(v)$ . This means that from the ex ante perspective, efficient breaches happen less often.

The question then becomes why under actual damages the breach threshold is higher than  $E(v)$ , which is the breach threshold under fixed ex ante damages? The answer is that under fixed ex ante damages, the seller's expected damages payment (gross of the contracted price) in case of a breach is fixed at  $E(v)$ , regardless of the buyer's ex post valuation. In contrast, under actual damages a buyer will file a lawsuit upon breach only if her ex post valuation is higher than the price,  $v > p$ . This means that *under actual damages, from the ex ante perspective the seller faces a left-truncated distribution of possible damages awards with a mean larger than  $E(v)$ . He will therefore breach less often*, and only when his costs are high enough to justify it. Indeed, as claimed in (iii), AD induces the seller sometimes to perform at a loss.

The analysis so far assumed that the consideration is paid upon performance. However, the superiority of ex ante expectation damages over actual damages remains even if price is assumed to have been paid in advance. In such a case, one would initially think that the buyer will always file a lawsuit against breach, and that therefore the distribution of possible damages the seller faces is no longer truncated. Yet, since courts observe the buyer's ex post actual damages, they will not make the buyer pay damages for the seller's breach when the buyer's valuation is lower

than the price of the widget (no negative damages in contract law). Rather, they will award the buyer restitution, returning to her the money she paid for the widget. As a result, the seller still faces the truncated distribution our analysis above suggested.

The superiority of expectation damages over actual damages is not due to the fact that expectation damages may induce parties to disclose pre-contractual private information as demonstrated in previous literature (see Ayres and Gertner, 1989; Bebchuk and Shavell, 1991; Ayres and Talley, 1994; Adler, 1999). In our model, at the contracting stage (Time 1) parties do not have private information. It is after contracting that they learn private information.

(ii) stipulates that the efficiency ranking of ED and AD relative to SP depends on the distributions. To better understand this point recall that under SP there are two cases under which the seller performs. First, the seller performs voluntarily when his costs are low. Second, the seller performs when a court orders specific performance. If the distributions of costs and valuation suggest that the buyer's expected valuation (given a breach) is sufficiently higher than the seller's expected cost, this second type of performance—forced performance—is efficiency-enhancing. In this instance, SP might be superior despite the adverse breach incentives it originally provides to the seller. Therefore, depending on the distributions, SP can be ranked anywhere when compared with ED and AD.

The previous literature usually assumes that by definition the breach set (the states of the world under which the seller breaches the contract in equilibrium) under SP is empty. However, once we take into account the victim's option to not sue for damages upon breach, the breach set under SP is no longer empty, rather it is  $\{(v, c) | v \leq p^{SP} \leq c\}$ .

In Appendix 2, we performed a similar analysis of these contract remedies but under different assumptions regarding the verification cost and litigation cost. First, we assume the costs of verifying the buyer's ex post damages during litigation are *positive*. Second, we assume parties face positive litigation costs if a lawsuit is filed. (We compare the American rule that each party pays his own litigation cost with the English rule under which the loser pays all the litigation costs). Not surprisingly, positive verification costs or more generally positive litigation costs further strengthens the advantage of ex ante expectation damages over actual damages, since the ex ante expectation damages remedy does not require verifying the ex post damages, it

entails a much less costly litigation or enforcement.<sup>13</sup> Proposition 1 summarizes all the results so far (including the results from Appendix 2 for the case of positive verification costs and positive litigation costs):

**Proposition 1** *Assume that the parties commit not to renegotiate the contract after learning new information. Then with verifiable damages the following holds:*

*(i) Awarding ex ante expectation damages is the welfare-maximizing (money) remedy, no matter whether verifying the ex post damages is costly or not, and no matter whether there are positive litigation costs, under either American rule or English rule; in particular, awarding actual damages (incorporating post-contracting information into damages determination) is inferior to awarding the fixed ex ante expectation damages;*

*(ii) The efficiency comparison with specific performance, however, depends on the distributions of costs and valuation.*

We have demonstrated that when parties commit to not renegotiate the contract ex post, the court had better stick to the fixed ex ante expectation damages, rather than seeking accuracy in damages, even when verifying ex post damages is costless. This is not due to the information disclosure incentive effect identified in previous literature (Ayres and Gertner, 1989; Bebchuk and Shavell, 1991; and Adler, 1999), but due to the distortion of incentives to breach under actual damages.

### ***3.3 Efficiency of Contract Remedies with Renegotiation***

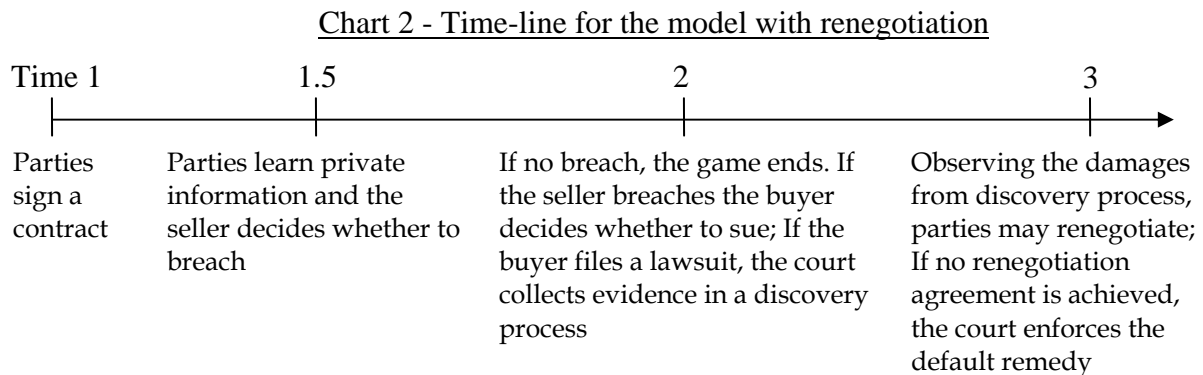
So far we have assumed that the parties can commit to not renegotiate after they acquire new information. We now relax this assumption and allow for renegotiation. Parties sign a contract with a default price,  $p$ , and anticipate that pre-trial renegotiation might take place after

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<sup>13</sup> In terms of informational demand, the remedies of specific performance and ex ante expectation damages are less costly than the actual damages remedy, since SP and ED do not require verifying ex post damages, they are the type of “*ex post information – free*” remedies. Even when the damages are unverifiable private information, it will not affect the enforcement of SP or ED as default remedies. In contrast, AD relies on verification of ex post damages. Therefore, it has this informational-demanding disadvantage compared with SP and ED.

the discovery process.<sup>14</sup> In the renegotiation, the seller (who has full bargaining power by assumption) makes a take-it-or-leave-it offer. If the offer is accepted by the buyer, the seller is exempted from performing the original contract. If renegotiation breaks down, the court will enforce the default remedy.

The time-line of the game with renegotiation is depicted below:



Given the buyer’s ex post damages are revealed through the discovery process, the seller’s optimal renegotiation strategy is quite straightforward regardless of the contract remedy: If  $v \geq c$ , the seller will seek to trade at a price which guarantees the buyer her status quo payoff from trial; If  $v < c$ , the seller will seek to breach the contract, paying money damages to ensure the buyer obtains her status quo payoff from trial. Notice that this simple renegotiation scheme maximizes the ex post joint payoff given the litigation exists. Also notice that, as the only party with private information at the renegotiation stage, the seller extracts all the renegotiation surplus. This is also consistent with the assumption that he has full bargaining power.

### **A. Specific Performance with Renegotiation**

We solve the equilibrium by backward induction. At time 3, parties completed the discovery process where the buyer’s valuation,  $v$ , is revealed to all parties. The seller decides on renegotiation strategy. The buyer’s and seller’s status quo payoff from litigation are  $v - p$ , and

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<sup>14</sup> There are many different assumptions one can make about the informational structure of the renegotiation game. For example, one may consider renegotiation after the parties learned their private information but prior to the discovery process in litigation. However, as the discovery process will unveil one party’s private information (the damages are ex post verifiable to the court), from the ex ante perspective parties would prefer to renegotiate only post discovery, because renegotiation with one-sided asymmetric information can lead to first best allocation if the party with private information makes the offer.

$p - c$ , respectively, since the default remedy is specific performance. So the buyer will accept an offer only if her guaranteed payoff is at least  $v - p$ . Given  $v$ , the seller's optimal strategy is to not make any renegotiation offer if  $c \leq v$ ; and to make a take-it-or-leave-it damages offer  $v - p$  to breach when  $c > v$ . Then at Time 2, upon breach the buyer will sue only if  $v > p$ . The seller will breach when  $c > p$ .<sup>15</sup> Therefore, the seller's optimization problem is:

$$\begin{aligned} \text{Max}_p \pi_S^{SP_r} &= \int_0^p (p - c) dF(c) + \int_p^{\bar{c}} \left\{ \begin{aligned} &\int_p^{\min(c, \bar{v})} (p - v) dG(v) \\ &+ \int_{\min(c, \bar{v})}^{\bar{v}} (p - c) dG(v) \end{aligned} \right\} dF(c); \\ \text{s.t. } \pi_B^{SP_r} &= \int_0^p (E(v) - p) dF(c) + \int_p^{\bar{c}} \int_p^{\bar{v}} (v - p) dG(v) dF(c) \geq 0. \end{aligned}$$

Similarly, it is straightforward to show from Kuhn-Tucker conditions that the constraint is binding. Therefore, the equilibrium price and expected joint payoff are:

$$(10) \quad p^{SP_r} = p^{SP};$$

$$(11) \quad j\pi^{SP_r} = \int_0^p (E(v) - c) dF(c) + \int_p^{\bar{c}} \int_{\min(c, \bar{v})}^{\bar{v}} (v - c) dG(v) dF(c).$$

The equilibrium price is the same as under SP without renegotiation. The reason is that in both cases the buyer is guaranteed an ex post payoff of  $v - p$ , while the seller extracts the entire ex ante surplus. However, the joint expected payoff is larger when renegotiation is possible because renegotiation prevents the occurrence of the inefficient (forced) performance when the seller attempted to breach but the buyer nonetheless sought performance.<sup>16</sup> In other words, the opportunity of renegotiation post discovery allows the seller to pay actual damages rather than to perform when delivery is inefficient.

### ***B. Ex Ante Expectation Damages with Renegotiation***

At time 3, the buyer's valuation,  $v$ , is revealed to all parties through the discovery process. The seller chooses a renegotiation strategy. The buyer will accept an offer only if her guaranteed payoff is at least  $E(v) - p$ . The seller's optimal strategy is to renegotiate to trade at

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<sup>15</sup> We know that the seller's payoff from performance is  $p - c$ . There are two cases: (1) when  $c < p$ , the seller's expected payoff from breach is  $\int_p^{\bar{v}} (p - c) dG(v) < (p - c)$ . Therefore, he will perform in this case; (2) when  $c \geq p$ , the seller's expected payoff from breach (taking into account renegotiation given attempted breach) is  $\int_p^c (p - v) dG(v) + \int_c^{\bar{v}} (p - c) dG(v) > (p - c)$ . Therefore, he will breach in this case.

