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## Standard Breach Remedies, Quality Thresholds, and Cooperative Investments

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# BONN ECON DISCUSSION PAPERS

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## Standard Breach Remedies, Quality Thresholds, and Cooperative Investments

by

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December 2008



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# Standard Breach Remedies, Quality Thresholds, and Cooperative Investments

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December 5, 2008

## Abstract

When investments are non-verifiable, inducing cooperative investments with simple contracts may not be as difficult as previously thought. Indeed, modeling “expectation damages” close to legal practice, we show that the default remedy of contract law induces the first best. Yet, in order to lower informational requirements of courts, parties may opt for a "specific performance" regime which grants the breached-against buyer an option to choose "restitution" if the tender's value falls below some (arbitrarily chosen) quality threshold. In order to implement this regime, no more information needs to be verifiable than is implicitly assumed in Che and Hausch (1999).

*Keywords:* breach remedies, incomplete contracts, cooperative investments.

*JEL-Classification:* K12, L22, J41, C70

## 1 Introduction

When parties in bilateral trade make relationship-specific investments which have little value to third parties, markets do not protect them against opportunistic expropriation by their trading partner. This is when contracts are potentially useful. Yet, if we assume

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that contracts are inherently incomplete, they might not offer enough protection. As a result, the danger of hold-up would lead parties to invest less than the socially optimal level (Williamson 1979, 1985; Grout, 1984; Grossman and Hart, 1986; Hart and Moore, 1988).

In response to this result of underinvestment, a large body of literature on contractual solutions to the hold-up problem has developed. By showing that simple (incomplete) contracts can achieve the first best in many situations, the literature argues that the incompleteness of contracts might not pose too serious a problem. There are two strands of this literature.

One strand considers the special informational environment of Hart and Moore (1988), who assume that it is impossible to contract on *any* investment-related information including quality of output. It shows that simple contracts can solve the hold-up problem if specific investments are selfish in nature. This is the case where, for example, a seller invests in order to reduce her cost or a buyer invests in order to increase his benefit from the procured good or service (Chung, 1991; Aghion, Dewatripont, and Rey, 1994; Nöldeke and Schmidt, 1995; Edlin and Reichelstein, 1996). Yet, these results do not carry over to the case of a supplier investing to adapt products to the buyer's special needs. Indeed, Che and Hausch (1999) show that contracts are completely useless in protecting such purely cooperative investments, if it is impossible to rule out ex-post renegotiation.<sup>1</sup>

The other strand of the literature is less explicit about informational assumptions and mainly concerned with the impact of the standard breach remedies of contract law on the efficiency of specific investments. Starting with the seminal papers of Shavell (1980, 1984) and Rogerson (1984), this literature asks how these breach remedies interact with simple contracts specifying little more than the good to be exchanged and the price to be paid (*essentialia negotii*). It often concludes that achieving the first best is possible.

Two such efficiency results exist for cooperative investments. Che and Chung (1999) show that, with costless renegotiation, a simple contract, which does not condition on investment, achieves the first best if the contract is governed by a regime of "reliance

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<sup>1</sup>We borrow the term "cooperative investments" from Che and Hausch (1999). They were first studied in an incomplete contract setting by MacLeod and Malcolmson (1993) and are also referred to as "cross investments" (e.g. Guriev, 2003) or "investments with externalities" (e.g. Nöldeke and Schmidt, 1995).

damages". This is a standard remedy of contract law under which the court orders the breaching buyer to reimburse the seller all his investments. Schweizer (2006) shows that a regime of "bilateral expectation damages" also achieves the first best even in bilateral investment problems, seemingly contradicting Che and Chung (1999) who argue that "expectation damages" do not induce any cooperative investments. Under this remedy, the court orders the breaching party to compensate the victim such that the latter is in as good a position as if the contract had been performed. The difference in results stems from Schweizer's assumption that the contract also specifies investments and that parties accordingly can claim damages if the counter party underinvested relative to the level stipulated in the contract.

