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Optimal Remedies for Bilateral Contracts

ABSTRACT: In a bilateral contract, parties exchange promises creating reciprocal obligations. In this paper, we extend the standard models of contract remedies to consider the incentives created by bilateral contracts. We show that when the values of the parties' performance are interdependent, bilateral contracts create effort incentives that are superior to unilateral contracts. In contracts with independent values, bilateral contracts also offer a valuable instrument to correct imperfections in the contract enforcement. Such imperfections include potential insolvency, litigation costs and court errors. We further consider the effect of ex post renegotiation and sequential performances on the parties' ex ante incentives.

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1. Introduction

The Restatement (Second) of Contracts defines a bilateral contract as an agreement in which the parties exchange promises of performance with one another. Unlike unilateral contracts in which parties exchange a promise for an actual performance, the parties to a bilateral contract undertake reciprocal obligations, each of which generates a performance problem for its promisor and a reliance problem for its promisee.[4] For example, a contract involving an exchange of goods or services between two parties creates bilateral obligations, each of which is capable of generating a surplus when received by the other party. The same bilateral nature of the contractual relationship is present when goods or services are exchanged for a promised money payment. In the absence of costless access to capital markets, parties face a reliance problem for a promised payment, as much as they face a reliance problem for a promised good or service. Parties rely on a promised payment, for example, when they plan investments that increase the value of the payment if received but could likewise increase the loss if the payment is not received.

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[4] When parties exchange promises with the intent to exchange performances, each party is at the same time a promisor of his obligation and a promisee of the other party's obligation. Restatement (Second) of Contracts § 231 and the Introductory Note to Ch.10.

The special features of bilateral contracts have thus far escaped the attention of law and economics scholars, as they have been focused on the study of unilateral breach situations. In this article, we wish to fill this gap in the literature. Parties generally enter into contracts with reciprocal performance obligations as a matter of convenience (e.g., an exchange of goods or services to reduce transaction costs, avoid outlays of money, or reduce tax burdens) or to exploit relevant synergies between the parties' performances. Consider, for example, the reciprocal obligations undertaken by a singer and his concert organizer, or an artist and her exhibition organizer, or the reciprocal obligations undertaken by two coauthors, and more generally, by two professional partners. In these cases, it would be costly or undesirable to disentangle the parties' bilateral obligations into separate unilateral obligations.

We suggest that in addition to these reasons, the choice of bilateral contracts in real-life contractual practice may also be driven by the parties' wish to mitigate the effects of imperfections in the enforcement of their contractual relationship. Contrary to intuition, we show that the incentives faced by the parties in a bilateral contract are different from those that the parties would face if entering into two separate unilateral contracts. In the presence of imperfections, such as insolvency, litigation costs and court errors, the effects of a bilateral contract are not just the sum of two separate unilateral contracts with analogous obligations. As is well-known in the literature, insolvency, litigation costs and court errors create distortion of incentives. We show that these distortions are mitigated when parties enter into a bilateral agreement. In a bilateral contract the contracting parties are given an opportunity to tie two contractual obligations together, with incentives that are superior to those achievable with two independent unilateral contracts. This superiority derives from specific legal remedies that apply to bilateral contracts, such as the defense of non-performance for unilateral breach and the preclusion rules for bilateral breach. These remedies play an important role in bilateral contracts, allowing parties to tie two contractual obligations together and to use each other's contractual surplus as a kind of bonding mechanism. These findings unveil the comparative advantages of these alternative contractual structures under various scenarios.

The article is structured as follows. Section 1 identifies the problem and discusses it in the context of existing literature. Section 2 develops an economic model to study the features of bilateral contracts and shows that when the parties' performances have interdependent values, bilateral contracts provide superior incentives to the corresponding pair of unilateral contracts. We further consider the effects of imperfections such parties' insolvency, litigation costs and court errors, showing that in those situations bilateral expectation damages provide suboptimal incentives for parties. Section 3 analyzes the results in the context of existing legal remedies for breach of contract, paying special attention to the defense of non-performance under the Restatement (Second) of Contracts and other remedies used in cases of bilateral breach. We show the advantages of bilateral contract arrangements in coping with the contract imperfections discussed in Section 2. Section 4 extends the analysis to allow the possibility of renegotiation and sequential performances. Section 5 concludes.

2. Bilateral Contracts and the Role of Imperfections

The question of which remedy would best incentivize the optimal performance of contracts has been widely researched in law and economics. Much of the early literature in this field builds around the contributions of Barton (1972) and Shavell (1980). Barton addresses the issue by asking how a single, value-maximizing firm would design damage measures in order to induce two divisions of this integrated firm to create optimal breach and reliance investments. Shavell derives the choice of optimal contract remedies by identifying a "Pareto efficient complete contingent contract" at the time of contracting. Both frameworks allow breach of contract if non-performance would result in greater joint wealth of the parties than would performance. In both of these models, legal remedies are designed to mimic the entitlements that would be chosen by the parties under these hypothetical frameworks.

The existing literature identifies expectation damages as the measure of damages best suited for promoting optimal performance and reliance investments. Expectation damages force a breaching promisor to compensate the promisee for the foregone benefit from the contract, bringing the promisee to the same level of utility he would have received in the event of successful performance. This effectively links liability to the benefit foregone by the promisee, creating incentives for efficient performance in the absence of other externalities caused by the breach (Posner, 1972; Shavell, 1980).[5] Under expectation damages, however, the promisee will undertake excessive reliance. By compensating the promisee for the foregone benefit in the event of breach, expectation damages operate as a form of implicit insurance, inducing the promisee to invest in reliance as if performance were likely to materialize with certainty (Shavell, 1980).[6] These well-known results are generally derived from models involving two parties, each playing a specific role: a promisor (debtor of the performance) who invests in performance efforts and a promisee (creditor of the performance) who invests in reliance. This standard set-up allows attention to be focused on the promisor's performance incentives and the promisee's reliance incentives, but neglects to capture the peculiar features of bilateral contracts.

Some recent literature analyzes issues pertaining to reciprocal performance obligations, similar to the obligations studied in this paper. Che and Chung (1999) analyze breach remedies in cases of cooperative investment, wherein specific investments undertaken by one party of a contract generate a direct benefit to the other party. This can occur in joint ventures, partnerships, and the like. The authors show that expectation damages perform poorly in contracts of this type. Schweizer (2006) revisits this issue, and points out that the results of Che and Chung come from the implicit assumption of

[5] The standard taxonomy of contract damages is generally based on the distinctions among expectation, reliance, and restitution interests (Fuller and Perdue, 1936). Commonly adopted measures of damages in contract law are linked to one of these three 'interests' of the promisee. See also Mahoney (2000).

[6] The issue of optimal remedies for breach of contracts has been investigated from a different perspective within the framework of incomplete contracts. Standard results show that the impossibility of entering into complete contracts that specify the efficient level of effort and reliance in each state contingency induces underinvestment in relationship-specific assets (Williamson, 1985; Hart and Moore, 1988, 1990). However, even in the prospect of later holdups, the presence of adequate contractual protection can mitigate the problem of underinvestment. When renegotiation is available even incomplete contracts can induce the parties to invest at an efficient level when either specific performance or expectation damages are applied as breach remedies (Edlin and Reichelstein, 1995).

unilateral expectation damages. The very nature of cooperative investments means that both parties could claim damages. In a regime of cooperative investments, Schweizer then shows that a rule of bilateral expectation damages is efficient. Adler (2008) also considers the case of bilateral contracts, with special attention to the case of anticipatory repudiation.[7]

The present paper addresses a different and indeed more general problem, encompassing a large number of situations frequently encountered in everyday contractual practice. We consider the general case in which both parties promise performance capable of creating a surplus for the other party, and investigate whether existing legal remedies are appropriate to deal with the peculiar problem posed by bilateral contracts in a variety of situations.

2.1 Setting the Stage: A Bilateral Contract Model

We develop a model adopting many of the conventional assumptions: parties are risk-neutral players and their objective is to maximize their wealth; ex post renegotiation is prohibitively costly; [8] performance efforts affect the probability of performance (performance quality is fixed); performance materializes as an all-or-nothing event (partial performance is not possible); and contracts do not create externalities for third parties.

The timing of the model is as follows. At time one, the parties enter into a contract in which party 1 undertakes the obligation to deliver a good, service or payment (performance) to party 2. In return, party 2 undertakes the obligation to provide a good, service or payment (counter-performance) to party 1. At time two, both parties invest in effort to carry out their respective obligations and invest in reliance on the other party's promised performance. At time three, the state of nature is observed and we see whether performance and counter-performance are possible, given the parties' respective effort levels. At time four, each party will either (a) obtain performance, or (b) face breach and sue for damages.

Performance efforts undertaken by party 1, e_1, influence the probability $p_1(e_1)$ of successful performance by party 1, where the probability of success increases with effort at a decreasing rate: $p_1' > 0$ and $p_1'' < 0$.[9] Party 2 undertakes investments r_2 in reliance on party 1's performance. We assume that, in the relevant region, the gain $G_2(r_2)$ obtained by party 2 when performance is carried out increases with reliance at a decreasing rate:

[7] Unlike the present study, the focus in Adler is on how a prohibition on a breaching party's suit can lead to efficient performance of an inefficient contract and distort investment incentives in anticipation of this event. In Adler's framework there is no circumstance in which a party both breaches and desires performance; rather Adler considers whether a party will engage in anticipatory repudiating if and only if it is efficient to do so.

[8] The assumption of "no ex post renegotiation" applies to the case of material breach where the benefit of the foregone performance is irreversibly lost as a result of non-performance. Examples would include situations in which the time of the performance is of the essence (e.g., catering for a wedding, recording equipment for a live performance) or in which the nature of the performance is non-fungible (e.g., breach through the sale to a third party of a piece of art or a unique piece of property).

[9] Following the established convention in the literature, we use a probabilistic performance function in which the probability of performance depends on effort, rather than modeling a deterministic performance/breach decision. This allows us to consider interior solutions and compare effort and reliance levels under alternative legal rules.