<sup>16</sup>  $j\pi^{SP_r} - j\pi^{SP} = - \int_p^{\bar{c}} \int_{p^{SP}}^{\min(c, \bar{v})} (v - c) dG(v) dF(c) \geq 0$ .

price  $p - E(v) + v$  when  $v \geq c$ ; and to not make any renegotiation offer when  $v < c$ . Anticipating the strategies in Time 3, then back at Time 2, the seller *always* chooses to breach because his payoff from performance is  $p - c$ ; while his expected payoff from breach is  $\int_0^{\min(c, \bar{v})} (p - E(v)) dG(v) + \int_{\min(c, \bar{v})}^{\bar{v}} (p - E(v) + v - c) dG(v) = p - E(v) + \int_{\min(c, \bar{v})}^{\bar{v}} (v - c) dG(v)$ , which is never smaller than  $p - c$ .<sup>17</sup> This implies that the seller sometimes strategically breach (breach when  $p - c > 0$ ) in order to take advantage of the litigation process to extract the buyer's private information and surplus. The seller's optimization problem is:

$$\begin{aligned} \text{Max}_p \pi_S^{EDr} &= p - E(v) + \int_0^{\bar{c}} \int_{\min(c, \bar{v})}^{\bar{v}} (v - c) dG(v) dF(c) \\ \text{s. t. } \pi_B^{EDr} &= E(v) - p \geq 0. \end{aligned}$$

Obviously,  $p^{EDr} = E(v)$ , and the joint expected payoff is:

$$(12) \quad j\pi^{EDr} = \int_0^{\bar{c}} \int_{\min(c, \bar{v})}^{\bar{v}} (v - c) dG(v) dF(c).$$

Again, the equilibrium price is the same as under ED with no renegotiation, but the joint payoff is increased with the opportunity to renegotiate. In fact, as can be seen from the expression of  $j\pi^{EDr}$ , *when post discovery renegotiation is possible, the ex ante expectation damages remedy induces first best allocation*. Under the case of no renegotiation, ED is the best money damages remedy; while under the case with renegotiation,  $ED_r$  is the best remedy among *all* remedies, including money damages and specific performance.<sup>18</sup>

### C. Actual Damages with Renegotiation

At Time 3 the parties in litigation observe the buyer's actual damages through the discovery process. The buyer will accept an offer only if it guaranteed her a payoff no less than  $v - p$ . Given this, the seller's optimal strategy is to renegotiate to trade at price  $p$  when  $v \geq c$ ; and to not make any renegotiation offer when  $v < c$ . Anticipating the strategies in Time 3, the buyer upon breach at Time 2 will sue for damages only if  $v > p$ . The seller's payoff from

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<sup>17</sup>  $p - E(v) + \int_{\min(c, \bar{v})}^{\bar{v}} (v - c) dG(v) - (p - c) = \begin{cases} c - E(v) > 0 & \text{if } c \geq \bar{v} \\ \int_0^c (c - v) dG(v) \geq 0 & \text{if } c < \bar{v} \end{cases}$

<sup>18</sup> In Appendix 2, we provide an analysis of the case with renegotiation when there are positive litigation costs, thus affecting the parties' incentive to litigate. We show numerically in that case ED is still more efficient than AD under American rule. Only in very limited scenarios under English rule, that result may change.

performance is  $p - c$ ; and his expected payoff if he breaches the contract is:  $\int_p^{\min(\max(c,p),\bar{v})} (p - v) dG(v) + \int_{\min(\max(c,p),\bar{v})}^{\bar{v}} (p - c) dG(v)$ . Therefore, the seller will breach only when  $c > p$ . Comparing with the remedy  $SP_r$ , we can see that the parties have exactly the same breach and litigation thresholds, the same status quo payoffs and the same renegotiation strategies<sup>19</sup>. Therefore, the seller's optimization problem here is exactly the same as under  $SP_r$ , and we have:

$$(13) \quad p^{AD_r} = p^{SP_r} = p^{SP};$$

$$(14) \quad j\pi^{AD_r} = j\pi^{SP_r} = \int_0^{p^{SP}} (E(v) - c) dF(c) + \int_{p^{SP}}^{\bar{c}} \int_{\min(c,\bar{v})}^{\bar{v}} (v - c) dG(v) dF(c).$$

In the model with renegotiation the joint payoff under  $AD_r$  is again lower than under  $ED_r$ , since  $ED_r$  induces the first best efficient breach. Proposition 2 summarizes the results for the model with renegotiation:

**Proposition 2** *Assume that after discovery the parties may renegotiate the contract, if there is no verification cost and no litigation cost, the following hold:*

- (i)  $ED_r$  is the first best remedy, unconditionally superior to all other remedies;
- (ii)  $AD_r$  and  $SP_r$  are equivalent remedies;
- (iii) The opportunity to renegotiate post discovery is valuable for parties, i.e., it (at least weakly) enhances efficiency.

We had concern whether the results hinge on the assumption of costless verification and costless litigation. We therefore investigated one case with positive verification cost and the other case with positive litigation costs under both American rule and English rule with renegotiation in Appendix 2. We found that the main efficiency result (that  $ED_r$  is more efficient than  $AD_r$ ) is robust to the modifications of the verification cost and litigation cost. With positive

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<sup>19</sup> The intuition is the following: when there is no renegotiation, given a same price level, the parties' breach and litigation thresholds would be totally the same under both AD and SP. The only difference between the two remedies is what happens after breach and litigation, which is performance under SP, whereas is money transfer between parties under AD. It is this difference that leads to different equilibrium prices and joint payoffs under the two remedies without renegotiation. However, when there is renegotiation, that post-breach difference disappears. After breach the same Pareto optimal allocation will emerge in the equilibrium through renegotiation. Thus, the equilibrium prices and joint payoffs under  $AD_r$  and  $SP_r$  are the same when there is renegotiation.

verification cost,  $ED_r$ , remains as the first best remedy since enforcing ex ante expectation damages does not require verification of ex post damages. The change is that  $AD_r$  and  $SP_r$  are no longer equivalent when the cost of verification is positive, since enforcing  $AD_r$  requires verification at some cost, while enforcing  $SP_r$  does not require verification of ex post damages. With positive litigation costs,  $ED_r$  no longer induces exactly first best allocations, but it still fares better than  $AD_r$  and  $SP_r$  under American rule. Under English rule, except when litigation costs are sufficiently high relative to the expected trade surplus,  $ED_r$  is more efficient than  $AD_r$  and  $SP_r$  for most ordinary cases. This is shown numerically in Appendix 2.

Therefore, interestingly, the renegotiation opportunity amplifies the advantage of ex ante expectation damages over actual damages and specific performance. Actually, with renegotiation, the ex ante expectation damages reduces the inefficiency region to the smallest, compared to other remedies, by inducing more efficient renegotiation.

#### **4. Conclusion**

The previous literature on contract remedies in large part failed to account for the non-breaching party's option to not sue for damages upon breach. They typically start the efficiency analysis of various contract remedies assuming, as given, that there will be litigation for breach of the contract. However, the victim of breach might choose not to sue for remedy if the expected payoff from the lawsuit is negative, given the contractual terms and her private information about her loss from breach.<sup>20</sup> We have shown in the paper that this option of acquiescing to breach has important implications for incentives to breach and efficiencies of various contract remedies. For instance, in traditional analyses of specific performance, economists assumed that its breach set is empty, since attempted breach will be litigated and performance will be ordered. But, if the (privately-informed) non-breaching party's valuation is lower than the contracted price, she will not file a lawsuit. Thus, even specific performance will induce a non-empty breach set. Under specific performance, there are two cases of performance: voluntary performance when the seller's cost is lower than the contracted price; and involuntary performance when he attempted to breach but was litigated against and the court ordered performance. Even though from the voluntary performance component the breach threshold

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<sup>20</sup> This could be because the state of the world which materialized after the initial uncertainty disappeared was not favorable for the breached-against party, or perhaps because some "secrecy interest" (Ben-Shahar and Bernstein (2000)) makes suing unprofitable in the long run due to exposures of valuable secrets.

under specific performance is not optimal, the involuntary performance component may create some efficiency gain. Depending on the distribution of values specific performance can be more or less efficient than other remedies.

Moreover, once we incorporate the non-breaching party's option to not sue into the analysis, we find that the court should commit to awarding fixed damages, which are preferable to flexible damages adaptive to ex post information, since the latter will distort incentives to breach. Specifically, we demonstrated that the ex post expectation damages, which we called actual damages will induce under-breach from the ex ante perspective. The reason is as follows: if her value is lower than the contracted price, the non-breaching party will not sue for damages. The breaching party thus anticipates that once the breach is litigated he will face a truncated distribution of damages, which increases his expected cost of breach. This distortion of breach incentives leaves the actual damages inferior to fixed damages. Thus, even when acquiring ex post information is costless, a welfare-maximizing court should not bother to do so. Rather, it will commit to awarding fixed ex ante expectation damages. The court's commitment to ignoring ex post information when determining contract damages restores the contracting parties' efficient incentives to breach. We reach this result for different reasons from the information-forcing property of expectation damages, *à la Hadley vs. Baxendale* (see Bebchuk and Shavell, 1991), as at the contracting stage in our model parties did not possess any private information. Rather, the advantage of fixed damages in our model comes from the restoration of efficient incentives to breach at the interim stage when the parties learn private information post-contracting.

We further studied the case with pre-trial renegotiation, and found that the advantage of fixed expectation damages over actual damages is increased when parties can renegotiate. When the litigation cost is very small relative to the joint expected surplus of the transaction, ex ante expectation damages with renegotiation induces first best allocation. The efficiency result is robust to the modification of verification cost and litigation cost.<sup>21</sup>

As is explained in the legal appendix courts often award the lower of the ex-ante damages and the ex-post actual damages. One implication from our results is that courts should not choose

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<sup>21</sup> Except under English rule when litigation costs are sufficiently high relative to the expected trade surplus, actual damages may be more efficient.

the lower of the two but always award the foreseeable ex ante damages,<sup>22</sup> regardless of the level of ex post actual damages.

To focus on the distortion of incentives to breach and the efficiency of contract remedies, we demonstrated the above points using a very simple model, leaving some interesting aspects unexplored. In the future we plan to further explore this line of research by accounting for investment incentives and considering the problem of “hold up.” Also we focused on exclusive-remedy contracts instead of *optional-remedy contracts* (in the sense that the non-breaching party can choose upon breach from a menu of different remedies, see Brooks (2006), Avraham and Liu (2006), Ayres and Goldbart (2001), and Ayres and Balkin (1997)). We would like to see how the option of acquiescing to breach affects those optional-remedy contracts in future research.