The puzzling coexistence of the "irrelevance of contracting" result in Che and Hausch (1999) and the "first-best" results in Che and Chung (1999) and Schweizer (2006) can be explained by the latter papers' (implicit) relaxing of informational assumptions. In order to enforce "reliance damages", investments have to be verifiable in court. Yet then, it is not very surprising from the perspective of contract theory that the first best should be feasible. Indeed, parties could also directly condition on investments in their original contract. For "bilateral expectation damages", also the buyer's valuation would have to be verifiable. Then, however, it follows from principal-agency theory that risk neutral parties in unilateral investment settings will always be able to achieve the first best (e.g. Holmström, 1979).<sup>2</sup> Still, the point is that efficiency is induced by real-world institutions of contract law, rather than by some fancy mechanism or forcing contract. The fact, however, that different contract remedies with very different informational requirements for enforcement are compared on equal footing reveals a rather cavalier attitude towards informational problems. In fact, this strand of literature simply *assumes* that courts possess all relevant information.

Given that courts will not always be equally able to apply different breach remedies, our aim is to be precise regarding the informational requirements of the institutional solutions we propose. Throughout the paper, we shall not stick to the *explicit* infor-

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<sup>2</sup>Indeed, principal-agent literature has long been concerned with what Che and Hausch (1999) have called "cooperative investments" in the bilateral trade literature.

mational environment of Hart and Moore (1988) and Che and Hausch (1999) for two reasons. First, while certainly a very interesting polar case, it would imply that none of the *standard* breach remedies could be applied, except for “specific performance” (which only requires the court to enforce the contract).<sup>3</sup> This, however, seems very restrictive for many purposes. Second, and more subtle, it is inconceivable how courts should be able to verify whether a widget was traded or not, without being able to tell a widget from a non-widget. In other words, by assuming that courts can observe whether trade has occurred or not, Che and Hausch (1999) *implicitly* assume that courts are able to verify whether the good in question exceeds a certain minimal quality threshold. This is still much less than assuming that courts can observe the gains of trade for every possible realization of the good’s quality level. Yet, it is enough for their “irrelevance of contracting result” to no longer apply and, as we shall show in Section 5, to even achieve first-best levels of cooperative investments.<sup>4</sup>

We proceed by first revisiting “expectation damages”, which is the default remedy of common law within the same framework as Che and Chung (1999). Expectation damages compensate the victim of breach in the amount of profit that he would have received had the contract been duly performed. Che and Chung (1999) show that it performs very badly inducing *zero* cooperative investments. This result, however, follows from their implicit assumption that the contract stays silent in terms of *required quality*. Yet, this will often not be the case. Even if the parties do not stipulate anything explicit as to quality in their contract (express warranty), the court will do it for them by default, e.g. by requiring the good to serve its ordinary purpose (implied warranty of merchantability).<sup>5</sup> Taking this feature of real world contracting into account, we can show that expectation damages will always induce *positive* levels of cooperative investments. Indeed, it is even possible

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<sup>3</sup>In this sense Edlin and Reichelstein (1996) provide a result which is interesting for both strands of the literature when they speak of “specific performance”. Yet, they also give results for “expectation damages”.

<sup>4</sup>However, the problems identified in Che and Hausch (1999) reappear, if quality is multidimensional and courts fail to take into account all quality dimensions when deciding whether the good exceeds minimal quality.

<sup>5</sup>See Section 2-314 and 2-315 of the Uniform Commercial Code (UCC). The analysis of Che and Chung (1999) continues to apply if parties contract around implicit warranties without replacing them with “express warranties”. Moreover, in labour contracts, stipulating a required quality level might not be possible as a matter of law.

to achieve the first best by writing so-called Cadillac contracts (Edlin, 1996) which define the highest possible quality level as the quality required under the contract.<sup>6</sup> This result holds, even if, because of *non-verifiability of investments*, both “bilateral expectation damages” as proposed by Schweizer (2006) and “reliance damages” as advocated by Che and Chung (1999) are not available. Hence, as the default regime already induces the first best, there is generally no need for privately stipulated reliance damages, as proposed by Che and Chung (1999).