$G_2' > 0$ and $G_2'' < 0$. To simplify the model, we normalize the payoff or loss for non-performance to be zero. As discussed above, we assume incomplete contracts, excluding the possibility for the parties to specify effort and reliance levels ex ante in their contract (i.e., e_1 and r_2 are non-contractible).[10]

In a bilateral contract, one or both parties could default on their contractual obligations, with four possible performance outcomes: both parties fulfilling their contractual obligations, one party performing and the other party breaching, and both parties breaching. We allow for different measures of damages to be due in the event of unilateral or bilateral breach. Specifically, $D_2^U(r_2)$ denotes damages due to party 2 when party 1 unilaterally defaults on the contract (we refer to this as "unilateral breach" case), and $D_2^B(r_2)$ denotes damages due to party 2 when party 2 is himself in default (we refer to this as "bilateral breach" case).

Without loss of generality, we allow interdependence in the values of the parties' performances. We denote with $\overline{G}_1$ the value of performance to party 1 when both parties perform their contractual obligations and with $\underline{G}_1$ the value of performance to party 1 in the event that only party 2 performs.[11] In contracts with interdependent values, the surplus for each party is larger when both fulfill their promise, i.e. $\overline{G}_1 > \underline{G}_1$. The surplus created by the contractual synergies is therefore equal to the difference between $\overline{G}_1$ and $\underline{G}_1$. Contracts with independent values, $\overline{G}_1 = \underline{G}_1$, will be studied as well. [12]

2.1.1 The Social Optimization Problem

In the absence of effects on third parties, the social objective function is the sum of the expected welfare of the contracting parties and can be written as follows: [13]

$$\max_{e_1, e_2, r_1, r_2} \; p_1(e_1)\,p_2(e_2)[\overline{G}_1(r_1) + \overline{G}_2(r_2)] + p_1(e_1)[1 - p_2(e_2)]\,\underline{G}_2(r_2) + [1 - p_1(e_1)]\,p_2(e_2)\,\underline{G}_1(r_1) - e_1 - e_2 - r_1 - r_2 \qquad (1)$$

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[10] Extending the conventional notation, we denote the performance effort undertaken by party 2 as e_2. This performance effort influences the probability $p_2(e_2)$ of successful performance by party 2, with $p_2' > 0$ and $p_2'' < 0$. The reliance investment undertaken by party 1 is r_1, and $G_1(r_1)$ is the gain obtained by party 1 when party 2 performs, where $G_1' > 0$ and $G_1'' < 0$ in the relevant region.

[11] An analogous notation applies to party 2. Following a standard assumption in the literature, the value of performance is assumed to be verifiable by courts when liquidating damages.

[12] Contracts with independent values can be treated analytically as a special case of contracts with interdependent values. To ease notation, the underscore and superscore signs for the independent-value cases are suppressed: $\overline{G}_1 = \underline{G}_1 = G_1$.

[13] The social problem in (1) (and FOCs as well) reduces to the same form of the standard problem in the unilateral contract scenario, i.e. when no performance effort is undertaken by party 2 ($e_2 = 0$), no reliance investment is undertaken by party 1 ($r_1 = 0$) and no gain can be realized from the counter-performance ($G_1 = 0$).

The first order necessary conditions with respect to the performance efforts e_1 and e_2 for the social optimum are:

$$p_1'(e_1)\cdot\left[G^e{}_2(r_2)+p_2\left(\overline{G}_1-\underline{G}_1\right)\right]=1 \qquad (2)$$

$$p_2'(e_2)\cdot\left[G^e{}_1(r_1)+p_1\left(\overline{G}_2-\underline{G}_2\right)\right]=1 \qquad (3)$$

where $G_i^e=p_i\overline{G}_i+\left(1-p_i\right)\underline{G}_i$ is the expected value of performance for party i, $i=1,2$. Conditions (2) and (3) specify that, for a social optimum, the marginal benefit of performance efforts for the two parties, given by the increased probability of successful performance, should equal the marginal cost of performance effort. Bilateral contracts with interdependent values are characterized by the presence of a positive externality that each party creates through his or her own performance effort: an increase in a party's own effort level produces a higher probability of securing the sought-after contract-specific surplus, equal to $\overline{G}_i-\underline{G}_i$.[14]

The first order conditions with respect to r_1 and r_2 for the social problem are:

$$p_2(e_2)\cdot G_1^{'e}(r_1)=1 \qquad (4)$$

$$p_1(e_1)\cdot G_2^{'e}(r_2)=1 \qquad (5)$$

where $G_i^{'e}=p_i\overline{G}_i^{'}+\left(1-p_i\right)\underline{G}_i^{'}$ is the expected marginal benefit of reliance for party i, $i=1,2$. Conditions (4) and (5) require that for a social optimum, the expected marginal gain from each party's reliance investment should equal the marginal cost of such reliance investment.

2.1.2 The Private Optimization Problem

We turn to the private problem confronting party 1. As normally assumed in these models, private incentives are affected by the measure of liability imposed in the event of unilateral or bilateral breach. We allow for different measures of damages to be chosen in those situations, denoting $D_1^U(r_1)$ and $D_1^B(r_1)$ as damages due to party 1 in the case of unilateral and bilateral breach, respectively. Analogous notation denotes damages due to party 2 in the case of unilateral and bilateral breach.

The problem for party 1 is given as follows:[15]

$$\begin{aligned}\max_{e_1,\,r_1}\quad & p_1(e_1)\,p_2(e_2)\,\overline{G}_1(r_1)+p_1(e_1)\left(1-p_2(e_2)\right)D_1^U(r_1)\\ & +\left(1-p_1(e_1)\right)p_2(e_2)\left[-D_2^U(r_2)+\underline{G}_1(r_1)\right]\\ & +\left(1-p_1(e_1)\right)\left(1-p_2(e_2)\right)\left[-D_2^B(r_2)+D_1^B(r_1)\right]-e_1-r_1\end{aligned} \qquad (6)$$

In the objective function (6), the first term refers to the payoff in the event of bilateral performance. The second and third terms concern the case of unilateral breach of party 2 and party 1 respectively, with the corresponding unilateral damage payments. The

[14] The externality increases the expected marginal benefit of effort by a positive term in LHS in (2) and (3), which is otherwise absent for unilateral contracts or bilateral contracts with independent values.

[15] The private problem faced by party 2 is symmetrical and the conditions stated in Proposition 1 below must be equally satisfied to create optimal incentives for party 2.

fourth term concerns the case of bilateral breach, where party 1 receiving damage compensation D_1^B and pays damages D_2^B to party 2.

The first order necessary conditions for the private optimum for party 1 with respect to e_1 and r_1 are the following:

$$p_1'(1-p_2)[(D_1^U - D_1^B) - (D_2^U - D_2^B)] + p_1'\left[D_2^U + p_2\left(\overline{G}_1 - \underline{G}_1\right)\right] = 1 \qquad (7)$$

$$p_2 G_1^{'e} + p_1(1-p_2)\,D_1^{U\prime} + (1-p_1)(1-p_2)D_1^{B\prime} = 1 \qquad (8)$$

Proposition 1: *In bilateral contracts, the privately optimal level of effort is socially optimal when the following two conditions hold:*

$$D_2^U = G_2^e \qquad (9)$$

$$D_1^U - D_1^B = D_2^U - D_2^B \qquad (10)$$

The privately optimal level of reliance is socially optimal when the following condition holds:

$$D_1^{U'} = D_1^{B'} = 0 \qquad (11)$$

Proof: See Appendix

Proposition 1 shows that in order to align private and social incentives, the traditional expectations damages (i.e. the idea of giving the non-breaching party the "benefit of the bargain") must hold. The additional requirement, specified in condition (10), can be fulfilled by setting damages for unilateral and bilateral breach equal to one another. This suggests that in order to align private and social incentives, courts may want to impose bilateral expectation damages in cases of bilateral breach. This result is consistent with the rule of bilateral expectation damages derived by Schweizer (2006). The result concerning optimal reliance is consistent with the standard result for the unilateral contract case, where setting marginal damages to zero avoids excessive reliance. In the following analysis, the condition of zero marginal damages applies to all cases that we examine and explicit discussion of reliance incentives will therefore be omitted.[16]

Proposition 2: *When the values of the parties' performances are interdependent, bilateral contracts provide incentives that are superior to the corresponding pair of unilateral contracts.*

Corollary: *When performance values are independent, bilateral contracts and unilateral contracts create equivalent incentives.*
Proof: See Appendix

The superiority of bilateral contracts when the parties' performances have interdependent values lies in the fact that parties are able to internalize the externality created by one party's performance on the other, by linking the two performances in a single contract.

In the following, we will show that the equivalence stated in the Corollary of Proposition 2, i.e., the equivalence between unilateral and bilateral contracts with

[16] Proofs are available from the authors upon request.

independent values, no longer holds in the presence of imperfections such as insolvency, litigation costs and court errors.

2.2 The Role of Imperfections

We model bilateral contracts in the presence of imperfections that limit the ability of a plaintiff to receive full compensation for breach of contract. We focus on three of the main factors that limit a plaintiff's ability to receive full compensatory damages: insolvency and judgment-proof defendants, litigation costs and court errors. We show that these factors distort parties' incentives, preventing the achievement of a social optimum under bilateral expectation damages (according to Proposition 1). In Section 3 we will use these results to show how these distortions are reduced by the existing remedies for bilateral contracts.

2.2.1 Insolvency

In the following we shall consider a contracting party potentially insolvent or judgment-proof if in the case of his own breach his wealth level cannot cover the damages set by the court at the level of expectation damages.[17] We denote with a_1 and a_2 the wealth of party 1 and 2. In analytical terms, party 1 is fully solvent if $a_1 \geq G_2^e$ and insolvent if $a_1 < G_2^e$. Insolvency may affect only one party (unilateral insolvency) or both parties (bilateral insolvency).

We shall consider these two cases in turn, showing that both unilateral and bilateral insolvency distort incentives away from social optimality when expectation damages are awarded.