## **Appendix 1.**

### **Part A. The Law of Remedies for Breach of Contract**

The general remedy for breach of contract is expectation damages: the amount required to put the injured party in as good of a situation as she would have been had the contract been performed.<sup>23</sup> The Restatement (Second) of Contracts awards damages equal to the loss in value of performance to the injured party plus consequential damages minus any cost avoided.<sup>24</sup> The UCC allows a buyer to collect contract-cover or contract-market damages.<sup>25</sup> Both common

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<sup>22</sup> One may have concern whether the courts are able to determine the ex-ante expectation damages in thin markets. We believe that courts are in fact able to handle such an ex-ante perspective when dealing with contracts. First, courts use the ex-ante perspective when they enforce doctrines such as mistake, impossibility and frustration. Second, many courts allow recovery of lost future profits due to a breach in both established business cases (e.g., *Denny Const., Inc. v. City and County of Denver*, 2009) and in new business cases (e.g., *Chung v. Kaonohi Center*, 1980). Arguably, proving fixed ex-ante damages in court should not be much different from proving lost future profits. In both cases courts are presented with evidence about the distribution of future damages. In the lost profits case it is future vis-a-vis the post-breach stage, whereas in the fixed ex-ante damages it is future vis-a-vis the contracting stage. Third, when awarding actual ex-post expectation damages courts typically limit damages to the *foreseeable* results from a breach at the time the contract was made. Indeed, this exercise is required in order to operationalize *Hadley v. Baxendale* (1854). Fourth, when reviewing liquidated damages clauses courts are required, under the penalty doctrine, to limit these damages to the reasonable ex-ante estimation of the non-breaching party’s expectation interest. To determine fixed ex-ante damages, all that is required of courts is to review evidence presented to them regarding the mean of the distribution of the non-breaching party’s expectation interest. This does not strike us as more difficult than other tasks courts have routinely done in contract disputes. In fact, courts seem already trained to contemplate, at the ex-post stage, the ex-ante distribution of possible damages. In fact, ex-ante damages could be easily interpreted as more broadly applying the foreseeability principle which is already utilized to override ex-post damages.

<sup>23</sup> See e.g., *Lar-Rob Bus Corp. v. Town of Fairfield*, 365 A.2d 1086, 1091 (Conn. 1975).

<sup>24</sup> Restatement (Second) of Contracts (RSC) § 347.

<sup>25</sup> See UCC §§ 2-712 (contract-cover damages), 2-713 (contract-market damages). Contract-market damages are the differential between the price provided by the contract and the fair market value of the contracted for

law's general expectation interest and the UCC's contract-market remedy can be measured ex ante, ex post at the time of contracted-for performance, or at an interim stage, i.e. at the time of the breach provided the breach occurred before the date of performance. The UCC's contract-cover damages, however, are always measured either ex post or at the interim stage because they are determined by what the party actually spent to buy replacement performance.<sup>26</sup> The general rule is that courts award damages determined ex-post (or at the interim stage), limiting them by what was reasonably foreseeable ex-ante.<sup>27</sup>

That courts award damages determined ex-post implies that if actual damages are smaller than what was reasonably expected courts will award the lower damages. In *Truitt v. Evangel Temple, Inc.* a plaintiff landlord leased property to tenants for \$21,000 annually during the relevant time period.<sup>28</sup> Even though the building sat empty for several months after the tenants breached, the court found no damages for the landlord.<sup>29</sup> The court based its decision on the fact that the landlord was able to later re-lease the building for \$27,000 annually.<sup>30</sup> The additional \$6,000 per year over the term of the original lease more than made up for the anticipated (and actual) lost income during the time the building sat empty.<sup>31</sup> In *General Supply & Equipment Co., Inc. v. Phillips*, a Texas appellate court remanded a case because, inter alia, the jury did not take into account the actual damages suffered when it determined the buyer's consequential damages.<sup>32</sup> Instead of allowing the jury to determine consequential lost profits based on the buyer's projections of what he would have profited from the defective greenhouse panels he purchased, the court said the lost profits should have been determined by the difference between

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performance. Contract-cover damages are the differential between the contract price and the actual cost for the aggrieved party to replace the contracted-for performance. Both §§ 2-712, 2-713 allow an aggrieved buyer to collect incidental or consequential damages under § 2-715, which limits consequential damages to those the seller had reason to know of at the time of contracting. The UCC § 2-716 also allows buyers to obtain specific performance or replevin under certain situations.

<sup>26</sup> See e.g., *Laredo Hides Co., Inc. v. H & H Meat Products Co., Inc.*, 513 S.W.2d 210, 221 (Tex.Civ.App. 1974) (applying § 2-712 to determine contract-cover damages as difference between cost of cover and contract price). If a court were to look at what the parties expected the replacement cost to be at the time of contract formation, then the court would in fact be awarding ex ante contract-market damages.

<sup>27</sup> See Robert E. Scott, *The Case for Market Damages: Revisiting the Lost Profits Puzzle*, 57 U. CHI. L. REV. 1155 (1990) (discussing the "tendency of courts and commentators to determine the contractual expectancy ex post").

<sup>28</sup> 486 A.2d 1169, 1171 (D.C. 1984).

<sup>29</sup> *Id.* at 1173.

<sup>30</sup> *Id.* at 1171-72.

<sup>31</sup> *Id.*

<sup>32</sup> 490 S.W.2d 913, 921 (Tex. Civ. App. 1972).

the actual value of the flowers sold and the fair market value of flowers grown under proper greenhouse panels.<sup>33</sup>

The limitation of damages by what was reasonably foreseeable ex-ante was famously established in the case of *Hadley v. Baxendale*.<sup>34</sup> While in *Hadley v. Baxendale* the plaintiff had at the contracting stage superior information about his future possible loss,<sup>35</sup> this principle has since served to limit damages even in cases where both parties were symmetrically informed at the contracting stage. For example, in *Mansfield v. Trailways, Inc.*, a Missouri appellate court affirmed a lower court decision to limit damages to those reasonably foreseeable.<sup>36</sup> A passenger sued a bus company for injuries she sustained because she was forced, by the lack of a working bathroom on the bus, to use the bathroom inside a bus station.<sup>37</sup> The passenger slipped while leaving the bus station bathroom and sued the bus company under the theory that it breached the part of the contract ensuring her a functional bathroom.<sup>38</sup> The court reasoned: “defendant, at the time it sold plaintiff the ticket for that journey, could not have reasonably contemplated that the lack of a usable restroom on the bus would cause plaintiff to sustain bodily injuries by falling down the stairway at the Wichita terminal.”<sup>39</sup>

The UCC, while it does not limit contract-market or contract-cover damages to those which are foreseeable, does limit *consequential damages* to those the seller had reason to know of at the time of contracting.<sup>40</sup> A California appellate court directly addressed this question in *Gerwin v. Southeastern Cal. Assn. of Seventh Day Adventists*.<sup>41</sup> In that case, the court first accepts the possibility that consequential damages can include the buyer’s lost profit.<sup>42</sup> Nonetheless, the court determined that the buyer at issue was not entitled to consequential damages because the seller had no reason to know the purpose for which the buyer was making the purchase.<sup>43</sup> The court made clear that the foreseeability requirement applies only to what the

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<sup>33</sup> *Id.* The court does not make clear whether the buyer’s projection was formed ex ante or ex post, but either way, the court used more recent ex post information to limit damages below the buyer’s projection.

<sup>34</sup> 9 Exch. 341, 156 Eng. Rep. 145 (1854)

<sup>35</sup> See 9 Exch. at 344 (plaintiffs acted urgently to acquire the replacement part and presumably knew the possible loss resulting from their mill being shut down for multiple days).

<sup>36</sup> 732 S.W.2d 547, 552 (Mo. App. 1987).

<sup>37</sup> *Id.* at 549

<sup>38</sup> *Id.*

<sup>39</sup> *Id.* at 552.

<sup>40</sup> See *supra* note #[citing 2-715].

<sup>41</sup> 14 Cal. App. 3d 209 (Cal.App. 1971).

<sup>42</sup> *Gerwin*, 14 Cal. App. 3d. at 220.

<sup>43</sup> *Id.*

parties knew ex ante, i.e. at the time when the contract was formed.<sup>44</sup> Thus, under both the common law and the UCC the foreseeability requirement can limit buyers' damages to those which should have been reasonably contemplated ex ante by the breaching party.

In sum, courts generally measure damages ex post, but if the ex ante expectation is smaller than the ex post measure, courts will limit the remedy to the smaller amount.<sup>45</sup> Thus, in a way, most courts pick the "smaller of the two" approach.

## Part B.

### Proof of Binding Constraint in Equilibrium under SP

*Proof.* The parties' expected payoff can be rewritten as  $\pi_S^{SP} = p - E(c) - G(p) \int_p^{\bar{c}} (p - c) dF(c)$ ,  $\pi_B^{SP} = F(p)[E(v) - p] + [1 - F(p)] \int_p^{\bar{v}} (v - p) dG(v)$ . Let  $\lambda$  be the multiplier for the constraint, then the Lagrangian for the seller's optimization program is  $\mathcal{L} = \pi_S^{SP} + \lambda \pi_B^{SP}$ . The first-order conditions are:

$$(A1) \quad \mathcal{L}_p = 1 - g(p) \int_p^{\bar{c}} (p - c) dF(c) - G(p)[1 - F(p)] + \lambda f(p) \int_0^p (v - p) dG(v) - \lambda F(p) - \lambda[1 - F(p)][1 - G(p)] = 0;$$

$$(A2) \quad \mathcal{L}_\lambda = F(p)[E(v) - p] + [1 - F(p)] \int_p^{\bar{v}} (v - p) dG(v) \geq 0;$$

$$(A3) \quad \lambda \geq 0; \lambda \mathcal{L}_\lambda = \lambda \left[ F(p)[E(v) - p] + [1 - F(p)] \int_p^{\bar{v}} (v - p) dG(v) \right] = 0.$$

We claim that the buyer's participation constraint is binding, i.e., her expected payoff is zero in equilibrium. Otherwise,  $\pi_B^{SP} > 0$ , which implies  $\lambda = 0$  by (A3). Then (A1) simplifies to  $1 - G(p)[1 - F(p)] + g(p) \int_p^{\bar{c}} (c - p) dF(c) = 0$ , which is a contradiction since the left hand side is always positive. Therefore, we have

$$\pi_B^{SP} = F(p^{SP})[E(v) - p^{SP}] + [1 - F(p^{SP})] \int_{p^{SP}}^{\bar{v}} (v - p^{SP}) dG(v) = 0.$$

## Appendix 2.

<sup>44</sup> *Id.*

<sup>45</sup> The confusion increases because even just as to ex post damages, courts are inconsistent as to the best time to measure loss. Thomas Jackson in his article *Anticipatory Repudiation and the Temporal Element of Contract Law: An Economic Inquiry into Contract Damages in Cases of Prospective Nonperformance*, (31 STAN. L. REV. 69 (1978)) discusses three options for measuring contract-market—and contract-cover—damages: ex post at the time of contracted-for performance, in the interim at the time of the breach, and the interim stage at the time of the breach but measured on the futures market for performance to be completed when the contracted performance was originally due. While there are cases to support all three options, under the UCC measuring damages at the interim stage is the majority view. The common law generally awards damages based on the original date of performance.