Still, reliance damages could be preferable for informational reasons. Expectation damages require the gains of trade to be verifiable. This imposes a considerable informational burden on courts. It will, however, depend on the circumstances whether reliance damages fare any better. Although accounting data is available, verifying investment is notoriously difficult. Contractors will always have the incentive to mischarge and misallocate costs. Karpoff and Vondracik (1999) report that “a total of seven different agencies monitor defense contractors to assure compliance with DOD [Department of Defense] regulations”. Moreover, many “fraud investigations are triggered by audits of contractor’s cost accounting records by the DOD’s Defense Contract Audit Agency” (p. 812). Hence, even if there is evidence of the use of reliance damages as reported by Che and Chung (1999), the evidence also reveals the need for costly monitoring on the part of the Department of Defense.

Furthermore, reliance damages are not the only alternative if parties doubt whether courts possess enough information to enforce expectation damages. Consider a regime, which allows the buyer to choose between “specific performance” and “restitution” if the tender’s value is below some threshold, and lets parties enforce the contract otherwise

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<sup>6</sup>Edlin (1996) also analyses Cadillac contracts in the context of expectation damages but makes a different point. He considers a setting where the seller makes *selfish* investments. In the absence of a contract, there will be underinvestment due to the hold-up problem. If, however, the contract stipulates the highest possible quality/quantity and it is the buyer who breaches the contract, the seller will overinvest. This is because he is fully insured and fails to take into account the states of the world where it is inefficient to trade (This is a version of the “overreliance” result by Shavell (1984) who implicitly assumes Cadillac contracts by modelling the trade decision as binary). To solve this problem, Edlin (1996) proposes to set the price so low, that it will always be the investing seller who breaches the contract. That makes him the residual claimant and provides him with efficient investment incentives. Yet, in order to make the seller accept a contract with such a low price, the buyer has to pay the seller a lump sum up front. By contrast, in our model, we are concerned with *cooperative* investments and need not rely on any up-front payments.



(SPR-regime). Under restitution, the parties are discharged of their duties under the contract, and the buyer recovers any progress payments that he might have made to the seller. As we will show, this regime also achieves the first best but, compared to expectation damages, lowers informational requirements considerably. Instead of observing the gains of trade for every possible realization of the tender's quality level, the court merely has to observe whether the tender's value is higher or lower than at least one *arbitrarily* chosen threshold level (e.g. the threshold which is convenient for courts). As we have argued before, this regime requires no more information to be verifiable than is *implicitly* assumed by Che and Hausch (1999). While it is difficult, even for an expert, to assess the absolute gains of trade in any possible instance, it should be relatively easy for him to testify whether the good is better or worse than some well-chosen benchmark. Whenever this poses fewer problems than verifying the absolute value of the seller's investment, we argue that parties who contemplate privately stipulated remedies, should use SPR instead of reliance damages.

The paper is organized as follows: Section 2 describes the model. In Section 3, we work out two benchmarks: the socially optimal level of investment and the investment level absent of institutional arrangements. In Section 4, we show that expectation damages induce first-best levels of cooperative investments. Our results pertaining to the optional remedy regime which generally grants the parties specific performance but allows the buyer to choose between specific performance and restitution if the good is non-conforming (SPR) is derived in Section 5. Section 6 concludes.

## 2 The model

A buyer and a seller potentially trade a good. Both parties are risk neutral. In the first period, the seller makes a relationship-specific cooperative investment,  $e \in \mathbb{R}_0^+$ . The buyer's benefit from trade,  $v$ , is a random variable stochastically determined by the amount of the seller's investment,  $e$ , measured in money terms. The scrap or resale value of the good to the seller is 0.<sup>7</sup> The cost of the seller's performance is deterministic and equal to a known constant,  $c > 0$ . That is, the seller's investment is cooperative, and

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<sup>7</sup>Consequently there cannot be a threat point effect like in Edlin and Hermalin (2000).

there are no selfish investments. This setting is identical to the setting studied in Che and Chung (1999).