Consider the case in which party 1 is insolvent and faces limited liability, with $a_1 < G_2^e$. In the event of a breach, party 1 will not be able to repay either D_2^U or D_2^B, and her liability will be limited to her wealth a_1. Party 2 will thus receive only partial compensation in the event of a breach. The objective function of party 1, as stated in (6), will be modified in order to take into account such limited liability and becomes:

$$\begin{aligned}\max_{e_1, r_1} \quad & p_1(e_1)\, p_2(e_2)\, \overline{G}_1(r_1) + p_1(e_1)\,(1 - p_2(e_2))\, D_1^U(r_1) \\ & + (1 - p_1(e_1))\, p_2(e_2)\,[-a_1 + \underline{G}_1(r_1)] \\ & + (1 - p_1(e_1))\,(1 - p_2(e_2))[-a_1 + D_1^B(r_1)] - e_1 - r_1\end{aligned} \tag{12}$$

Condition (7), which states the privately optimal effort of party 1, under bilateral expectations damages identified in Proposition 1, becomes:

$$p_1'(e_1) \cdot \left[a_1 + p_2 \left(\overline{G}_1 - \underline{G}_1 \right) \right] = 1 \tag{13}$$

When both contracting parties have limited assets, with $a_1 < G_2^e$ and $a_2 < G_1^e$, expectation damages set by the court will be payable by one party or the other only to the

[17] Hereinafter, for simplicity we shall refer to parties that face limited liability or that are judgment-proof as "insolvent."

extent of their respective wealth. Henceforth, in the event of her own breach party 1 pays a sum equal to a_1 to party 2, and symmetrically, party 2 pays up to a_2 to party 1. The objective function of party 1, as stated in (6), will be modified accordingly. Without loss of generality, we consider the case when $G_1^e > G_2^e$.

Condition (13) holds for party 1 and the following for party 2:

$$p_2'(e_2)\cdot\left[a_2 + p_1\left(\overline{G}_2 - \underline{G}_2\right)\right] = 1 \qquad (14)$$

Proposition 3. *In bilateral contracts with bilateral expectation damages, the presence of insolvency induces the insolvent party to undertake an inefficiently low level of effort.*
Proof: See Appendix

Corollary. *When both parties are insolvent, bilateral expectation damages induce both parties to undertake inefficiently low levels of effort.*
Proof: See Appendix

The presence of insolvency dilutes the effort incentives of the insolvent party or parties. It is interesting to observe that the privately optimal level of effort of the solvent party is not affected by the insolvency of his counterpart.[18] Further note that these qualitative results hold for all bilateral contracts, regardless of the interdependent or independent values of the parties' performances. Hereinafter, in the discussion of the other contract imperfections, we shall treat these two cases conjunctly, referring to them as bilateral contracts.

2.2.2 Litigation Costs

The presence of non-recoverable litigation costs may cause the parties to be compensated only partially in the case of a contract breach. Litigation costs are modeled according to the American rule, which would require each party to be responsible for its own attorney's fees unless otherwise specified by the contract. The Corollary of Proposition 4 and the proofs in the Appendix extend the result to the English rule in which the losing party in a dispute pays the litigation costs of the prevailing party. We consider litigation costs that are proportional to the value of the case, i.e. to the damages liquidated by courts. We denote with c the fraction of non-recoverable litigation costs that a party has to pay in the event of litigation.[19] The objective function of party 1 as stated in (6) is modified, in that party 1 pays c in any event of breach leading to litigation.

[18] The socially efficient level of effort is generated by the remedies specified in condition (10), given the fact that insolvency leads to partial compensation in both cases of unilateral and bilateral breach. The symmetric reduction of damages given by the limited liability (a_2 instead of G_1^e) in fact keeps the difference between D_1^U and D_1^B equal to zero, as when setting full expectation damages for bilateral breach, $D_1^U = D_1^B = G_1^e$.

[19] Here we abstract from asymmetries in the magnitude of litigation costs faced by the parties in the case of unilateral or bilateral breach, which would not add much to the intuition of our results.

$$\max_{e_1, r_1} \quad p_1(e_1)\,p_2(e_2)\,\overline{G}_1(r_1) + p_1(e_1)\,(1-p_2(e_2))\big(1-c\big)\,D_1^U(r_1)$$
$$+(1-p_1(e_1))\,p_2(e_2)\,[-\big(1+c\big)\,D_2^U(r_2)+\underline{G}_1(r_1)]$$
$$+(1-p_1(e_1))\,(1-p_2(e_2))[-\big(1+c\big)\,D_2^B(r_2)+\big(1-c\big)\,D_1^B(r_1)] \qquad (15)$$
$$-e_1-r_1$$

Condition (7) for the privately optimal effort of party 1, under bilateral expectation damages identified in Proposition 1, becomes:

$$p_1'(e_1)\cdot\left[\big(1+c\big)G_2^e + p_2\left(\overline{G}_1-\underline{G}_1\right)\right]=1 \qquad (16)$$

Proposition 4. *In bilateral contracts with bilateral expectation damages, the presence of non-recoverable litigation costs will induce inefficiently high levels of effort for both parties.*
Proof: See Appendix

Corollary. *In bilateral contracts with bilateral expectation damages, inefficiently high levels of effort are also induced by an English loser-pays rule.*
Proof: See Appendix

This result can be intuitively understood analogizing litigation costs to a tax on litigation. Similar to a tax, litigation costs render the breach-litigation outcome less desirable than the performance-non litigation outcome. In the presence of litigation costs, parties will therefore "substitute away" from litigation by increasing their effort and probability of performance. As it is shown in our mathematical Appendix, analogous results are obtained when litigation costs are modeled according to an English rule.[20]

2.2.3 Court Errors on Damages

Imperfect compensation may be caused by court errors during the assessment of damages. As the literature often points out, courts are prone to incur systematic errors or biases in the quantification of damages (Muris, 1983; Dore and Veitch, 1994). Likewise, courts may liquidate damages according to a measure that falls short of expectation damages due to difficulties of proof of subjective value, or they can impose limitations on damages based on the foreseeability of harm (Goetz and Scott, 1980 and Ayres and Gertner, 1983).

If courts liquidate damages with a systematic error term, k_i, damages will be analytically set as follows:

$$D_i^U = D_i^B = G_i^e + k_i,\ i=1,2 \qquad (17)$$

When perfect expectation damages are awarded, k_i is equal to zero. When courts liquidate damages with a systematic bias, k_i will be non-zero. Specifically, in the more

[20] Under the English rule, litigation costs c are modeled as payable in full by the party who is in breach. The same results hold if we adopt a refinement of the English rule, allowing for the judicial compensation of legal costs in the event of bilateral breach.

frequent case of undercompensation, k_i will have a negative value, giving the non-breaching party compensation lower than expectation damages. On the other hand, if courts were instead prone to overcompensate the victim of contractual breach, k_i will have a positive value, and the non-breaching party will receive compensation above perfect expectation damages. The objective function of party 1 as stated in (6) is changed to incorporate court errors stated in (17).

Condition (7) for the privately optimal effort of party 1, under bilateral expectation damages identified in Proposition 1, becomes:

$$p_1'(e_1)\cdot\left[G_2^e + k_2 + p_2\left(\overline{G}_1 - \underline{G}_1\right)\right] = 1 \qquad (18)$$

Proposition 5. *In bilateral contracts with bilateral expectation damages, the presence of court errors will induce an inefficiently low level of effort for both parties in cases of undercompensation.*
Proof: See Appendix

Corollary. *In the case of systematic overcompensation, parties will exert an inefficiently high level of effort.*
Proof: See Appendix

The intuition of this result is relatively straightforward. An undercompensation bias by the courts creates an incomplete internalization of the externality created by breach. This leads the prospective breaching party to adopt suboptimal level of effort to avoid the breach. Similarly, an overcompensation bias forces the breachor to face a cost of breach that exceeds the externality that he actually creates. This leads the prospective breachor to undertake an excessive level of effort.

3. Optimal Remedies for Bilateral Promises

Bilateral contracts are formally governed by the same legal principles governing contracts involving unilateral promises. However, several issues acquire particular significance or arise solely in cases of bilateral contracts. In this section, we examine these issues, extending the timeline of the basic model introduced in Section 2. In the face of a breach, the parties confront additional options made available to them by the specific legal remedies applicable to the cases of unilateral or bilateral breach. In the following, we will discuss the effects of these options. Specifically, Section 3.1 extends the timeline of the basic problem to consider the defense of non-performance, which becomes available to the non-breaching party when a unilateral breach occurs. Section 3.2 considers the effect of preclusion rules that apply when a bilateral breach occurs.

3.1. Unilateral Breach and the Defense of Non-Performance

Under most legal systems, in a bilateral contract a material breach or lack of substantial performance gives the non-breaching party the right to suspend his own

obligations under the contract.[21] This right is generally known as the defense of non-performance. The existence of a defense of non-performance implies that, in case of unilateral breach, the non-breaching party will alternatively sue for full expectation damages, or face breach and exercise the defense of non-performance, suing for reduced damages.

The defense of non-performance has ancient roots. The principle of excusing the victim of a contractual breach for his non-performance finds its origins in the Roman *exceptio inadimpleti contractus* (also known as the principle *inadimplenti non est adimplendum*), stating that lack of performance relieves the non-breaching party from his duty to perform his counter-performance. The principle enjoys widespread adoption in Civil law systems as a general principle of contract law and/or a specific rule for nominate contracts[22] and is part of recent draft codifications[23] (Moyle, 1892; Treitel, 1988). Other legal systems, including the international law of sales[24] and public international law[25] recognize a defense of non-performance by permitting the performance of an obligation to be withheld if the other party fails to perform its obligation.

At common law, the recognition of a general defense of non-performance is more recent. Although several eighteenth century common law decisions embody the idea that in bilateral contracts the obligation of each party is conditional on performance of the other party, it is not until later times that case law came to recognize a general defense of non-performance. The scope of the defense of non-performance under current U.S. law is quite

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[21] If breach is non-material (i.e., there has been substantial performance), then the other party has a claim for damages but is not excused from fulfilling his contractual obligation.