## I. Analysis of the Case with Positive Verification Cost

### 1. The Case of No Renegotiation

We continue to assume that at the interim stage the seller's costs and the buyer's valuation are private information and non-observable to the other party. The analysis in the main text assumed there were no litigation costs, and especially no costs to verify the buyer's damages. However, all litigation involves a costly discovery stage. For simplicity, we assume for the moment that all litigation costs fall on verifying the buyer's ex post damages. Specifically, we assume that verifying the buyer's ex post damages has a cost,  $\beta > 0$ , and we assume that the verification cost is constant and does not depend on which party bears this cost. A natural implication of the assumption that verification costs are positive is that enforcing the remedies of specific performance and ex ante expectation damages are less costly than enforcing the actual damages remedy because they do not require verifying the ex post damages. Thus, the results we obtained when we assumed that verification of the buyer's damages is costless for the ex ante expectation damages and specific performance remain. We therefore need to analyze only actual damages (under both the American rule and the English rule).

#### Actual Damages

##### A. The American Rule

Assume here that the default remedy in the contract is actual damages. We first assume the American rule applies, which makes the plaintiff (the buyer in our case) bear her own verification cost,  $\beta$ . Upon breach the buyer will sue for damages only if  $v > p + \beta$ . The seller's payoff from performance is  $p - c$ ; while his expected payoff from breach is  $\int_{p+\beta}^{\bar{v}} (p - v) dG(v)$ . Therefore, the seller will breach iff:

$$c > p + \int_{p+\beta}^{\bar{v}} (v - p) dG(v) := \widehat{Br}(p, \beta).$$

(Notation: we use *hat at top* to denote the *American rule* regime; and *tilde at top* to denote the *English rule* regime)

As can be seen from the definition above  $\widehat{Br}(p, \beta) > p$ , which implies that the seller in some cases voluntarily performs even when performance is unprofitable (because seller's costs are higher than the price he receives from buyer). This may seem counter-intuitive since under American rule the seller does not bear the cost of verifying the buyer's damages in case of a breach, and there is a positive probability that the buyer would decide not to sue at all upon breach. However, the reason that the seller sometimes voluntarily performs at a loss is the following: Under the American rule the buyer is less willing to challenge breaches and therefore the seller can escape paying damages in some cases. However, as a result in those cases in which the buyer *does* file a lawsuit the expected damages that the seller needs to pay is higher. As was explained in the main text, this means the seller faces a truncated distribution of damages which deters him from breaching, even under the American rule. Interestingly, as will be shown below, when we account for the possibility of renegotiation between the parties, this result changes. Specifically we show that under actual damages with American rule and renegotiation, the seller may strategically breach (i.e. breach when performance is profitable) in order to extract surplus from the buyer.

As before, the Kuhn-Tucker conditions for the seller's optimization problem entail that in equilibrium the buyer's participation constraint must be binding, i.e.,  $\widehat{\pi}_B^{AD} = \int_0^{\widehat{Br}(p,\beta)} (E(v) - p)dF(c) + \int_{\widehat{Br}(p,\beta)}^{\bar{v}} (v - p - \beta)dG(v) dF(c) = 0$ . The equilibrium price and joint payoff are:

$$(A4) \quad \hat{p}^{AD} = E(v) + \left\{ \left[ 1 - F\left(\widehat{Br}(\hat{p}^{AD}, \beta)\right) \right] \int_{\hat{p}^{AD} + \beta}^{\bar{v}} (v - E(v) - \beta)dG(v) \right\} / \left[ \frac{1 - G(\hat{p}^{AD} + \beta)}{+F(\widehat{Br}(\hat{p}^{AD}, \beta))G(\hat{p}^{AD} + \beta)} \right];$$

$$(A5) \quad \widehat{j\pi}^{AD} = \int_0^{\widehat{Br}(\hat{p}^{AD}, \beta)} (E(v) - c)dF(c) - \beta \left[ 1 - F\left(\widehat{Br}(\hat{p}^{AD}, \beta)\right) \right] [1 - G(\hat{p}^{AD} + \beta)].$$

## B. The English Rule

We now assume the English Rule applies, which makes the breaching party (the seller) bear the verification cost,  $\beta$ . In that case, at Time 3, upon breach, the buyer will sue for damages if  $v > p$ . Hence, the seller's expected payoff from breach is  $\int_p^{\bar{v}} (p - v - \beta)dG(v)$ . Therefore he will breach iff

$$c > p + \int_p^{\bar{v}} (v - p + \beta)dG(v) := \widetilde{Br}(p, \beta).$$

As before  $\widetilde{Br}(p, \beta) > p$ , which implies that the seller in some cases voluntarily performs at a loss. The reason is twofold. First, as before, the truncation of damages distribution deters breach under actual damages. Second, under the English rule the breaching party bears the verification cost in litigation, which further reduces the attractiveness of a breach to the seller.

It can be shown that the buyer's participation constraint is binding in equilibrium, i.e.,  $\widetilde{\pi}_B^{AD} = \int_0^{\widetilde{Br}(p,\beta)} (E(v) - p)dF(c) + \int_{\widetilde{Br}(p,\beta)}^{\bar{v}} (v - p)dG(v) dF(c) = 0$ . The equilibrium price and the joint surplus are:

$$(A6) \quad \tilde{p}^{AD} = E(v) + \left\{ \left[ 1 - F\left(\widetilde{Br}(\tilde{p}^{AD}, \beta)\right) \right] \int_{\tilde{p}^{AD}}^{\bar{v}} (v - E(v))dG(v) \right\} / \left[ \frac{1 - G(\tilde{p}^{AD})}{+F(\widetilde{Br}(\tilde{p}^{AD}, \beta))G(\tilde{p}^{AD})} \right];$$

$$(A7) \quad \widetilde{j\pi}^{AD} = \int_0^{\widetilde{Br}(p,\beta)} (E(v) - c)dF(c) - \beta \left[ 1 - F\left(\widetilde{Br}(\tilde{p}^{AD}, \beta)\right) \right] [1 - G(\tilde{p}^{AD})].$$

The following Lemma holds:

**Lemma A1** *Assume that parties commit not to renegotiate the contract ex post, and that verifying buyer's ex post damages is costly, then the following holds:*

(i)  $AD < ED$ , under both the English Rule and the American Rule.

(ii) Under actual damages (with both the English Rule and the American Rule) the seller sometimes voluntarily performs at a loss.

(iii) The American rule is superior to the English rule under the actual damages remedy iff:

$$\int_{\widetilde{Br}(\tilde{p}^{AD}, \beta)}^{\widehat{Br}(\hat{p}^{AD}, \beta)} (E(v) - c)dF(c) \geq \beta \left\{ \begin{array}{l} \left[ 1 - F\left(\widehat{Br}(\hat{p}^{AD}, \beta)\right) \right] [1 - G(\hat{p}^{AD} + \beta)] \\ - \left[ 1 - F\left(\widetilde{Br}(\tilde{p}^{AD}, \beta)\right) \right] [1 - G(\tilde{p}^{AD})] \end{array} \right\}.$$

*Proof.* (i) Under the American rule, the difference between the joint expected payoffs under actual damages and ex ante expectation damages is:

$$\widehat{j\pi}^{AD} - \widetilde{j\pi}^{ED} = \int_{E(v)}^{\widehat{Br}(\hat{p}^{AD}, \beta)} (E(v) - c)dF(c) - \beta \left[ 1 - F\left(\widehat{Br}(\hat{p}^{AD}, \beta)\right) \right] [1 - G(\hat{p}^{AD} + \beta)] < 0,$$

since the first item is always negative, and the second item is always positive. Similarly we can prove for the case under English rule.

(ii) Follows from the fact that the breach threshold under both rules is larger than the contracted price.

(iii) Follows from comparison of the joint payoffs.

Remark:

ED is the superior remedy to AD. This is not only due to the deadweight loss embedded in the verification costs ( $\beta > 0$ ) under the remedy of actual damages, but also because the incentives to breach are further distorted, relative to the ED remedy, which provides the best ex-ante incentives to breach among all money damages remedies.

## 2. Accounting for Renegotiation

As in the main text, we now assume that in the litigation stage, the seller observes the buyer's ex post damages through the discovery process; but that the verification of damages in the court is only required when renegotiation fails and the remedy enforced by the court requires knowing the buyer's ex post damages. The renegotiation game is exactly as in the main text (pre-trial renegotiation after discovery), the only difference here is that if the renegotiation fails, there is an extra cost to enforce the actual damages remedy due to the positive verification cost. (As above, positive verification cost has no impact on enforcing specific performance or ex-ante expectation damages which requires no ex-post information).

### Actual Damages with Renegotiation

#### A. American Rule

Under the American Rule, the victim of breach bears her own verification cost of ex post damages. At Time 3 the seller observes the buyer's damages through the discovery process. In the renegotiation stage the buyer will accept an offer only if she is guaranteed a payoff of at least  $v - p - \beta$ , which is her payoff if she rejects the offer. As a result the seller's optimal strategy is to offer to deliver the good but only in return for a higher price  $p + \beta$  if  $c \leq v + \beta$ ; and to not make any renegotiation offer otherwise. Anticipating the strategies at Time 3, the buyer will sue for damages at Time 2 only if  $v > p + \beta$ . The seller's expected payoff from breach is:  $\int_{p+\beta}^{\min(\bar{v}, \max(p+\beta, c-\beta))} (p-v)dG(v) + \int_{\min(\bar{v}, \max(p+\beta, c-\beta))}^{\bar{v}} (p+\beta-c)dG(v)$ . Therefore, the seller will breach when<sup>46</sup>

$$c > p - [(1 - G(p + \beta))/G(p + \beta)] \beta := \widehat{BR}_r(p, \beta).$$

Since  $\widehat{BR}_r(p, \beta) < p$ , we conclude that the  $AD_r$  regime (under American rule) sometimes induces strategic breach (i.e., breach when performance is profitable). The intuition is simple. With a strategic breach there is a positive probability the buyer will file a lawsuit, thus leading to disclosure of the buyer's private information through the discovery process in litigation. As a

<sup>46</sup> There are three cases: (1)  $c < p + 2\beta$ . In this case  $c - \beta < p + \beta$ . So if the buyer sues upon breach (i.e.,  $v > p + \beta$ ), then  $c - \beta < p + \beta < v$ , the seller would offer to trade, and his expected payoff from breach is  $[1 - G(p + \beta)](p + \beta - c)$ . When this is compared with his payoff from performance  $p - c$ , the seller will breach only when  $c > p - [(1 - G(p + \beta))/G(p + \beta)] \beta$ . (2)  $p + 2\beta < c < \bar{v} + \beta$ . In this case  $p + \beta < c - \beta < \bar{v}$ . The seller's expected payoff from breach is  $\int_{p+\beta}^{c-\beta} (p-v)dG(v) + \int_{c-\beta}^{\bar{v}} (p+\beta-c)dG(v)$ . When this is compared with his payoff from performance  $p - c$ , the seller will always breach in this region. (3)  $c > \bar{v} + \beta$ . In this case  $c - \beta > \bar{v}$ . The seller's expected payoff from breach is  $\int_{p+\beta}^{\bar{v}} (p-v)dG(v)$ . When this is compared with his payoff from performance  $p - c$ , the seller will always breach in this region. Therefore, in sum, the seller will breach only if  $c > p - [(1 - G(p + \beta))/G(p + \beta)] \beta$ .

result the seller can extract some surplus from the buyer in renegotiation by taking advantage of the revealed private information. Furthermore, under the American rule the verification cost is borne by the buyer, which further reduces the possible cost of breach for the seller. Hence, depending on seller's cost of performance, breach may be more attractive than performance to him even when performance is profitable. This is in contrast with the case of no renegotiation, where AD induced voluntary performance at a loss in some cases.