The timing of the model, depicted in Figure 1, is as follows: At date 0, the buyer and the seller sign a contract. The contract specifies a fixed price  $p$  to be paid by the buyer upon performance as stipulated in the contract. It also specifies a quality level  $\bar{v}$  and a lump sum payment  $t$  made by the seller to the buyer. At date 1, the seller makes a cooperative investment:  $e \geq 0$ . At date 2, the buyer's benefit from the seller's performance,  $v$ , is drawn from  $[0, v_h]$  by the distribution function  $F(\cdot | e)$ . The seller's cost of performance is deterministic and equal to  $c$ , where  $0 \leq c < v_h$ . At date 3, the parties play a breach game, in which they announce their willingness to deliver or accept the good and choose among the available breach remedies. This game will be explained in more detail below.

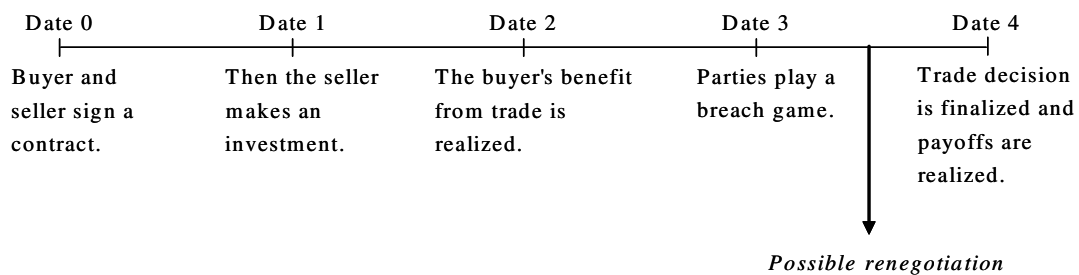


Figure 1: Timeline.

We assume that renegotiation has no associated costs and can occur at any time after date 3 and before the seller actually performs at date 4. The parties split the surplus from renegotiation at an exogenously given fixed ratio, with the seller receiving a share  $\alpha \in [0, 1]$ .<sup>8</sup> Under this assumption, the buyer's choice of legal remedy can be reversed whenever reversing it is mutually beneficial for both parties.

As a leading example, consider a car manufacturer who contracts with an engineering firm to develop the motor for a new car. Assume that the development of the motor roughly consists of two stages: A design stage, where a prototype is developed; and an engineering stage, which prepares for production. If the parties sign a contract, the engineering firm will first invest into R&D to come up with a prototype. The quality

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<sup>8</sup>The same ex-post bargaining setup was used by Edlin and Reichelstein (1996).

of the prototype will tend to rise as investment into the design process increases. After the quality of the prototype becomes apparent, the parties decide whether to proceed to the engineering stage. This decision will be made in the shadow of the available legal remedies that define the threat points in negotiations.

Different legal remedies require different information to be verifiable. In the case of expectation damages (ED) the court must observe the buyer's valuation and the seller's variable cost. For restitution (R), it must be observable whether the buyer's benefit from performance lies below or above a certain threshold level  $\bar{v}$ . In the case of specific performance (SP), the court must only observe whether delivery has occurred. We assume that the court cannot verify the seller's investment. The seller's choice of investment may be private information. Everything else, however, is observable by the parties. The following technical assumptions are made throughout:

**Assumption 1**  $F(\cdot | \cdot)$  is twice continuously differentiable.

**Assumption 2**  $F_e(\cdot | e) < 0$  and  $F_{ee}(\cdot | e) > 0$  for all  $v$  in  $(0, v_h)$  and for all  $e \geq 0$ .

**Assumption 3**  $F_e(v | 0) = -\infty$  and  $F_e(v | \infty) = 0$  for all  $v$  in  $(0, v_h)$ .

Assumption 2 means that an increase in  $e$  moves the distribution in the sense of the first-order stochastic dominance at a decreasing rate, while Assumption 3 ensures an interior solution.