[22] The French *Code Civil* adopts the exception of non-performance through many specific provisions relating to sales (Articles 1612 and 1652), barter (Article 1704) and deposit (Article 1948), but the exception of non-performance is generally regarded as a principle applicable to all contracts creating bilateral obligations (Malecki, 1999, pp. 37-53). Likewise, German law (BGB § 320) formulates the exception as a general principle, under the name of *plea of unperformed contract*. A similar approach is followed by Spanish-based legal systems (e.g., Article 1426 of the Spanish *Código Civil*) and by the Swiss law of obligations (Article 82 of the Swiss *Code des Obligations*). Italian law adopts the *exceptio inadimpleti contractus* both as a general principle (Article 1460 of the Italian *Codice Civile*) and as a rule applicable to specific bilateral contracts (e.g., under Articles 1565 and 1901).

[23] Section 4.III.3:401 of the Model Rules of European Private Law, govern the right of a breachee to withhold performance: "Right to withhold performance of reciprocal obligation: (1) A creditor who is to perform a reciprocal obligation at the same time as, or after, the debtor performs has a right to withhold performance of the reciprocal obligation until the debtor has tendered performance or has performed." See the ongoing work by the Study Group on a European Civil Code/Research Group on EC Private Law (2008).

[24]The defense of non-performance has been adopted by the United Nations Convention on Contracts for the International Sale of Goods (Vienna, 11 April 1980, Treaty Document Number 98-9 (1984), UN Document Number A/CONF 97/19, 1489 UNTS 3). Article 71 of the Convention provides the so-called defense of non-performance, stating that a party may suspend the performance of his obligation if, after the conclusion of the contract, it becomes apparent that the other party will not perform a substantial part of his obligations. Article 72 provides that the right to withhold performance applies also in the case of anticipatory breach of contract and provides a remedy that is available even before the obligation becomes due, offering protection against a future breach of contract (Cenini and Parisi, 2009).

[25] In the international law of treaties, the rule that a material breach of a treaty gives the aggrieved state the right to suspend or terminate its obligation was first affirmed by a well-known decision of the Permanent Court of International Justice, which stated "The principle ... [*inadimplenti non est adimplendum*] is so just, so equitable, so universally recognized that it must be applied in international relations." Case of the *Diversion of Water from the Meuse (Netherlands v Belgium)* [1937], *P.C.I.J., Series A/B, No. 70.* The rule was subsequently codified under Article 60 of the 1969 Vienna Convention on the Law of Treaties. See A/CN.4/492,2 A/CN.4/496, Sect. D, A/CN.4/498 and Add.1-4, A/CN.4/L.574 and Corr.1 and 3.

broad, and acquires particular significance in the context of bilateral promises, although the prerequisites for this defense varied across jurisdictions. The Restatement (Second) of Contracts makes the defense available in all but a few cases in which different periods are affixed within which each party is to perform.[26]

A defense of non-performance gives the non-breaching party the option of withholding performance in the event of a substantial breach. As a practical matter, the non-breaching party can choose to withhold performance and to be released from his obligations, or he can continue to pursue the performance of the bilateral contract. The right of the non-breaching party to be excused from counter-performance does not eliminate his right to obtain full damages. When invoking a defense of non-performance in contracts involving bilateral promises, damages are calculated by taking the value of the promised performance and subtracting the benefits, if any, that the non-breaching party received from not having to complete his or her own performance. [27]

A non-breaching party may choose to cancel the contract and exercise the defense of non-performance for a variety of reasons.[28] In the case of unilateral breach considered here, we model a bilateral contract with simultaneous performances, in which each party has the right to exercise the defense of non-performance.[29] The availability of this defense modifies the options available at time four of the timeline of our model. At time four, each promise who is ready to perform will alternatively (a) obtain counter-performance, (b) face breach and sue for full expectation damages, or (c) face breach and exercise the defense of non-performance with reduced damages. The assumptions regarding the parties' information at this stage are not too stringent, given the legal rules that govern how parties can be placed in default under most legal systems.[30]

Whenever the defense of non-performance is exercised, courts reduce the damage that the breaching party should pay by an amount equal to the savings that the non-breaching party attains by not having to complete his performance. Formally, when a breaching party i does not receive the non-breaching party's performance due to the non-breaching party's defense of non-performance, the damages that he owes are reduced by an amount h_i equivalent to the breachee's savings. The non-breaching party who exercises the defense of non-performance has the opportunity to redeploy the performance towards

[26] This is now the default rule followed by Restatement (Second) of Contracts §234 for contracts that are capable of being performed simultaneously.

[27] *Daugherty v. Bruce Realty and Dev.*, 892 S.W. 2d 332 (Mo. App. 1995). When exercising a defense of non-performance, expectation damages are adjusted in light of the salvage value of the withheld performance.

[28] In addition to the possible psychological inclination to withhold one's own cooperation when the other party fails to cooperate, several economic factors help an aggrieved party decide whether to exercise the defense. For an interesting study of strategic and irrational threats of non-performance, see Bar-Gill and Ben-Shahar (2004).

[29] In Section 4.2, we will extend the model to consider the case of sequential performances, in which only the party whose performance is due last, is entitled to exercise the defense of non-performance.

[30] According to the Restatement (Second) of Contracts §234, when performances are due simultaneously, the tender of one party's performance is required for a demand of counter-performance (i.e., each duty of performance is constructively conditioned on tender of the other). Therefore, no counter-performance is due unless the first obligation is duly performed or tendered. See also, Perillo (2003), p. 424-429; Corbin (1999), § 35.6. Hence a party that is in breach cannot strategically invoke a defense of non-performance against his breaching counterpart to avoid being found in breach, simply because he should show his readiness to perform prior to demanding performance and putting the other party in default.

alternative uses (V_i).[31] Parties do not know ex ante the redeployment value V_i and the estimate of this value will depend on the fungible nature of the performance (e.g., contract-specificity of the performance investment and the ability to redeploy the performance towards alternative uses). Analytically, we assume that redeployment value is distributed according to a distribution function $F(V_i)$ and an associated density function $f(V_i)$. Party *i* will exercise the defense of non-performance only when the redeployment value is higher than the cost savings h_i associated with the decision of non-performing. The defense of non-performance is exercised with probability α_i, where $\alpha_i = 1 - F(h_i)$ and provides an expected benefit V_i^e, where $V_i^e = \int_{h_i}^{\infty} V_i f(V_i) dV_i$.

Payoffs will be modified accordingly. In the case of unilateral breach the non-breaching party, for example party 1, is entitled to expectation damages D_1^U and the expected benefit associated with the defense of non-performance, V_1^e. Likewise, in the event of his own breach, party 1 would be liable to compensate party 2 D_2^U for party 2's loss net of the reduction in damages when party 2 exercises the defense of non-performance (with probability α_2) and $\underline{G}_1$, the counter-performance value when party 2 performs (with probability $(1-\alpha_2)$). In the event of his own unilateral breach, party 1 will therefore receive a payoff equal to $-D_2^U + \alpha_2 h_2 + (1-\alpha_2)\underline{G}_1$.

In the following three subsections, we examine the role of the defense of non-performance in correcting the contract imperfections discussed in Section 2.

3.1.1 Insolvency

The defense of non-performance plays an important role in correcting the distortions created by insolvency in contract relationships. In the face of a contractual breach, the defense of non-performance gives the breachee the opportunity to limit his loss by withholding performance and redeploying it toward alternative uses. Given the breachor's insolvency, losses are only partially recoverable, and reducing the amount that needs to be collected through litigation by means of the defense of non-performance effectively reduces the non-breaching party's exposure. The presence of insolvency therefore increases the likelihood that the defense of non-performance is used. With an increase in the degree of insolvency, the defense becomes increasingly more appealing.

More generally, a breachee may find it convenient to exercise the defense of non-performance according to the degree of insolvency of his breachor. Interestingly, due to insolvency the non-breaching party may exercise the defense of non-performance even when the redeployment value V_i falls below the reduction of damages h_i. This would be a case of inefficient redeployment undertaken by a non-breaching party in order to reduce

[31] We assume that redeployment is not possible when breach materializes. The breach probability $(1-p)$ hence includes only situations in which a party fails in his or her efforts and is not ready to deliver the contractual performance.

his losses, in the presence of an insolvent counterpart.[32] Analytically, the breachee will choose to redeploy for a larger range of redeployment values (up to a threshold $\underline{v}_1 < h_1$ such that the loss due to insolvency is, at least partially, recovered through the redeployment).[33] When the defense of non-performance is exercised, the insolvent breachor will pay the expected reduced damages only when his wealth a_1 is higher than the reduced damages $G_2^e - h_2$, otherwise he will pay damages up to his wealth a_1.[34]

In the case of unilateral insolvency of party 1, the objective function of party 1 will be modified in order to take into account limited liability and the defense of non-performance:

$$\begin{aligned}\max_{e_1, r_1} \quad & p_1 p_2 \overline{G}_1(r_1) + p_1(1-p_2)\left[D_1^U(r_1) + V_1^e\right] \\ & + (1-p_1)\, p_2\, [-a_1 + \alpha_2 \max\left[0, a_1 - \left(G_2^e - h_2\right)\right] + \left(1-\alpha_2\right)\underline{G}_1(r_1)] \quad (19) \\ & + (1-p_1)(1-p_2)[-a_1 + D_1^B(r_1)] - e_1 - r_1\end{aligned}$$

Condition (7) for the privately optimal effort of party 1, under bilateral expectations damages identified in Proposition 1, becomes:

$$p_1'\left[a_1 + p_2\left(\overline{G}_1 - \underline{G}_1\right) + \left(1-p_2\right)V_1^e + p_2\alpha_2\left(\underline{G}_1 - \max\left[0, a_1 - \left(G_2^e - h_2\right)\right]\right)\right] = 1 \quad (20)$$

A symmetric condition holds in case of insolvency of party 2.