The seller's optimization problem is:

$$\begin{aligned} \text{Max}_p \hat{\pi}_S^{ADr} &= \int_0^{\widehat{B}r_r(p,\beta)} (p-c)dF(c) + \int_{\widehat{B}r_r(p,\beta)}^{\bar{c}} \left\{ \begin{array}{l} \int_{p+\beta}^{\min(\bar{v}, \max(p+\beta, c-\beta))} (p-v)dG(v) \\ + \int_{\min(\bar{v}, \max(p+\beta, c-\beta))}^{\bar{v}} (p+\beta-c)dG(v) \end{array} \right\} dF(c) \\ \text{s. t. } \hat{\pi}_B^{ADr} &= \int_0^{\widehat{B}r_r(p,\beta)} (E(v)-p)dF(c) + \int_{\widehat{B}r_r(p,\beta)}^{\bar{c}} \int_{p+\beta}^{\bar{v}} (v-p-\beta)dG(v) dF(c) \geq 0. \end{aligned}$$

It can be shown that in equilibrium the constraint is binding and the price and joint surplus are given as follows:

$$(A8) \quad \hat{p}^{ADr} = E(v) + \left\{ \left[ 1 - F(\widehat{B}r_r(\hat{p}^{ADr}, \beta)) \right] \int_{\hat{p}^{ADr}+\beta}^{\bar{v}} (v - E(v) - \beta) dG(v) \right\} / \left[ +F(\widehat{B}r_r(\hat{p}^{ADr}, \beta))G(\hat{p}^{ADr} + \beta) \right];$$

$$(A9) \quad \widehat{\pi}^{ADr} = \int_0^{\widehat{B}r_r(\hat{p}^{ADr}, \beta)} (E(v) - c) dF(c) + \int_{\widehat{B}r_r(\hat{p}^{ADr}, \beta)}^{\bar{c}} \left[ \int_{\hat{p}^{ADr}+\beta}^{\min(\bar{v}, \max(\hat{p}^{ADr}+\beta, c-\beta))} (v-c) dG(v) - \int_{\hat{p}^{ADr}+\beta}^{\min(\bar{v}, \max(\hat{p}^{ADr}+\beta, c-\beta))} \beta dG(v) \right] dF(c).$$

## B. English Rule

Under English rule the seller bears the verification cost. At Time 3 the buyer will accept an offer only if it guarantees her a payoff of at least  $v - p$ . Accordingly, the seller's optimal strategy is to offer to deliver the good at the original price  $p$  if  $v \geq c - \beta$ ; and to breach and not make any renegotiation offer otherwise. Anticipating the litigation and renegotiation outcome in Time 3, the buyer in Time 2 will sue for damages only if  $v > p$ . So the seller's expected payoff from breach is:  $\int_p^{\min(\bar{v}, \max(c-\beta, p))} (p - v - \beta) dG(v) + \int_{\min(\bar{v}, \max(c-\beta, p))}^{\bar{v}} (p - c) dG(v)$ .

Therefore, he will breach when<sup>47</sup>

$$c > p := \widehat{B}r_r(p, \beta).$$

Therefore, under  $AD_r$  with the English rule there is neither strategic breach nor strategic performance. This is in great contrast to what we saw above for the American rule. The reason is that under the English rule there are two countervailing effects of breach: one is information disclosure via the discovery process which allows the seller to take advantage of the renegotiation to extract surplus from the buyer; the other is that the seller will now have to bear the verification cost if the buyer sues and the renegotiation breaks down. It turns out that these

<sup>47</sup> There are three cases: (1)  $c < p$ . In this case  $c - \beta < p$ . So if the buyer sues upon breach (i.e.,  $v > p$ ), then  $c - \beta < p < v$ , the seller would offer to trade, and his expected payoff from breach is  $[1 - G(p)](p - c)$ . When this is compared with his payoff from performance  $p - c$ , the seller will always perform in this region. (2)  $p < c < p + \beta$ . In this case  $c - \beta < p$ . The seller's expected payoff from breach is  $\int_p^{\bar{v}} (p - c) dG(v)$ . When this is compared with his payoff from performance  $p - c$ , the seller will always breach in this region. (3)  $c > p + \beta$ . In this case  $c - \beta > p$ . The seller's expected payoff from breach is  $\int_p^{c-\beta} (p - v - \beta) dG(v) + \int_{c-\beta}^{\bar{v}} (p - c) dG(v)$ . When this is compared with his payoff from performance  $p - c$ , the seller will always breach in this region. Therefore, in sum, the seller will breach only if  $c > p$ .

two countervailing effects cancel each other under  $AD_r$  with English rule, such that the seller breaches if and only if performance is unprofitable.

It can be shown that in equilibrium the buyer's participation constraint is binding, i.e.,  $\tilde{\pi}_B^{AD_r} = \int_0^p (E(v) - p)dF(c) + \int_p^{\bar{c}} \int_p^{\bar{v}} (v - p)dG(v) dF(c) = 0$ , and the price and expected joint surplus are:

$$(A10) \quad \tilde{p}^{AD_r} = E(v) + \left\{ [1 - F(\tilde{p}^{AD_r})] \int_{\tilde{p}^{AD_r}}^{\bar{v}} (v - E(v))dG(v) \right\} / \left[ \frac{1 - G(\tilde{p}^{AD_r})}{+F(\tilde{p}^{AD_r})G(\tilde{p}^{AD_r})} \right];$$

$$(A11) \quad \tilde{\pi}^{AD_r} = \int_0^{\tilde{p}^{AD_r}} (E(v) - c)dF(c) + \int_{\tilde{p}^{AD_r}}^{\bar{c}} \left[ \int_{\min(\bar{v}, \max(c-\beta, p))}^{\bar{v}} (v - c)dG(v) - \int_{\tilde{p}^{AD_r}}^{\min(\bar{v}, \max(c-\beta, p))} \beta dG(v) \right] dF(c).$$

In the main text we showed that *when accounting for renegotiation then  $ED_r$  attains first best allocation regardless of whether verifying the ex post damages is costly or not.* Therefore,  $AD_r < ED_r$ . Once the verification cost is positive,  $AD_r$  and  $SP_r$  no longer result in the same outcome, since  $AD_r$  involves costly verification in some cases, while  $SP_r$  never does. The exact ranking between  $AD_r$  and  $SP_r$  with positive verification cost depends on the distributions of the seller's costs and the buyer's value.

**Lemma A2** *Assuming that parties may engage in post-discovery yet pre-trial renegotiation and that verifying ex post damages is costly, the following holds:*

- (i)  $ED_r$  is the first best remedy, unconditionally superior to all other remedies;
- (ii) The comparison between  $AD_r$  and  $SP_r$  with positive verification cost depends on distributions;
- (iii) The opportunity for renegotiation enhances efficiency when the default remedy for breach is specific performance or ex ante expectation damages; in contrast, the opportunity to renegotiate may make the actual damages more or less efficient;
- (iv) Under  $AD_r$  with the American rule the seller sometimes strategically breaches in order to extract surplus from the buyer; while he does not do so under the English rule.

In sum, we have demonstrated that whether verifying ex post damages is costly or not, both with and without renegotiation, the court does better to stick to the fixed ex ante expectation damages rather than seek accuracy in determining damages.

## II. Analysis of the Case with Litigation Cost

### 1. The Case of No Renegotiation

We now assume that the parties' litigation costs are  $l_b$  and  $l_s$  for the buyer and seller, respectively. These costs are fixed and are independent of any verification cost.

#### A. Specific Performance

##### A.1 American Rule

First we analyze the case where parties bear their own litigation costs. We solve the equilibrium by backward induction. At Time 3, upon breach the buyer will file a lawsuit only if

$v > p + l_b$ ; the seller's expected payoff from breach is  $\int_{p+l_b}^{\bar{v}} (p - c - l_s) dG(v)$ . Therefore, the seller will breach if

$$c > p + l_s \frac{1-G(p+l_b)}{G(p+l_b)} := Br^{SP^l}(p).$$

The seller chooses a price to maximize his expected payoff subject to the buyer's participation constraint.

$$\begin{aligned} Max_p \pi_S^{SP^l} &= \int_0^{Br^{SP^l}(p)} (p - c) dF(c) + \int_{Br^{SP^l}(p)}^{\bar{c}} \int_{p+l_b}^{\bar{v}} (p - c - l_s) dG(v) dF(c) \\ s. t. \pi_B^{SP^l} &= \int_0^{Br^{SP^l}(p)} (E(v) - p) dF(c) + \int_{Br^{SP^l}(p)}^{\bar{c}} \int_{p+l_b}^{\bar{v}} (v - p - l_b) dG(v) dF(c) \geq 0. \end{aligned}$$

It turns out that in equilibrium the constraint is binding,  $\pi_B^{SP^l} = 0$ . Therefore the equilibrium price and the expected joint payoff under SP are given by:

$$(A12) \quad p^{SP^l} = E(v) + \left\{ \left[ 1 - F(Br^{SP^l}(p^{SP^l})) \right] \int_{p^{SP^l}+l_b}^{\bar{v}} (v - E(v) - l_b) dG(v) \right\} / \left[ \frac{1 - G(p^{SP^l} + l_b)}{+F(Br^{SP^l}(p^{SP^l}))G(p^{SP^l} + l_b)} \right];$$

$$(A13) \quad j\pi^{SP^l} = \int_0^{Br^{SP^l}(p^{SP^l})} (E(v) - c) dF(c) + \int_{Br^{SP^l}(p^{SP^l})}^{\bar{c}} \int_{p^{SP^l}+l_b}^{\bar{v}} (v - c - l_b - l_s) dG(v) dF(c).$$