### 3 Benchmark

As a benchmark, we consider the first-best outcome. It has two components: (i) the efficient trade decision has trade occur if and only if  $v \geq c$ , and (ii) the efficient investment level  $e_0$ , maximizes the net expected gains from trade, conditional on the efficient trade decision:

$$e_0 \in \arg \max W(e) \equiv \int_c^{v_h} (v - c) F_v(v | e) dv - e. \quad (1)$$

Integrating (1) by parts, the efficient investment level,  $e_0$ , is characterized by the

following first-order condition:

$$W'(e_0) = - \int_c^{v_h} F_e(v|e_0) dv - 1 = 0. \quad (2)$$

If parties do not contract but simply bargain at date 3, they will split the gains of trade according to their respective bargaining power. The seller's expected payoff will then be:

$$U_n(e) \equiv \alpha \int_c^{v_h} (v - c) F_v(v|e) dv - e. \quad (3)$$

Integrating by parts and differentiating, we can write the first-order condition for the seller's optimal investment decision  $e_n$ :

$$U'_n(e_n) \equiv -\alpha \int_c^{v_h} F_e(v|e_n) dv - 1 = 0 \quad (4)$$

As  $F_e(v|\cdot) < 0$  and  $F_{ee}(v|\cdot) > 0$ , it can be seen that the seller underinvests:  $e_n < e_0$ . By Assumptions 2 and 3, both  $e_0$  and  $e_n$  are unique, finite, and strictly positive.

## 4 Expectation damages

### 4.1 Renegotiation impossible

First consider the game that is induced by the expectation damages remedy which is widely held to be the default remedy in the US. Under this rule, the breaching party has to compensate his counter party such that the latter is in as good a position as if the former party had fully performed.

Therefore, after quality  $v$  of the prototype is realized, the supplier faces the following decision: If he chooses to deliver the good ( $D$ ), he receives the trade price, incurs production or supply costs, and has to compensate the buyer for having breached the contract if quality is below the required quality level  $\bar{v}$ . Hence the supplier's payoff is  $p - c - [\bar{v} - v]^+$ , where we shall frequently use the notation  $[\cdot]^+ = \max[\cdot, 0]$ . If he chooses not to deliver ( $\bar{D}$ ), and making the natural assumption that  $c < p < \bar{v}$ ,<sup>9</sup> he merely has to

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<sup>9</sup>Absent up-front payments and assuming that the parties write first-best contracts ( $\bar{v} = v_h$  see below), this assumption directly follows from the parties' participation constraints. For all  $\bar{v} < v_h$ , however, the assumption implies the buyer's share in the gains of trade to be at least:

$$\int_{\bar{v}}^{v_h} (v - \bar{v}) dF(v|e) > 0.$$

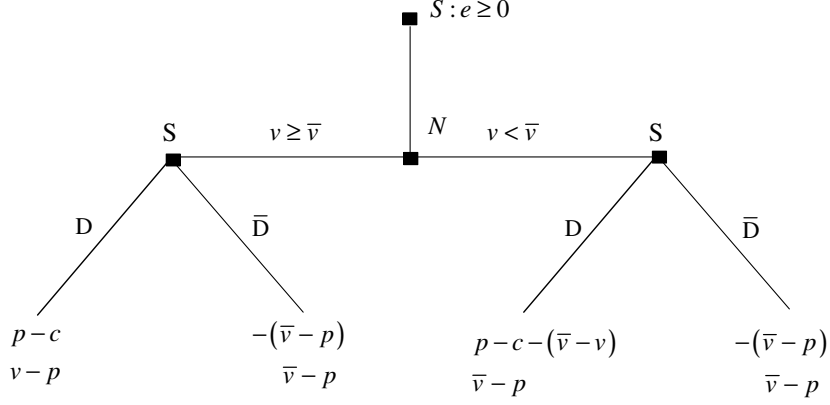


Figure 2: Subgame induced by ED starting with the seller's investment decision.

pay the buyer damages of  $\bar{v} - p$  (Figure 2). Note, that the court will calculate damages with respect to  $\bar{v}$  because this is the quality that the supplier was required to deliver under the contract.<sup>10</sup>