Proposition 6. *In bilateral contracts, the defense of non-performance corrects the distortions caused by unilateral and bilateral insolvency.*
Proof: See Appendix

When a breachor is not sufficiently solvent to cover damages and when the performance is redeployable, the breachee will likely invoke the defense of non-performance. This reduces the extent of the uncompensated harm for the breachee. Further, the insolvent party knows that in the event of his own breach he would likely lose the surplus from the contractual counter-performance and will thus increase his effort to avoid such loss. These two effects counterbalance the dilution of incentives caused by unilateral or bilateral insolvency,

[32] The threat to withhold performance in case of unilateral breach provides the non-breaching party with an additional leverage that may induce higher performance efforts, hence correcting the dilution of incentives caused by insolvency. In the absence of insolvency, however, the defense of non-performance may lead to excessive performance efforts. This problem could be avoided by allowing each party to avoid the defense and force the counter-performance by issuing a bond with a face value equal to the expectation damages payable in case of unilateral breach. This would limit the use of the defense of non-performance to cases of actual insolvency, avoiding distortion of incentives.

[33] The threshold value $\underline{v}_1$ is set such that $G_1^e - a_2 = \int_{\underline{v}_1}^{h_1} v_1 f\left(v_1\right) dv_1$. The defense of non-performance will be exercised with probability $\alpha_2 = 1 - F\left(\underline{v}_2\right)$

[34] Analytically, the payoff is written such that party 1 always pays a_1, and receives the reduction in damages with probability α_2 only if his wealth is sufficiently high, in case $a_1 > G_2^e - h_2$, otherwise he gets no reduction, i.e. $-a_1 + \alpha_2 \max\left[0, a_1 - \left(G_2^e - h_2\right)\right]$

rendering the defense of non-performance an effective remedy to create optimal incentives in contractual relationships between potentially insolvent parties.[35]

3.1.2 Litigation Costs

The defense of non-performance does not generally eliminate the need for litigation for the parties. The breachee who exercises the defense is in fact entitled to receive (reduced) damages from his breachor and will likely need to resort to litigation to collect such damages. In the presence of litigation costs, a bilateral contract with a defense of non-performance poses the following private problem for party 1:

$$\begin{aligned}\max_{e_1,\, r_1} \quad & p_1 p_2 \overline{G}_1 + p_1(1-p_2)[(1-c) D_1^U + V_1^e] \\ & + (1-p_1) p_2 [-(1+c)(D_2^U - \alpha_2 h_2) + (1-\alpha_2)\underline{G}_1] \\ & + (1-p_1)(1-p_2)[-(1+c) D_2^B + (1-c) D_1^B] - e_1 - r_1\end{aligned} \tag{21}$$

The first order condition with respect to e_1, under bilateral expectation damages, for a social optimum becomes:

$$p_1'[(1+c) G_2^e + p_2(\overline{G}_1 - \underline{G}_1) + (1-p_2) V_1^e + p_2 \alpha_2 \underline{G}_1 - p_2 \alpha_2 (1+c) h_2] = 1 \tag{22}$$

Proposition 7. *In bilateral contracts, the defense of non-performance has an undetermined effect on the distortion caused by litigation costs under the American and English rules.*
Proof: See Appendix

The indeterminate effect of the defense of non-performance on the parties' efforts in the presence of litigation costs is due to the existence of two countervailing effects.

The first effect is due to the fact that, by performing, the non-breaching party eliminates the other party's defense of non-performance, hence protecting his right to demand the sought-after contractual benefit. This additional benefit of performance leads to an increase in performance efforts. The second effect of the defense of non-performance is due to the mitigation of the distortion created by litigation costs. By reducing the amount of payable damages, the defense of non-performance reduces the "tax" that litigation imposes on the parties in the event of breach, rendering the breach-litigation outcome less undesirable than otherwise. This leads to a reduction in performance incentives. As shown in the Appendix, this effect applies to both American-type and English-type systems. These two effects entirely offset one another in the special case where the litigation costs equal the surplus that was obtainable through the contractual performance.

3.1.3 Court Errors on Damages

Under the assumption of damages liquidated according to (17), in the presence of the defense of non-performance, first order condition with respect to e_1 becomes:

[35] In case of unilateral insolvency, the solvent party's incentives to exert effort are inefficiently high, given the other party's effort. However, since privately optimal efforts are strategically interdependent, a higher effort level for the solvent party may have second-order effects that correct the distortion for the insolvent party in presence of a sufficiently high level of strategic interdependence.

$$p_1'\left[G_2^e + k_2 + p_2\left(\overline{G}_1 - \underline{G}_1\right) + (1-p_2)V_1^e + p_2\alpha_2\left(\underline{G}_1 - h_2\right)\right] = 1 \qquad (23)$$

Proposition 8 *In bilateral contracts, the defense of non-performance corrects the distortion caused by undercompensation.*

Corollary*: The defense of non-performance exacerbates the distortion caused by overcompensation.*
Proof: See Appendix

As shown in Section 2.2.3, legal rules that limit the extent of compensable harm to objective value and to foreseeable losses dilute performance incentives. More generally, any undercompensation bias by courts and fact-finders will have the effect of lowering performance efforts. The defense of non-performance corrects this distortion. This is due to the fact that, under this rule, the parties have an additional incentive to avoid their own breach in order to ensure the surplus from the contractual counter-performance. This additional benefit of effort can be seen in the two extra terms which are present in condition (23) as compared to (18) under perfect expectation damages. The defense of non-performance would, however, become undesirable in the opposite situation in which courts are subject to systematic overcompensation errors.

3.2. Bilateral Breach and Preclusions

Bilateral contracts create bilateral obligations between parties. In most legal systems, when no time sequence is specified for fulfilling these obligations, either party can demand performance from the other by offering his own performance.[36] Parties' performances are seen as conditional on the other party's offer to perform. A successful action in contracts requires showing that the plaintiff would have been ready to perform but for the other party's breach.[37] Thus, when both parties are breaching, parties are barred from bringing an action against one another.[38]

Legal systems adopt different means to achieve this result. In some cases, an action brought by a breaching party is barred on substantive grounds: the right to demand performance presupposes readiness to provide counter-performance. A breaching party is by definition not ready to perform his obligation, and in these legal systems he has no rights against his breaching counterpart. Other systems reach similar results by creating procedural preclusions: a plaintiff is required to put his defendant in default (providing him

[36] In most cases, when the timing of the parties' performances is unspecified or when performances are due simultaneously, either party can demand performance from the other by offering or tendering his own performance. See e.g., Restatement (Second) of Contracts, § 238; UCC § 2-507. It is only when different periods are affixed within which each party is to perform that the counter-performance is construed as conditional and dependent on the performance of the other party. In all other situations where the same time is fixed for performance, or where time is fixed for one party and no time is fixed for the other; or where no time is fixed for the performance of either party, performances are presumed to be due simultaneously. In all such cases, either party can trigger performance from the other (after the specified period has elapsed, when a time was specified), by offering his own counter-performance. Restatement (Second) of Contracts, § 234.
[37] Perillo (2003), p. 430.
[38] *Malani v. Clapp,* 56 Haw. 507, 542 P.2d 1265 (1975).

with an opportunity to perform), prior to commencing an action in contracts. In bilateral contracts with mutually conditional obligations, a promisee who wishes to put his promisor in default is required to make a conditional offer or tender of his own performance: a promisee who is himself in breach cannot possibly make such an offer. Hence, similar to a "clean hand rule," a procedural preclusion prevents a breaching party to exercise an action in contracts against his breaching counterpart.

Whether substantive or procedural in nature, a preclusion rule implies that no action in contracts stands for a party who is unable or unwilling to offer his counter-performance. The effects of a preclusion rule differ from the application of a damage compensation rule. Compensation operates in situations in which money is owed by both parties and merely offsets (reducing *pro tanto*) the debt on each side, while a preclusion rule entirely extinguishes the right of action for both parties.

In the U.S., case law affirms the rule that a party who repudiates or defaults on his contractual obligations is not entitled to maintain an action on the contract. The rationale of this principle is best expressed in an 1824 leading case in which the Massachusetts Supreme Judicial Court barred the action of the defaulting plaintiff, stating "The law is indeed most reasonable in itself. … It requires [the plaintiff] to act justly by a faithful performance of his own engagements before he exacts the fulfillment of dependent obligations on the part of others."[39] This decision still reflects the weight of authority, although not without challenge.[40]

The effects of a preclusion rule on parties' incentives can be analyzed by assuming, in our basic model presented in Section 2, that no damages are due by either party in the event of bilateral breach: $D_1^B = 0$ and $D_2^B = 0$.[41] In the case of bilateral breach considered here, the preclusion rule offers the same options available at time four of the timeline of the general model, although with different payoffs. At time four, the breaching party will alternatively (a) face a bilateral breach and avoid liability due to the preclusion rule, or (b) obtain performance and become responsible for full expectation damages for unilateral breach.

[39] *Stark v. Parker*, 19 Mass. (2 Pick.) 267, 275 (1824)

[40] For discussions of the judicial treatment of claims brought by plaintiffs who were themselves in default, see A.D. (1949, p. 844); Lee (1966, p. 1023); Palmer (1978, § 5.13); and Perillo (2003, p. 445). In most jurisdictions, case law affirms the principle that no action in contracts stands for a party who repudiates or defaults on his contractual obligations. A party who is guilty of even a substantial or material default may still be allowed a remedy, however, but not one based on an action in contracts. The remedies available in these cases are often based on restitution, such as when the defaulting plaintiff provided partial performance and attempts to recover in quasi-contract for the benefits conferred upon the other party to the contract. Older case law denied an action of restitution in quasi-contracts, but more recent case law has granted recovery in quasi-contract, especially in situations where the plaintiff partially performed employment obligations. This evolution in case law is reflected in Restatement (Second) of Contracts § 388(1) which provides: "Restitution in Favor of Party in Breach. (1) … if a party justifiably refuses to perform on the ground that his remaining duties of performance have been discharged by the other party's breach, the party in breach is entitled to restitution for any benefit that he has conferred on the injured party by way of part performance or reliance."