## A.2 English Rule

Now we analyze the case where the seller (the breaching party in our model) bears the litigation costs for both himself and the buyer. At Time 3, upon breach the buyer will file a lawsuit only if  $v > p$ ; the seller's expected payoff from breach is  $\int_p^{\bar{v}} (p - c - l_s - l_b) dG(v)$ . Therefore, the seller will breach if

$$c > p + (l_s + l_b) \frac{1-G(p)}{G(p)} := Br^{SP^l}(p).$$

The seller chooses a price to maximize his expected payoff subject to the buyer's participation constraint. It can be shown that in equilibrium the constraint is binding,  $\pi_B^{SP^l} = \int_0^{Br^{SP^l}(p)} (E(v) - p) dF(c) + \int_{Br^{SP^l}(p)}^{\bar{c}} \int_p^{\bar{v}} (v - p) dG(v) dF(c) = 0$ , and the equilibrium price and the expected joint payoff under SP are given by:

$$(A14) \quad p^{SP^l} = E(v) + \left\{ \left[ 1 - F(Br^{SP^l}(p^{SP^l})) \right] \int_{p^{SP^l}}^{\bar{v}} (v - E(v)) dG(v) \right\} / \left[ \frac{1 - G(p^{SP^l})}{+F(Br^{SP^l}(p^{SP^l}))G(p^{SP^l})} \right];$$

$$(A15) \quad j\pi^{SP^l} = \int_0^{Br^{SP^l}(p^{SP^l})} (E(v) - c) dF(c) + \int_{Br^{SP^l}(p^{SP^l})}^{\bar{c}} \int_{p^{SP^l}}^{\bar{v}} (v - c - l_b - l_s) dG(v) dF(c).$$

## B. Ex Ante Expectation Damages

### B.1 American Rule

To solve for the equilibrium price under this regime, we consider two cases distinguished by the buyer's litigation decision upon breach. Case (1)  $p > E(v) - l_b$ . In this case, since the buyer's payoff from litigation,  $E(v) - p - l_b$ , is negative, she never sues upon breach. As a result, the seller breaches only if  $c > p$ . Seller's optimization problem in this price region (we denote the price in this region as  $\hat{p}^{(1)}$ ) is:

$$\text{Max}_{\hat{p}^{(1)}} \pi_S^{ED\hat{1}} = \int_0^{\hat{p}^{(1)}} (\hat{p}^{(1)} - c) dF(c), \quad \text{s.t. } \pi_B^{ED\hat{1}} = \int_0^{\hat{p}^{(1)}} (E(v) - \hat{p}^{(1)}) dF(c) \geq 0 \text{ and } \hat{p}^{(1)} > E(v) - l_b.$$

Obviously,  $\hat{p}^{(1)*} = E(v)$ , and the seller's expected payoff is  $\hat{\pi}_S^{(1)} = \int_0^{E(v)} (E(v) - c) dF(c)$ .

Case (2)  $p \leq E(v) - l_b$ . In this case, since the buyer's payoff from litigation,  $E(v) - p - l_b$ , is non-negative, she always sues upon breach. As a result, the seller breaches only if  $c > E(v) + l_s$ . His optimization problem in this price region (denoted as  $\hat{p}^{(2)}$ ) is:

$$\text{Max}_{\hat{p}^{(2)}} \pi_S^{ED\hat{1}} = \int_0^{E(v)+l_s} (\hat{p}^{(2)} - c) dF(c) + \int_{E(v)+l_s}^{\bar{c}} (\hat{p}^{(2)} - E(v) - l_s) dF(c),$$

$$\text{s.t. } \pi_B^{ED\hat{1}} = \int_0^{E(v)+l_s} (E(v) - \hat{p}^{(2)}) dF(c) + \int_{E(v)+l_s}^{\bar{c}} (E(v) - \hat{p}^{(2)} - l_b) dF(c) \geq 0 \text{ and } \hat{p}^{(2)} \leq E(v) - l_b.$$

Obviously, in this region  $\hat{p}^{(2)*} = E(v) - l_b$ , and the seller's expected payoff is  $\hat{\pi}_S^{(2)} = \int_0^{E(v)+l_s} (E(v) - l_b - c) dF(c) - \int_{E(v)+l_s}^{\bar{c}} (l_b + l_s) dF(c)$ .

Clearly,  $\hat{\pi}_S^{(1)} > \hat{\pi}_S^{(2)}$ . Therefore, the optimal price  $p^{ED\hat{1}} = E(v)$ , and the joint expected payoff is:

$$(A16) \quad j\pi^{ED\hat{1}} = \int_0^{E(v)} (E(v) - c) dF(c),$$

which is the same as the joint expected payoff under the optimal money damages in the case of no litigation cost, as illustrated in the main text.

## B.2 English Rule

Similarly, it can be shown that the joint expected payoff under English rule is:

$$(A17) \quad j\pi^{ED\hat{1}} = \int_0^{E(v)} (E(v) - c) dF(c) = j\pi^{ED\hat{1}}.$$

Therefore, under the ex ante expectation damages remedy with litigation costs, the litigation cost shifting rule does not matter; the equilibrium joint payoff is the same under both the English and under the American rule.

We now compare *ED* with the welfare-maximizing money damages in the case with positive litigation cost. To determine the optimal court-imposed (money) damages, we assume that given some court-imposed damages, the buyer's optimal litigation threshold is  $b$  (i.e., she will sue upon breach only when  $v \geq b$ ); while the seller's optimal breach threshold is  $a$  (i.e., he will breach when  $c \geq a$ ). Then the joint expected payoff is  $j\pi = \int_0^a (E(v) - c) dF(c) - [1 - F(a)][1 - G(b)](l_b + l_s)$ . The court will choose a money damage such that the induced breach and litigation thresholds  $a$  and  $b$  will maximize the joint expected payoff. Simple calculus gives us:  $a^* = E(v)$ ;  $b^* = \bar{v}$ . We can see from the above analysis that the ex ante expectation damages remedy exactly induces these decision thresholds. Hence, *ED* is also the optimal money damages remedy, under both American and English rules.

**Lemma A3** *Assume parties commit not to renegotiate the contract ex post, then  $j\pi^{ED\hat{1}} = j\pi^{ED\hat{1}} = \int_0^{E(v)} (E(v) - c) dF(c)$ , and the ex ante expectation damages remedy is the welfare-maximizing money damages remedy whether or not there are litigation costs.*

Comparing the joint payoff under *ED* with the joint payoff under *SP* with American rule yields:

$$j\pi^{ED\hat{1}} - j\pi^{SP\hat{1}} = \left[ \underbrace{\int_0^{E(v)} (E(v) - c) dF(c) - \int_0^{Br^{SP\hat{1}}(v^{SP\hat{1}})} (E(v) - c) dF(c)}_{\text{Difference in efficiency from voluntary performance}} \right]$$

Difference in efficiency from voluntary performance

$$\begin{aligned}
& - \underbrace{\left[ 1 - F \left( Br^{SP^l} \left( p^{SP^l} \right) \right) \right] \left[ 1 - G \left( p^{SP^l} + l_b \right) \right] \left[ E \left( v \mid v \geq p^{SP^l} + l_b \right) - E \left( c \mid c \geq Br^{SP^l} \left( p^{SP^l} \right) \right) \right]} \\
& \qquad \qquad \qquad \text{Potential efficiency gain from involuntary performance under SP} \\
& + \underbrace{\left[ 1 - F \left( Br^{SP^l} \left( p^{SP^l} \right) \right) \right] \left[ 1 - G \left( p^{SP^l} + l_b \right) \right] (l_b + l_s)} \\
& \qquad \qquad \qquad \text{Difference in expected litigation cost}
\end{aligned}$$

$$= \Delta'_1 - \Delta'_2 + \Delta'_3,$$

where we define

$$\Delta'_1 := \int_{Br^{SP^l} \left( p^{SP^l} \right)}^{E(v)} (E(v) - c) dF(c);$$

$$\Delta'_2 := \left[ 1 - F \left( Br^{SP^l} \left( p^{SP^l} \right) \right) \right] \left[ 1 - G \left( p^{SP^l} + l_b \right) \right] \left[ E \left( v \mid v \geq p^{SP^l} + l_b \right) - E \left( c \mid c \geq Br^{SP^l} \left( p^{SP^l} \right) \right) \right];$$

$$\Delta'_3 := \left[ 1 - F \left( Br^{SP^l} \left( p^{SP^l} \right) \right) \right] \left[ 1 - G \left( p^{SP^l} + l_b \right) \right] (l_b + l_s).$$

$\Delta'_1$  is the difference in efficiency between  $ED^l$  and  $SP^l$  due to the different incentives that the two remedies provide for *voluntary* performance.  $\Delta'_2$  is the potential efficiency gain emerging from the seller's *involuntary* performance under  $SP^l$ .  $\Delta'_3$  is the expected litigation costs under  $SP^l$ . The comparison of joint payoff stipulates that if  $\Delta'_1 + \Delta'_3 \geq \Delta'_2$ , then  $SP^l$  is inferior to  $ED^l$ ; otherwise,  $SP^l$  becomes superior, as the efficiency gain from forced performance under  $SP^l$  more than offsets the potential efficiency loss from the inferior breach incentives it provides. We obtained similar results for the case of English rule.

## C. Actual Damages

### C.1 American Rule

At Time 3 the buyer will sue for actual damages only if  $v > p + l_b$ , so the seller's expected payoff from breach is:  $\int_{p+l_b}^{\bar{v}} (p - v - l_s) dG(v)$ . Therefore, he will breach when

$$c > p + \int_{p+l_b}^{\bar{v}} (v - p + l_s) dG(v) := Br^{AD^l}(p).$$

It is obvious that  $Br^{AD^l}(p) > p$ , which implies that the seller sometimes voluntarily delivers at a loss. The seller's optimization problem is:

$$Max_p \pi_S^{AD^l} = \int_0^{Br^{AD^l}(p)} (p - c) dF(c) + \int_{Br^{AD^l}(p)}^{\bar{c}} \int_{p+l_b}^{\bar{v}} (p - v - l_s) dG(v) dF(c)$$

$$s. t. \pi_B^{AD^l} = \int_0^{Br^{AD^l}(p)} (E(v) - p) dF(c) + \int_{Br^{AD^l}(p)}^{\bar{c}} \int_{p+l_b}^{\bar{v}} (v - p - l_b) dG(v) dF(c) \geq 0.$$

It turns out that in equilibrium the constraint is binding, and the price and joint surplus are given in the following expressions:

$$(A18) \quad p^{AD^l} = E(v) + \left\{ \left[ 1 - F \left( Br^{AD^l} \left( p^{AD^l} \right) \right) \right] \int_{p^{AD^l} + l_b}^{\bar{v}} (v - E(v) - l_b) dG(v) \right\} / \left[ \begin{array}{c} 1 - G \left( p^{AD^l} + l_b \right) \\ + F \left( Br^{AD^l} \left( p^{AD^l} \right) \right) G \left( p^{AD^l} + l_b \right) \end{array} \right];$$

$$(A19) \quad j\pi^{AD^l} = \int_0^{Br^{AD^l}(p^{AD^l})} (E(v) - c) dF(c) - \left[ 1 - F \left( Br^{AD^l} \left( p^{AD^l} \right) \right) \right] \left[ 1 - G \left( p^{AD^l} + l_b \right) \right] (l_b + l_s).$$