It is easy to see that in subgame perfect equilibrium, the seller will take the efficient delivery decision, choosing to deliver whenever the value of the good is higher than variable cost of production,  $v > c$ . The seller's expected payoff is therefore:

$$\begin{aligned}
 U_{ED}(e) \equiv & -(\bar{v} - p) F(c|e) + \int_c^{\bar{v}} [p - c - (\bar{v} - v)] F_v(v|e) dv \\
 & + \int_{\bar{v}}^{v_h} (p - c) F_v(v|e) dv - e.
 \end{aligned} \tag{5}$$

Rearranging and differentiating, we get the following first-order condition for the level of investment  $e_{ED}$  which maximizes the seller's payoff:

$$U'_{ED}(e_{ED}) = - \int_c^{\bar{v}} F_e(v|e_{ED}) dv - 1 = 0. \tag{6}$$

Comparing this expression with the benchmark condition (2) and observing that  $U''_{ED}(e) < 0$  by Assumption 2, Proposition (1) immediately follows:

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Without up-front payments, it is therefore not possible to find a  $p < \bar{v}$  which allows to achieve any possible distribution of the ex-ante gains of trade for all  $\bar{v}$ . Still, as a matter of real world contracting,  $p < \bar{v}$  seems to be a natural assumption, as courts tend to set  $\bar{v}$  higher as the price increases. There may even be a trade-off between efficiency and the distribution of the gains of trade according to the parties' bargaining power.

<sup>10</sup>We have implicitly made the simplifying assumption that the buyer always accepts delivery. In Appendix A, we show that the analysis of this and the following subsection does not change if we allow both the seller *and* the buyer to breach.

**Proposition 1** *If renegotiation is impossible, expectation damages induce positive levels of cooperative investments. For  $\bar{v} < v_h$ , there will be underinvestment, yet investment incentives rise in required quality  $\bar{v}$ . If parties set required quality such that it cannot be met with positive probability,  $\bar{v} \geq v_h$  (Cadillac contract, see Edlin, 1996), expectation damages implement the first best.*

**Remark 1** *If  $\bar{v} \geq v_h$  the parties can achieve any distribution of the ex-ante gains of trade without making use of up-front payments.*

The intuition for this result is the following. If the good is non-conforming to the contract, any increase in the quality level above variable cost benefits the seller by reducing his damage payment  $\bar{v} - v$ . If however, the good is conforming to the contract, the seller receives a fixed payoff  $p - c$ , irrespective of how much the realized level of quality exceeds the threshold level  $\bar{v}$ . Hence, the seller does not fully internalize the benefit of his investment and consequently underinvests relative to the socially optimal level. Yet, as  $\bar{v}$  increases, the range of valuations for which the benefit of investing is not internalized shrinks, and investment incentives improve until they finally reach first best levels for  $\bar{v} = v_h$ .<sup>11</sup>

Our result stands in contrast to Proposition 1 of Che and Chung (1999), who conclude that expectation damages induce *zero* cooperative investments if renegotiation is not possible. This follows from their implicit assumption that the contract remains silent about required quality ( $\bar{v} = 0$ ). Yet, in practice, even if the parties do not stipulate anything explicit regarding quality in their contract, the court will often, by default, do it for them (see Section 2-314 and 2-315 of the Uniform Commercial Code). In our example of the car manufacturer, the court would at least require the motor to work or to match the performance criteria of a reference product. However, the analysis of Che and Chung (1999) continues to apply to cases where the parties waive the warranty of merchantability without substituting it with an express warranty. Moreover, it is sometimes not possible as a matter of law to stipulate levels of required quality in labour

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<sup>11</sup>Another way to see this is that, for  $\bar{v} = v_h$ , the seller's payoff will always be the joint payoff minus a constant term of  $\bar{v} - p$ . This makes the seller a residual claimant.

contracts. As we will show in the next subsection, we can get a similar result when we allow for renegotiation.