[41] When remedies in quasi-contracts are available, the damages payable in the event of bilateral breach would not be equal to zero. For the purpose of analyzing the parties' incentives, all that matters is the size of the remedy rather than its doctrinal label. Although the remedy generally available in restitution may be less (or in some cases greater) than the remedy available in contracts, its availability is nevertheless capable of minimizing the distortions otherwise created by the preclusion rule.

3.2.1 Insolvency

We can study the effects of the preclusion rule in bilateral contracts affected by unilateral insolvency by substituting the parameter values for party 1 and 2 in condition (7). The following first order conditions hold respectively for the (insolvent) party 1 and (solvent) party 2:

$$p_1'(e_1)[a_1 + p_2\left(\overline{G}_1 - \underline{G}_1\right) + (1-p_2)(G_1^e - a_1)] = 1 \qquad (24)$$

$$p_2'(e_2)[G_1^e + p_1\left(\overline{G}_2 - \underline{G}_2\right) + (1-p_1)(a_1 - G_1^e)] = 1 \qquad (25)$$

In the case of bilateral insolvency, where $a_1 > a_2$, the following first order conditions hold respectively for parties 1 and 2:

$$p_1'(e_1)[a_1 + p_2\left(\overline{G}_1 - \underline{G}_1\right) + (1-p_2)(a_2 - a_1)] = 1 \qquad (26)$$

$$p_2'(e_2)[a_2 + p_1\left(\overline{G}_2 - \underline{G}_2\right) + (1-p_1)(a_1 - a_2)] = 1 \qquad (27)$$

Proposition 9. *In bilateral contracts with unilateral insolvency, the preclusion rule corrects the distortion of effort for the insolvent party.*

Corollary. *In bilateral contracts with bilateral insolvency, the preclusion rule corrects the distortion of effort for the relatively poorer party but exacerbates the distortion for the relatively wealthier party.*
Proof: See Appendix

The application of the preclusion rule to bilateral contracts creates asymmetric distortions on the parties, leading to the paradoxical result that the party that produces the higher value undertakes a suboptimal level of effort, while the party that produces something of lower value ends up undertaking more effort towards its production. This distortion can mitigate the dilution of incentives created by insolvency: in the case of unilateral insolvency, the preclusion rule may correct the dilution of incentives for the insolvent party when the insolvent party has the higher surplus from the contract. On the contrary, the preclusion rule may create a downward distortion for the solvent party, when such party is also appropriating the higher surplus from the contract. This is due to the fact that a preclusion rule leads the parties to consider their foregone gain, rather than the other party's foregone benefit (a rule of bilateral expectation damages would instead lead them to take into account the other party's foregone benefit from the bargain). Under a preclusion rule, an insolvent party (say, party 1) who is in breach would therefore lose the expected value of the counter-performance G_1^e. This is a treat that offsets the dilution of incentives caused by the insolvency. In case of bilateral insolvency, if $a_1 > a_2$, the preclusion rule improves the (otherwise diluted) incentives for the relatively poorer party 2, although it may exacerbate the distortion for the relatively wealthier party 1.

3.2.2 Litigation Costs

Under a preclusion rule, a breachor is precluded from obtaining any compensation from his counterpart who is also in breach. Hence, when the contracting parties find themselves in a situation of bilateral breach, they will generally choose not to litigate, avoiding litigation costs. With a preclusion rule and litigation costs, the private problem for party 1 becomes:

$$\begin{aligned}\max_{e_1,\, r_1}\ & p_1 p_2 \overline{G}_1 + p_1(1-p_2)(1-c)D_1^U \\ & + (1-p_1)p_2[-(1+c)D_2^U + \underline{G}_1]\end{aligned} \tag{28}$$

The first order condition with respect to e_1, under bilateral expectation damages and preclusion rule, becomes:

$$\begin{aligned}p_1'[&(1+c)G_2^e + p_2\left(\overline{G}_1 - \underline{G}_1\right) + (1-p_2)\left(G_1^e - G_2^e\right) \\ &-(1-p_2)\left(G_1^e + G_2^e\right)c] = 1\end{aligned} \tag{29}$$

Proposition 10. *In bilateral contracts with symmetric contract surplus, the preclusion rule corrects the inefficiently high effort incentives created by litigation costs under the American and English rules for both parties.*

Corollary. *When the contract surplus is asymmetrical, the effort incentives induced by litigation costs under the American and English rules are corrected for the party with lower surplus but are exacerbated for the other party.*
Proof: See Appendix

The preclusion rule becomes an effective instrument for the creation of optimal effort incentives in the presence of litigation costs. This is because, with a preclusion rule, the parties avoid litigation in the event of a bilateral breach. Following our analogy of litigation costs to a tax, the preclusion avoids the imposition of the litigation tax in cases of bilateral breach, hence reducing the distortion created by litigation costs under both American-type and English-type systems.

3.2.3 Court Errors on Damages

Under the assumption of damages liquidated according to (17), the preclusion rule yields a first order condition with respect to e_1 equal to:

$$p_1'[G_2^e + k_2 + p_2\left(\overline{G}_1 - \underline{G}_1\right) + (1-p_2)\left(G_1^e - G_2^e\right) + (1-p_2)\left(k_1 - k_2\right)] = 1 \tag{30}$$

Proposition 11. *The preclusion rule has no effect on the parties' incentives when the parties have symmetrical surpluses and are subject to the same court errors.*

Corollary. *When the parties have asymmetrical surpluses and face different court errors, the preclusion rule has mixed effects on the parties' incentives depending on the relative size of the contractual surplus and the relative size of the court errors.*
Proof: See Appendix

A standard rule of expectation damages would lead party 1 to take into account the other party's benefit from the bargain, $D_2^B = G_2^e$. However, in the event of a bilateral breach, a preclusion rule leads party 1 to consider his foregone gain G_1^e. Consider two parties with asymmetric contract surplus, for example $G_1^e > G_2^e$, facing the same court errors $|k_1| = |k_2|$. The preclusion rule corrects the distortion for the party with higher surplus and exacerbates the distortion for the other party. The intuition lies in the previous observation: the preclusion rule induces the party to take into account his own foregone gain and so it induces an increase in effort for the party that faces the higher preclusion loss in the case of a bilateral breach. On the other hand, consider two parties having the same contract surplus, $G_1^e = G_2^e$, but facing an asymmetrical court bias $|k_1| > |k_2|$. In this case, the preclusion rule corrects the distortion induced by the court's undercompensation error for the party that faces the smaller court error, but exacerbates the distortion for the other party.

4. Extensions

In the following we consider two extensions that take into consideration some features of real life contracting. In the first extension, we consider the effects of ex post renegotiation on ex ante incentives. Renegotiation may be particularly relevant when through a defense of non-performance, a contracting party withholds performance from another party who still has an interest in it. With renegotiation, the breaching party may still obtain the sought-after performance. In Subsection 4.1 we will consider the extent to which the opportunity of ex post renegotiation would dilute the incentive effects of the defense of non-performance. In the second extension, we consider situations of bilateral contracts where the parties' performances are due at different times. Unlike the general case where performances are capable of being performed simultaneously, when performances are due sequentially, the defense of non-performance is only available to the party whose performance is due last. In Subsection 4.2 we extend our analysis to take into account the possibility of sequential performances in bilateral contracts, to verify the robustness of our results to the presence of sequential performances.

4.1 The Effects of Renegotiation

The previous analysis followed the conventional setup of the contract breach problem in the law and economics literature. In this analysis, we assumed that parties did not have an opportunity to renegotiate. As discussed in Section 3.1, when a party exercises the defense of non-performance, valuable contractual surplus may be forfeited. Further, by withholding performance and redeploying it elsewhere, resources may be utilized for suboptimal uses. In this subsection, we allow the parties the opportunity to renegotiate in the presence of a defense of non-performance to correct for possible inefficient allocations.[42] If the original contracting party, say party 2, was the most valuable user of

[42] In a bilateral breach case, the preclusion rule excludes the application of breach remedies, practically eliminating the effect of the contract between the parties. Parties may still have an interest in the exchange, but they would need to enter into a new contract, rather than renegotiating their old contract.

party 1's performance, the defense creates a potential loss: the non-breaching party (party 1) is ready to perform but is withholding performance from the other party, who would otherwise still be interested in receiving it. Analytically, this means $\underline{G}_2 > V_1$. In these situations, parties may capture the surplus $\underline{G}_2 - V_1$ by renegotiating for performance.[43] Party 2 can offer a share s_1 of total surplus to party 1, inducing him to perform his side of the contract,[44] with an additional benefit from renegotiation equal to $s_1\left[\underline{G}_2 - V_1\right]$.[45] In the following, we study the effect of this renegotiation opportunity on the parties' ex ante incentives.

When renegotiation is possible, in the absence of contract imperfections, the objective function of party 1 becomes:

$$\begin{aligned}\max_{e_1, r_1} \quad & p_1 p_2 \overline{G}_1 + p_1(1-p_2)\left[D_1^U + \alpha_1\left[V_1 + s_1\left(\underline{G}_2 - V_1\right)\right]\right] \\ & + (1-p_1)\, p_2\, [-D_2^U + \alpha_2\left(1-s_2\right)\left(\underline{G}_1 - V_2\right) + \left(1-\alpha_2\right)\underline{G}_1] \\ & + (1-p_1)(1-p_2)[-D_2^B + D_1^B] - e_1 - r_1\end{aligned} \qquad (31)$$

First order condition for privately optimal effort of party 1 is:

$$p_1'\begin{bmatrix} G_2^e + p_2\left(\overline{G}_1 - \underline{G}_1\right) + (1-p_2)\alpha_1\left(V_1 + s_1(\underline{G}_2 - V_1)\right) \\ + p_2\alpha_2\,\underline{G}_1 - p_2\alpha_2\left(1-s_2\right)(\underline{G}_1 - V_2) \end{bmatrix} = 1 \qquad (32)$$

Proposition 12. *Renegotiation opportunities strengthen the effects of the defense of non-performance when the non-breaching party has a sufficiently high bargaining power.*

Corollary. *In the opposite case when the breaching party has stronger bargaining power, renegotiation opportunities dilute the effects of the defense of non-performance.*
Proof: See Appendix

The effects of renegotiation on ex ante incentives depend upon the parties' bargaining power and ability to appropriate the renegotiation surplus.[46] When the non-breaching party has a stronger bargaining power ($s_1 > \bar{s}_1$), the defense of non-performance would provide an even stronger leverage to correct the contract imperfections discussed in Section 2 and may induce optimal levels of effort. Renegotiation opportunities may instead reduce the effectiveness of the defense of non-performance when the breaching party has stronger

[43] Without loss of generality, we assume that rational renegotiation will take place with probability 1 when $\underline{G}_2 > V_1$ and V_1 is known.