## C.2 English Rule

At Time 3 the buyer will sue for actual damages only if  $v > p$ , so the seller's expected payoff if he breaches the contract is:  $\int_p^{\bar{v}} (p - v - l_b - l_s) dG(v)$ . Therefore, he will breach when

$$c > p + \int_p^{\bar{v}} (v - p + l_b + l_s) dG(v) := Br^{AD^i}(p).$$

It is obvious that  $Br^{AD^i}(p) > p$ , implying that the seller sometimes voluntarily delivers at a loss. It can be shown that the equilibrium price and joint surplus are the following:

$$(A20) \quad p^{AD^i} = E(v) + \left\{ \left[ 1 - F(Br^{AD^i}(p^{AD^i})) \right] \int_{p^{AD^i}}^{\bar{v}} (v - E(v)) dG(v) \right\} / \left[ \frac{1 - G(p^{AD^i})}{+F(Br^{AD^i}(p^{AD^i}))G(p^{AD^i})} \right];$$

$$(A21) \quad j\pi^{AD^i} = \int_0^{Br^{AD^i}(p^{AD^i})} (E(v) - c) dF(c) - \left[ 1 - F(Br^{AD^i}(p^{AD^i})) \right] [1 - G(p^{AD^i})] (l_b + l_s).$$

As before, the comparison of joint payoffs under AD and under SP depends on distributions. Lemma A4 summarizes:

**Lemma A4** *Assume that parties commit to not renegotiate the contract after learning new information, and that there are positive litigation costs, then the following hold:*

- (i) *ED is superior to AD under both American rule and English rule, actually ED is the welfare-maximizing money damages;*
- (ii)  *$ED^i < SP^i$  iff  $\Delta'_1 + \Delta'_3 < \Delta'_2$ ; and similarly, the comparisons between  $ED^i$  and  $SP^i$ , between AD and SP under American and English rules depend on distribution of values and the litigation cost parameters.*

## 2. The Case with Renegotiation

We now assume that the parties may renegotiate the original contract, in the same way as in the main text. For simplicity we will focus on the cases where  $\bar{c} \leq \bar{v}$ .

### A. Specific Performance with Renegotiation

#### A.1 American Rule

At the litigation stage the seller observes the buyer's actual damages and may make a take-it-or-leave-it offer to the buyer. In contrast to our analysis above of situations involving positive verification cost where costs were incurred only if the remedy to be enforced requires verification of damages, in the current case the parties' litigation costs are assumed to be sunk once the lawsuit is filed, regardless of the default remedy. Under specific performance, the buyer's and seller's status quo payoff from litigation (exclusive of the litigation costs) are  $v - p$ , and  $p - c$ , respectively. Therefore the buyer will accept an offer only if her guaranteed payoff is at least  $v - p$ . Given this, the seller's optimal renegotiation strategy is to not make any offer if  $v \geq c$ ; and to make a take-it-or-leave-it damages offer of  $v - p$  to breach when  $v < c$ . Therefore, at Time 2 the buyer will sue upon breach only if  $v > p + l_b$ . As a result, the seller's expected payoff from breach is

$$\int_{p+l_b}^{\max(c, p+l_b)} (p - v - l_s) dG(v) + \int_{\max(c, p+l_b)}^{\bar{v}} (p - c - l_s) dG(v).$$

Therefore, he will breach when

$$c > \frac{1}{G(\max(c, p+l_b))} \left[ \int_0^{p+l_b} p dG(v) + \int_{p+l_b}^{\bar{v}} l_s dG(v) + \int_{p+l_b}^{\max(c, p+l_b)} v dG(v) \right] := Br^{SP^i}(p).$$

The seller's optimization problem is:

$$\begin{aligned}
\text{Max}_p \pi_S^{SP_r^l} &= \int_0^{Br^{SP_r^l}(p)} (p-c) dF(c) + \int_{Br^{SP_r^l}(p)}^{\bar{c}} \left\{ \begin{aligned} &\int_{p+l_b}^{\max(c,p+l_b)} (p-v-l_s) dG(v) \\ &+ \int_{\max(c,p+l_b)}^{\bar{v}} (p-c-l_s) dG(v) \end{aligned} \right\} dF(c); \\
\text{s.t. } \pi_B^{SP_r^l} &= \int_0^{Br^{SP_r^l}(p)} (E(v)-p) dF(c) + \int_{Br^{SP_r^l}(p)}^{\bar{c}} \int_{p+l_b}^{\bar{v}} (v-p-l_b) dG(v) dF(c) \geq 0.
\end{aligned}$$

It can be shown that the constraint is binding, and the equilibrium price and expected joint payoff are:

$$(A22) \quad p^{SP_r^l} = E(v) + \left\{ \left[ 1 - F \left( Br^{SP_r^l} \left( p^{SP_r^l} \right) \right) \right] \int_{p^{SP_r^l}+l_b}^{\bar{v}} (v - E(v) - l_b) dG(v) \right\} / \left[ \begin{aligned} &1 - G \left( p^{SP_r^l} + l_b \right) \\ &+ F \left( Br^{SP_r^l} \left( p^{SP_r^l} \right) \right) G \left( p^{SP_r^l} + l_b \right) \end{aligned} \right];$$

$$(A23) \quad j\pi^{SP_r^l} = \int_0^{Br^{SP_r^l}(p^{SP_r^l})} (E(v) - c) dF(c) + \int_{Br^{SP_r^l}(p^{SP_r^l})}^{\bar{c}} \int_{\max(c,p^{SP_r^l}+l_b)}^{\bar{v}} (v - c) dG(v) dF(c) \\ - \int_{Br^{SP_r^l}(p^{SP_r^l})}^{\bar{c}} \int_{p^{SP_r^l}+l_b}^{\bar{v}} (l_b + l_s) dG(v) dF(c).$$

## A.2 English Rule

We now analyze the case where the losing party (i.e., the seller) bears all the litigation costs. At the litigation stage the buyer will accept an offer only if her guaranteed payoff is at least  $v - p$ . Given this, the seller's optimal strategy is to not make any renegotiation offer if  $v \geq c$ ; and to make a take-it-or-leave-it damages offer of  $v - p$  to breach when  $v < c$ . Therefore, at Time 2 the buyer will sue upon breach only if  $v > p$ . As a result, the seller's expected payoff from breach is  $\int_p^{\max(c,p)} (p - v - l_b - l_s) dG(v) + \int_{\max(c,p)}^{\bar{v}} (p - c - l_b - l_s) dG(v)$ . Therefore, he will breach when

$$c > \frac{1}{G(\max(c,p))} \left[ \int_0^p p dG(v) + \int_p^{\bar{v}} (l_b + l_s) dG(v) + \int_p^{\max(c,p)} v dG(v) \right] := Br^{SP_r^l}(p).$$

It can be shown that the equilibrium price and expected joint payoff are:

$$(A24) \quad p^{SP_r^l} = E(v) + \left\{ \left[ 1 - F \left( Br^{SP_r^l} \left( p^{SP_r^l} \right) \right) \right] \int_0^{p^{SP_r^l}} (E(v) - v) dG(v) \right\} / \left[ \begin{aligned} &1 - G \left( p^{SP_r^l} \right) \\ &+ F \left( Br^{SP_r^l} \left( p^{SP_r^l} \right) \right) G \left( p^{SP_r^l} \right) \end{aligned} \right];$$

$$(A25) \quad j\pi^{SP_r^l} = \int_0^{Br^{SP_r^l}(p^{SP_r^l})} (E(v) - c) dF(c) + \int_{Br^{SP_r^l}(p^{SP_r^l})}^{\bar{c}} \int_c^{\bar{v}} (v - c) dG(v) dF(c) \\ - \int_{Br^{SP_r^l}(p^{SP_r^l})}^{\bar{c}} \int_{p^{SP_r^l}}^{\bar{v}} (l_b + l_s) dG(v) dF(c).$$

## B. Ex Ante Expectation Damages with Renegotiation

### B.1 American Rule

As we discussed before, there are two cases under this regime distinguished by the buyer's litigation decision upon breach. Case (1)  $p > E(v) - l_b$ . In this price region, as we have proved,  $\hat{p}^{(1)*} = E(v)$ , and the seller's expected payoff is  $\hat{\pi}_S^{(1)*} = \int_0^{E(v)} (E(v) - c) dF(c)$ .

Case (2)  $p \leq E(v) - l_b$ . In this case, since the buyer's payoff from litigation,  $E(v) - p - l_b$ , is non-negative, she always sues upon breach. Given that the litigation costs are sunk at the renegotiation stage, the buyer will only accept an offer with guaranteed payoff at least  $E(v) - p$ . Therefore, the seller's optimal renegotiation strategy is to offer to deliver at price  $p - E(v) + v$  when  $v \geq c$ ; and to not make any offer when  $v < c$ . Anticipating the strategies in Time 3, the

seller at Time 2 chooses to breach when  $\int_0^c (c - v)dG(v) > l_s$ ,<sup>48</sup> where the left hand side is the expected renegotiation surplus he can extract from the buyer, the right hand side is the litigation cost. Denote  $\varphi(c) := \int_0^c (c - v)dG(v) - l_s$ , and let  $\varphi(\hat{c}^*) = 0$ . Obviously,  $\varphi'(c) > 0$ . Therefore, the seller breaches when  $c > \hat{c}^*$ . The seller's optimization problem in this price region (denoted as  $\hat{p}^{(2)}$ ) is:

$$\begin{aligned} \text{Max}_p \pi_S^{ED\bar{1}} &= \int_0^{\hat{c}^*} (p - c)dF(c) + \int_{\hat{c}^*}^{\bar{c}} \left\{ \begin{array}{l} \int_0^c (p - E(v))dG(v) \\ + \int_c^{\bar{v}} (p - E(v) + v - c)dG(v) - l_s \end{array} \right\} dF(c) \\ \text{s. t. } \pi_B^{ED\bar{1}} &= \int_0^{\hat{c}^*} (E(v) - p)dF(c) + \int_{\hat{c}^*}^{\bar{c}} (E(v) - p - l_b)dF(c) \geq 0 \text{ and } p \leq E(v) - l_b. \end{aligned}$$

Obviously,  $\hat{p}^{(2)*} = E(v) - l_b$ . The seller's expected payoff in this price region is  $\hat{\pi}_S^{(2)*} = \int_0^{\hat{c}^*} (E(v) - l_b - c)dF(c) + \int_{\hat{c}^*}^{\bar{c}} \left\{ \int_c^{\bar{v}} (v - c)dG(v) - l_b - l_s \right\} dF(c)$ . The joint expected payoff is:

$$j\pi^{ED\bar{1}} = \max \left( \hat{\pi}_S^{(1)*}, 1 \left( \hat{\pi}_S^{(2)*} > \hat{\pi}_S^{(1)*} \right) \left[ \hat{\pi}_S^{(2)*} + l_b F(\hat{c}^*) \right] \right), \text{ where the indicator function } 1(S) = 1, \text{ if the statement } S \text{ is true, and equals 0 otherwise.}$$