## 4.2 Renegotiation possible

If renegotiation is possible, adjustments to the payoffs in Figure 2 need to be made.<sup>12</sup> If  $v < \bar{v}$ , it is still optimal for the seller to announce delivery for  $v \geq c$  and to breach the contract for  $v < c$ . Hence, the seller's equilibrium payoffs will be  $p - c - (\bar{v} - v)$  and  $-(\bar{v} - p)$  respectively, just as in the case without renegotiation. If  $v \geq \bar{v}$ , however, equilibrium payoffs may change. Assuming that  $c < p < \bar{v}$ , the seller will breach the contract if:

$$v > \frac{\bar{v} - c}{\alpha} + c \equiv x(\bar{v}). \quad (7)$$

Intuitively imagine that an engineering firm develops a motor which is much better than required under the contract,  $v \gg \bar{v}$ . By breaching the contract, it only has to pay damages of  $\bar{v} - p$ . This may be less than the seller's share in the renegotiation surplus of  $\alpha(v - c)$ . Hence, the seller will have an incentive to strategically breach the contract for high realizations of  $v$ . Consequently, the seller's equilibrium payoffs will be  $p - c$  for  $v \leq x(\bar{v})$  and  $-(\bar{v} - p) + \alpha(v - c)$  for  $v > x(\bar{v})$ . Of course, the latter case can only occur for

$$x(\bar{v}) < v_h \iff \bar{v} < \alpha(v_h - c) + c \equiv \hat{v} \leq v_h, \quad (8)$$

which will never be the case for sufficiently high levels of required quality  $\bar{v}$ . The seller's expected payoff is therefore:

$$\begin{aligned} U_{\overline{ED}}(e) \equiv & -(\bar{v} - p) F(c|e) + \int_c^{\bar{v}} [p - c - (\bar{v} - v)] F_v(v|e) dv \\ & + \int_{\bar{v}}^{x(\bar{v})} (p - c) F_v(v|e) dv + \int_{x(\bar{v})}^{v_h} [-(\bar{v} - p) + \alpha(v - c)] F_v(v|e) dv - e. \end{aligned} \quad (9)$$

Rearranging and differentiating, we get the following first-order condition for the investment decision  $e_{\overline{ED}}$  which maximizes the seller's expected payoff:

$$-\int_c^{\bar{v}} F_e(v|e_{\overline{ED}}) dv - a \int_{x(\bar{v})}^{v_h} F_e(v|e_{\overline{ED}}) dv - 1 = 0. \quad (10)$$

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<sup>12</sup>We follow Che and Chung (1999) and Che and Hausch (1999) in assuming that the possibility of renegotiation influences the parties' breach decision. This implies that the parties anticipate being able to renegotiate after the court's decisions. In Rogerson (1984) parties can only renegotiate prior to going to court.

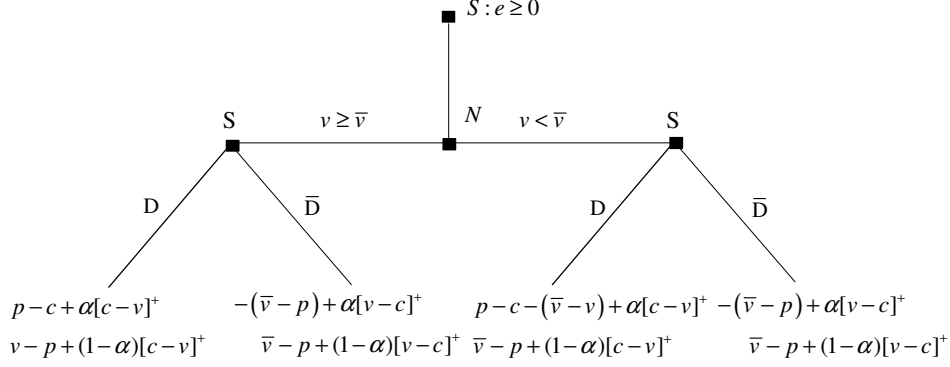


Figure 3: Subgame induced by expectation damages with renegotiation.