[44] For the purpose of this analysis we assume away the use of strategic threats of inefficient breach considered by Bar-Gill and Ben-Shahar (2004) and concentrate on parties' renegotiation pending a non-strategic defense of non-performance.

[45] A symmetric renegotiation opportunity occurs in case of party 1's unilateral breach. We model asymmetric bargaining power, where s_2 is the share of surplus appropriated by party 2.

[46] Renegotiation mitigates the distortion of the defense of non-performance if party 1's bargaining power is below a threshold value $\bar{s}_1$, defined in the Appendix.

bargaining power. At the limit, when the breaching party has full bargaining power ($s_1 < \overline{s_1}$), the defense of non-performance would lose its effectiveness, since it would represent an empty treat by the non-breaching party.

The fact that the ability of the defense of non-performance in correcting contract imperfections may be strengthened or diluted by renegotiation opportunities poses a relevant policy question, as to whether courts should encourage or require renegotiation prior to allowing the defense of non-performance. Our analysis may shed light on this question, unveiling the tradeoff between the benefits of renegotiation in correcting misallocations of performance and the possible effects of renegotiation in the presence of contract imperfections.

4.2 Sequential Performances

In the U.S., when the parties' obligations are capable of being performed simultaneously, the defense of non-performance can be invoked by both contracting parties. When performances are due at different times, the defense of non-performance is only available to the party whose performance is due last. This is because when performances are due at different times, the performance, or tender of performance, of one party is not needed for putting the other in default.[47] In this case, a breachee who is unable to perform could invoke the defense of non-performance to avoid the consequences of his breach, when his performance is due last.

In this subsection, we extend the analysis presented in Section 3 to take into account the possibility of sequential performances in bilateral contracts. Consider a contract that requires parties to perform at different times where the defense of non-performance is available only to the party required to perform last. Assume that in a bilateral contract, party 1's performance is due before party 2's performance. The timeline of the contract is as follows: (1) at time 0 parties sign a bilateral contract, (2) at time 1 party 1 chooses e_1 and r_1 and party 2 e_2 and r_2, (3) at time 2 state of nature on party 1's ability to perform is observed (4) at time 3 party 1 either performs or does not perform according to the realization of $p(e_1)$, (5) at time 4 state of nature on party 2's ability to perform is realized, (6) at time 5 party 2 decides whether to exercise the defense of non-performance, (7) at time 6 parties eventually sue for damages. The defense of non-performance can only be exercised by party 2, who can observe party 1's breach before his performance is due.

The first-order conditions for the privately optimal effort of party 1 and 2 become, respectively:

$$p_1'\left[G_2^e + p_2\left(\overline{G}_1 - \underline{G}_1\right) + p_2\alpha_2\left(\underline{G}_1 - h_2\right)\right] = 1 \qquad (33)$$

$$p_2'\left[G_1^e + p_1\left(\overline{G}_2 - \underline{G}_2\right) + \left(1 - p_1\right)V_2^e\right] = 1 \qquad (34)$$

[47] When performances are not capable of being simultaneous, the duty of performance for the party whose performance is due first cannot be constructively conditioned on tender of the other. In the case considered under Restatement (Second) of Contracts § 234, where different periods are affixed within which each party is to perform, the default rule of simultaneous performance does not apply, and the defense of non-performance is only available for the party whose performance is due last.

Proposition 13. *In bilateral contracts with sequential performances, the defense of non-performance has qualitatively similar effects to the case with sequential performances for both parties.*
Proof: See Appendix

The effects of the defense of non-performance derived in Section 3.1 are robust to the presence of sequential performances, where the defense is available only to the party whose performance is due last. Interestingly, even though in the sequential case the defense is only available to one party, the effects of the defense of non-performance are present for both parties, inducing both parties to invest in higher effort. In the presence of the contract imperfections studied in Section 3, a unilateral defense of non-performance corrects the incentives in a qualitatively similar way to the case where the defense is available to both parties. Effort incentives are clearly improved in the case of insolvency and under-compensation, while the effect remains undetermined in the presence of legal costs. The correction of incentives is weaker, but still present for the party whose performance is due last. This is because the party whose performance is due first has no opportunity to withhold performance in case of breach by the other party.

These results have several practical implications. For example, our results suggest that when the parties face a problem of bilateral insolvency, it is preferable to specify that the performances are due simultaneously, in order to give a defense of non-performance to both parties. When the parties' obligations are not capable of being performed simultaneously, it is desirable to specify the timing of performance and counter-performance in such a way as to give the solvent (or less insolvent) party a defense of non-performance against his counterpart. Similarly, in case of under-compensation errors that affect one contracting party, incentives may be realigned by making the party who faces the under-compensation error perform last. The inverse sequence of performances could instead be used to correct overcompensation errors. These implications could further be checked empirically to see whether they are consistent with current contractual practice.

5. Conclusions

Bilateral contracts and the legal remedies that govern bilateral contracts provide valuable enforcement mechanisms that are not available when parties enter into separate unilateral contracts. In this paper, we have extended the standard contract model and have shown that bilateral contracts have two important advantages compared to unilateral contracts. First, when the values of the parties' performances are interdependent, bilateral contracts create effort incentives that are superior to those created by unilateral contracts. Second, bilateral contracts offer a valuable instrument for correcting imperfections in the contract enforcement, such as potential insolvency of one or both parties, litigation costs and court errors.

The superiority of bilateral contracts in the presence of imperfections hinges upon the specific remedies that apply to bilateral contracts, such as the defense of non-performance under Restatement (Second) of Contracts and preclusion rules used in cases of bilateral breach. We have shown that these remedies correct the distortion of incentives created by imperfections in the contract enforcement. We have further shown that

renegotiation may strengthen or undermine the effectiveness of bilateral remedies in correcting contract imperfections, depending on the allocation of bargaining power between the contracting parties. These results may shed some light on the ongoing European debate on the inclusion of a general defense of non-performance in the common frame of reference for the unification of European contract law. We have finally shown that the results derived for the defense of non-performance are robust to the presence of sequential performances, where the defense of non-performance is made available only to the party whose performance is due last.

Further analysis, empirical and comparative, would be desirable in order to understand to what extent the identified features of bilateral contract remedies affect contractual practice. Given that it is often possible to disentangle a bilateral contract relationship into two separate unilateral arrangements, when we see contracts creating reciprocal performance obligations we should ask why the parties chose such an arrangement. Our analysis suggests that bilateral contracts are more frequently entered into when the contract is affected by potential insolvency, costly litigation and imperfect adjudication. The peculiar features of bilateral contract remedies could in fact be used instrumentally by contracting parties to cope with potential enforcement problems. There are several other testable propositions that follow from our analysis. For example, our analysis suggests that these joint agreements should be more common in industries where legal enforcement is imperfect (e.g., situations where courts are likely to underestimate the actual value of performance or to reduce liquidated damage amounts). Likewise, we should observe an instrumental use of bilateral contracts remedies to correct for other imperfections in contractual regimes and relationships (e.g., when the value of the contract is high relative to the wealth of the parties). There are also relevant theoretical extensions worthy of consideration. For example, it would be interesting to extend the analysis to consider contracts where the parties' efforts affect the quality, as well as the probability, of performance, and where partial performance becomes possible. Likewise, in reality parties often lack complete information on the actual distribution of contractual surplus between themselves. A promisee knows how much he values the sough-after performance but is likely to have incomplete information on the other party's expected gain. In future extensions, it would be interesting to verify under which circumstances incomplete information could affect the results identified in our analysis.

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Mathematical Appendix

In the following proofs we denote a bilateral contract with interdependent values as case 1 (denoted as C1) and one with independent values as case 2 (denoted as C2).

Proof of Proposition 1. C1: Straightforward from the comparison of conditions (2) and (7). C2: Straightforward from the comparison of conditions (2) and (7) when $\overline{G}_2 = \underline{G}_2 = G_2$.

Proof of Proposition 2. Conditions (9) and (10) guarantee socially optimal effort for parties 1 and 2. Suppose parties negotiate two separate unilateral contracts. The objective functions for party 1 are:

$$\max_{r_1} \; p_2(e_2)G_2(r_1) + \left(1 - p_2(e_2)\right)D_1^U(r_1) - r_1 \qquad (35)$$

$$\min_{e_1} \left(1 - p_1(e_1)\right)\left(-D_2^U(r_2)\right) - e_1 \qquad (36)$$

A symmetrical problem holds for party 2. Regarding privately optimal effort, OCs for parties 1 and 2 are:

$$p_1'(e_1)D_2^U = 1 \qquad (37)$$

$$p_2'(e_2)D_1^U = 1 \qquad (38)$$

Under conditions (9) and (10): $e_i^{*U} \le e_i^{*B}, i = 1,2$, since the LHS in (37) and (38) is increasing in e_i, where e_i^{*U} and e_i^{*B} denotes the privately optimal effort respectively in a unilateral and bilateral contract for party $i, i = 1,2$.