## B.2 English Rule

Under the English rule with ex ante expectation damages, the equilibrium price must satisfy  $p \leq E(v)$ , otherwise, if  $p > E(v)$ , the buyer's expected payoff would always be negative (both when the seller performs and when the seller breaches), and she would never have signed such a contract. Hence, given  $p \leq E(v)$ , the buyer always sues upon breach and she will only accept a renegotiation offer with guaranteed payoff at least  $E(v) - p$ . The seller's optimal strategy is to offer to deliver at price  $p - E(v) + v$  when  $v \geq c$ ; and to not make any offer at the renegotiation stage when  $v < c$ . Anticipating the strategies at Time 3, the seller at Time 2 chooses to breach when  $\int_0^c (c - v)dG(v) > l_b + l_s$ ,<sup>49</sup> where the left hand side is the expected renegotiation surplus he can extract from the buyer, and the right hand side is the seller's litigation cost. Denote  $\delta(c) := \int_0^c (c - v)dG(v) - l_b - l_s$ , and let  $\delta(\tilde{c}^*) = 0$ . (From the definitions it is straightforward to see that  $\tilde{c}^* > \hat{c}^*$ .) Obviously,  $\delta'(c) > 0$ . Therefore, the seller breaches when  $c > \tilde{c}^*$ . The seller's optimization problem in this price region (denoted as  $\tilde{p}^{(2)}$ ) is:

$$\begin{aligned} \text{Max}_p \pi_S^{ED\bar{1}} &= \int_0^{\tilde{c}^*} (p - c)dF(c) + \int_{\tilde{c}^*}^{\bar{c}} \left\{ \begin{array}{l} \int_0^c (p - E(v))dG(v) \\ + \int_c^{\bar{v}} (p - E(v) + v - c)dG(v) - l_b - l_s \end{array} \right\} dF(c) \\ \text{s. t. } \pi_B^{ED\bar{1}} &= E(v) - p \geq 0 \text{ and } p \leq E(v). \end{aligned}$$

<sup>48</sup> Because his payoff from performance is  $p - c$ ; while his expected payoff from breach is  $\int_0^c (p - E(v))dG(v) + \int_c^{\bar{v}} (p - E(v) + v - c)dG(v) - l_s = p - E(v) + \int_c^{\bar{v}} (v - c)dG(v) - l_s$ . He will breach when the payoff from breach exceeds the one from performance.

<sup>49</sup> Because his payoff from performance is  $p - c$ ; while his expected payoff from breach is  $\int_0^c (p - E(v))dG(v) + \int_c^{\bar{v}} (p - E(v) + v - c)dG(v) - l_b - l_s = p - E(v) + \int_c^{\bar{v}} (v - c)dG(v) - l_b - l_s$ . He will breach when the payoff from breach exceeds the one from performance.

Obviously,  $\tilde{p}^{(2)*} = E(v)$ . The joint expected payoff (which is the same as the seller's expected payoff) is  $j\pi^{ED\bar{l}} = \int_0^{c^*} (E(v) - c)dF(c) + \int_{c^*}^{\bar{c}} \left\{ \int_c^{\bar{v}} (v - c)dG(v) - l_b - l_s \right\} dF(c)$ .

## C. Actual Damages with Renegotiation

### C.1 American Rule

At Time 3 the buyer's damages are observed through the discovery process. She will accept an offer only if it guarantees her a payoff no less than  $v - p$ . Given this, the seller's optimal strategy is to renegotiate and offer delivery at price  $p$  when  $v \geq c$ ; and to not make any offer when  $v < c$ . Anticipating the strategies in Time 3, the buyer will sue for damages upon breach at Time 2 only if  $v > p + l_b$ . The seller's payoff from performance is  $p - c$ ; and his expected payoff if he breaches the contract is:  $\int_{p+l_b}^{max(c,p+l_b)} (p - v - l_s)dG(v) + \int_{max(c,p+l_b)}^{\bar{v}} (p - c - l_s)dG(v)$ . Therefore, the seller will breach when

$$c > \frac{1}{G(max(c,p+l_b))} \left[ \int_0^{p+l_b} pdG(v) + \int_{p+l_b}^{\bar{v}} l_s dG(v) + \int_{p+l_b}^{max(c,p+l_b)} vdG(v) \right] := Br^{AD\bar{l}}(p).$$

We can see that the seller's optimization problem is exactly the same as in the case of specific performance with renegotiation. Therefore, the equilibrium price and expected joint payoff are also the same (see equations (W19) and (W20)):

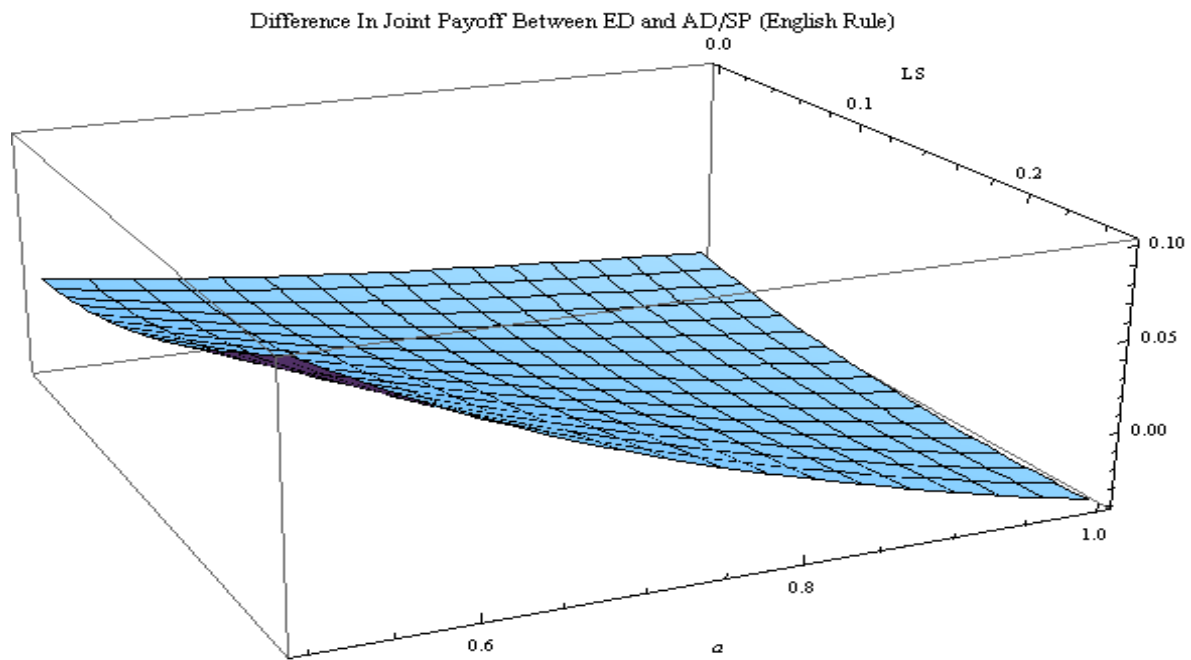
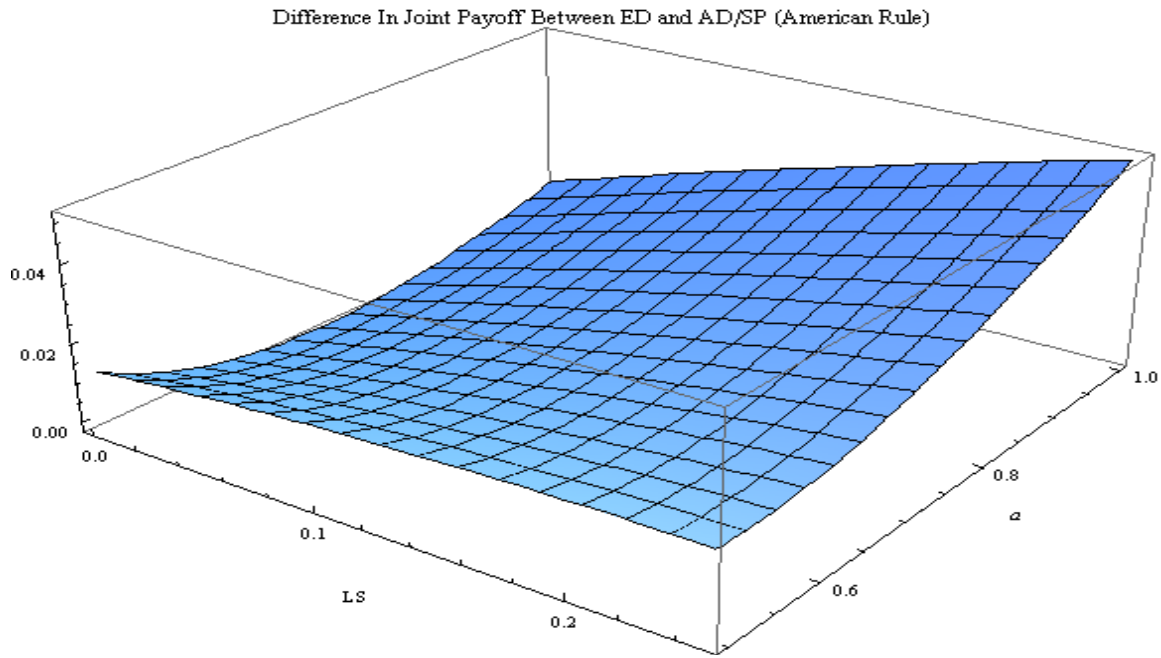
$$p^{AD\bar{l}} = p^{SP\bar{l}} \text{ and } j\pi^{AD\bar{l}} = j\pi^{SP\bar{l}}.$$

### C.2 English Rule

Similarly, the seller's optimization problem is exactly the same as in the case of specific performance with renegotiation under the English rule. Therefore the equilibrium price and expected joint payoff are also the same. (See equations (W21) and (W22)):

$$p^{AD\bar{l}} = p^{SP\bar{l}} \text{ and } j\pi^{AD\bar{l}} = j\pi^{SP\bar{l}}.$$

The graph below shows the difference between the joint payoffs under ED and under AD with the American Rule (Red) and with the English Rule (Blue). (The reader needs to keep in mind that  $j\pi^{AD\bar{l}} = j\pi^{SP\bar{l}}$ .) We assume the buyer's valuation is uniformly distributed between 0 and 1, and the seller's cost is uniformly distributed between 0 and  $a$ , where  $a$  runs from 0.5 to 1. The y-axis represents  $a$ , the seller's distribution's upper bound. First we fix  $l_b = 0.125$ , and let  $l_s \sim U[0,0.25]$ . The x-axis represents  $l_s$ , the seller's litigation cost, which runs from 0 to 0.25. The z-axis represents the difference in joint payoffs under the two remedies (ED and AD). (We do not present the other graph where we fix  $l_s = 0.125$ , and let  $l_b \sim U[0,0.25]$ .)



*Remark:* It is shown numerically that when we account for renegotiation, even when litigation is costly, under the American rule the ex ante expectation damages remedy is more efficient than actual damages, even if the court can accurately (without any special verification costs) assess the actual damages. Under the English rule, unless the litigation cost is sufficiently high relative to the expected trade surplus,  $ED_r$  is more efficient than  $AD_r$  (or  $SP_r$ ).

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