Proof of Corollary of Proposition 2. Conditions (9) and (10) reduce to (35) and (36) when $\overline{G}_1 = \underline{G}_1 = G_1$ and $\overline{G}_2 = \underline{G}_2 = G_2$, implying $e_i^{*U} = e_i^{*B}, i = 1,2$

Proof of Proposition 3. C1: In case of party 1's insolvency: $a_1 < G_2^e$. Straightforward from the comparison of condition (2) and (13), since LHS in (13) is increasing in e_1 .Condition (7) for party 2 – under conditions (9) and (10) is unchanged, as the incentives to provide a socially efficient effort level.

C2: Straightforward from the comparison of conditions (2) and (13) when $\overline{G}_1 = \underline{G}_1 = G_1$.

Proof of Corrolary of Proposition 3. C1: In case of bilateral insolvency: $a_1 < G_2^e$ and $a_2 < G_1^e$. See proof of Proposition 3 for party 1. Straightforward from the comparison of conditions (3) and (14) for party 2, since LHS in (14) is increasing in e_2.

C2: Straightforward from the comparison of conditions (2) and (13) for party 1 and (3) and (14) for party 2 when $\overline{G}_1 = \underline{G}_1 = G_1$ and $\overline{G}_2 = \underline{G}_2 = G_2$.

Proof of Proposition 4. C1: Straightforward from the comparison of (2) and (16), since LHS in (16) contains a positive term, equal to $p_1^{'} c G_2^e$ and is increasing in e_1. C2: Straightforward from the comparison of (2) and (16) when $\overline{G}_1 = \underline{G}_1 = G_1$. Symmetric proof applies to party 2.

Proof of Corollary of Proposition 4. In presence of the English rule, the objective function of party 1 is:

$$\begin{aligned}\max_{e_1, r_1} \quad & p_1(e_1)\, p_2(e_2)\, \overline{G}_1(r_1) + p_1(e_1)(1 - p_2(e_2)) D_1^U(r_1) \\ & + (1 - p_1(e_1))\, p_2(e_2)\, [-(1+c) D_2^U(r_2) + \underline{G}_1(r_1)] \\ & + (1 - p_1(e_1))(1 - p_2(e_2))[-(1+c) D_2^B(r_2) + D_1^B(r_1)] \\ & - e_1 - r_1\end{aligned} \tag{39}$$

The first order condition for privately optimal effort of party 1 coincides with equation (16). Same proof of Proposition 4 applies.

Proof of Proposition 5. C1: Straightforward from the comparison of (2) and (18), since LHS in (18) is increasing in e_1 , under $k_2 < 0$. C2: Same proof as in C1 under $\overline{G}_1 = \underline{G}_1 = G_1$. Symmetric proof applies to party 2.

Proof of Corollary of Proposition 5. Same proof of Proposition 5 when $k_2 > 0$.

Proof of Proposition 6. C1: In case of party 1's insolvency: $a_1 < G_2^e$. Straightforward from the comparison of condition (13) and (20), since the LHS in (20) is increasing in e_1. In case of bilateral insolvency: $a_1 < G_2^e$ and $a_2 < G_1^e$. Condition holds for party 1 and the following condition for privately optimal effort of party 2:

$$p_2' \left[a_2 + p_1 \left(\overline{G}_2 - \underline{G}_2 \right) + (1 - p_1) V_2^e + p_1 \alpha_1 \left(\underline{G}_2 - \max\left[0, a_2 - \left(G_1^e - h_1 \right) \right] \right) \right] = 1 \tag{40}$$

Straightforward from the comparison of conditions (14) and (40) for party 2, since LHS in (40) is increasing in e_2.

C2: Straightforward from the comparison of conditions (13) and (20) for party 1 and (14) and (40) for party 2 when $\overline{G}_1 = \underline{G}_1 = G_1$ and $\overline{G}_2 = \underline{G}_2 = G_2$.

Proof of Proposition 7. C1: The effect is indeterminate from the comparison of (16) and (22), since the LHS in (22) contains two additional positive terms $(1 - p_2) V_1^e + p_2 \alpha_2 \underline{G}_1$ and a negative term equal to $-p_2 \alpha_2 (1+c) h_2$ and LHS in (22) is increasing in e_1. C2: Same analysis applies when $\overline{G}_1 = \underline{G}_1 = G_1$. Symmetric proof applies to party 2.

In the case of an English rule, the first order condition for privately optimal effort of party 1 coincides with equation (22), hence same proof applies.

Proof of Proposition 8. C1: Straightforward from the comparison of (18) and (23), since LHS in (18) is increasing in e_1 , under $k_2 < 0$. C2: Same proof as in C1 under $\overline{G}_1 = \underline{G}_1 = G_1$. Symmetric proof applies to party 2.

Proof of Corollary of Proposition 8. Same proof of Proposition 8 when $k_2 > 0$.

Proof of Proposition 9. C1: Straightforward from the comparison of (13) and (24) since the LHS in (24) is increasing in e_1 for party 1. Straightforward from the comparison of (3) and (25), since the LHS in (25) is increasing in e_2. C2: Same proof as in C1 under $\overline{G}_1 = \underline{G}_1 = G_1$ and $\overline{G}_2 = \underline{G}_2 = G_2$

Proof of Corollary of Proposition 9. C1: Assume $a_1 > a_2$. Straightforward from the comparison of (13) and (26) since the LHS in (26) is increasing in e_1 for party 1. Straightforward from the comparison of (14) and (27), since the LHS in (27) is increasing in e_2. C2: Same proof as in C1 under $\overline{G}_1 = \underline{G}_1 = G_1$ and $\overline{G}_2 = \underline{G}_2 = G_2$

Proof of Proposition 10. C1: Assume $G_1^e = G_2^e$. Condition (29) simplifies to:

$$p_1'[(1+c)G_2^e + p_2\left(\overline{G}_1 - \underline{G}_1\right) - (1-p_2)\left(G_1^e + G_2^e\right)c] = 1 \qquad (41)$$

Straightforward from the comparison of (16) and (41), since the LHS in (41) is increasing in e_1. Symmetric proof applies to party 2.

In case of an English rule, the private problem for party 1 becomes:

$$\max_{e_1,\, r_1} \; p_1 p_2 \overline{G}_1 + p_1(1-p_2)D_1^U + (1-p_1)p_2[-(1+c)D_2^U + \underline{G}_1] \qquad (42)$$

The first order condition with respect to e_1, under bilateral expectation damages and preclusion rule, becomes:

$$p_1'[(1+c)G_2^e + p_2\left(\overline{G}_1 - \underline{G}_1\right) + (1-p_2)\left(G_1^e - G_2^e\right) - (1-p_2)cG_2^e] = 1 \qquad (43)$$

Under the assumption of $G_1^e = G_2^e$, (43) simplifies to:

$$p_1'[(1+c)G_2^e + p_2\left(\overline{G}_1 - \underline{G}_1\right) - (1-p_2)cG_2^e] = 1 \qquad (44)$$

Straightforward from the comparison of (16) and (44), since the LHS in (44) is increasing in e_1. Symmetric proof applies to party 2.

Proof of Corollary of Proposition 10. Assume $G_1^e < G_2^e$. Straightforward from the comparison of (16) and (29), since the LHS in (29) is increasing in e_1. C2: Same proof as in C1 under $\overline{G}_1 = \underline{G}_1 = G_1$. Symmetric proof applies to party 2. Analogous analysis applies to equation (43) in case of an English rule.

Proof of Proposition 11. C1: Assume $G_1^e = G_2^e$. Condition (30) simplifies to:

$$p_1'[G_2^e + k_2 + p_2\left(\overline{G}_1 - \underline{G}_1\right) + (1-p_2)\left(k_1 - k_2\right)] = 1 \qquad (45)$$

Straightforward from the comparison of (18) and (45), since the LHS in (45) is increasing in e_1. Assume $G_1^e > G_2^e$ and $k_1 = k_2$. Condition (30) simplifies to:

$$p_1'[G_2^e + k_2 + p_2\left(\overline{G}_1 - \underline{G}_1\right) + (1-p_2)\left(G_1^e - G_2^e\right)] = 1 \qquad (46)$$

Straightforward from the comparison of (18) and (46), since the LHS in (46) is increasing in e_1. C2: Same proof as in C1 under $\overline{G}_1 = \underline{G}_1 = G_1$. Symmetric proof applies to party 2.

Proof of Proposition 12. C1: In absence of any contract imperfections, first order condition for privately optimal effort of party 1 in presence of a defense of non-performance is:

$$p_1'\left[G_2^e + p_2\left(\overline{G}_1 - \underline{G}_1\right) + (1-p_2)V_1^e + p_2\alpha_2\left(\underline{G}_1 - h_2\right)\right] = 1 \qquad (47)$$

From the comparison of conditions (32) and (47), the LHS in (32) is higher than the LHS in (47) when the following condition is satisfied:

$$(1-p_2)\alpha_1 s_1\left(\underline{G}_2 - V_1\right) - p_2\alpha_2\left(1-s_2\right)\left(\underline{G}_1 - V_2\right) > -p_2\alpha_2 h_2 \qquad (48)$$

This condition is satisfied for $s_1 = s_2 = 1$, while it is never met for $s_1 = s_2 = 0$ when $\underline{G}_1 - V_2 > h_2$, according to which the gain from renegotiation of the breachor should be higher than the reduction in damages he got when the breachee exercises the defense of non-performance. There exists a threshold value of $\underline{s}_1$, such that the LHS in (32) is higher than the LHS in (47) when $s_1 \geq \bar{s}_1$, where $\bar{s}_1 = \frac{p_2}{1-p_2}\frac{\alpha_2}{\alpha_1}\frac{(1-s_2)(\underline{G}_1 - V_2) - h_2}{\underline{G}_2 - V_1}$. C2: Same proof as in C1 under $\overline{G}_1 = \underline{G}_1 = G_1$. Symmetric proof applies to party 2.

Proof of Corollary to Proposition 12. Straightforward when $s_1 < \bar{s}_1$

Proof of Proposition 13. C1: Straightforward from comparison of conditions (33) and (34) with (2) and (3) respectively. C2: Same proof as in C1 under $\overline{G}_1 = \underline{G}_1 = G_1$ and $\overline{G}_2 = \underline{G}_2 = G_2$