We can write the following proposition:<sup>13</sup>

**Proposition 2** *If required quality is low ( $\bar{v} < \hat{v} \iff x(\bar{v}) < v_h$ ), expectation damages induce higher levels of cooperative investments if renegotiation is possible than if it is not. The seller will underinvest, yet investment incentives increase in required quality  $\bar{v}$ . As required quality rises above a certain threshold,  $\bar{v} \geq \hat{v}$ , incentives under either assumption coincide. Cadillac contracts implement the first best.*

**Proof.** The proposition immediately follows from comparing expression (10) with expressions (6) and (2), observing that  $x(\bar{v}) > \bar{v}$  for all  $\bar{v}$ . As for the claim that investment incentives rise in  $\bar{v}$ , note that it follows from  $x(\bar{v}) \geq \bar{v}$  that

$$\frac{de_{ED}}{d\bar{v}} = \frac{-F_e(\bar{v} | e_{ED}) + F_e(x(\bar{v}) | e_{ED})}{\int_c^{\bar{v}} F_{ee}(v | e_{ED}) dv + \alpha \int_{x(\bar{v})}^{v_h} F_{ee}(v | e_{ED}) dv} \geq 0.$$

where the inequality is strict for  $\alpha \neq 1$ . ■

The intuition for the higher investment incentives under renegotiation is that the seller internalizes some of the benefit of his investment even if quality is conforming ( $v > \bar{v}$ ). This is because, following a strategic breach, the seller gets a share of the renegotiation surplus which increases in quality.

### 4.3 Discussion

The results of this section are summarized in Figure 4. The "zero investment result" of Che and Chung (1999) follows as a polar case where the level of required quality is set

<sup>13</sup>This result stands in contrast to Proposition 4 of Che and Chung (1999).



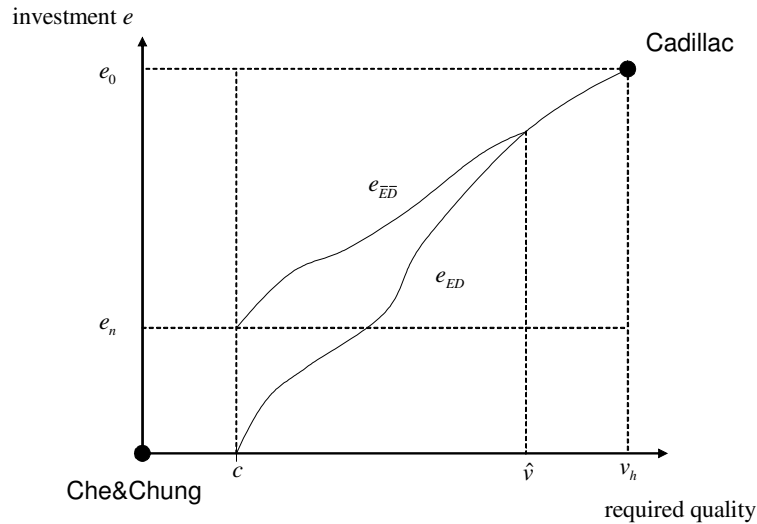


Figure 4: Incentives induced by expectation damages.

to zero. In this case, the seller's tender will always be conforming to the contract and the seller receives a fixed payment of  $p - c$  independent of the realized level of quality. Hence, he does not internalize any benefit from his investment. However, as required quality is set above variable cost, levels of cooperative investments will be positive as the seller can reduce his expected damage payments by investing into quality. Moreover, if renegotiations are possible, writing a contract always improves on the situation of writing no contract at all. As the level of required quality rises, the value of renegotiation decreases and eventually completely subsides. Cadillac contracts finally induce the first best level of cooperative investments independent of the possibility of renegotiation.

A real world example of such Cadillac contracts would be the contracts offered by moving companies.<sup>14</sup> They usually promise to deliver all their client's belongings to his new residence *intact*. This is as valuable as the company's performance can be, as most of the time, the company falls short of its promise and will have to compensate its client. Yet, we do not seem to *generally* observe such contracts in reality. In our example of the car manufacturer, parties would not normally agree on a motor that cannot be built at the current state of technology. This might make the results of Propositions 1 and 2 unappealing as a positive theory of how parties induce first-best cooperative investments.<sup>15</sup> Still, it is reassuring that expectation damages as the default common law

<sup>14</sup>This example is due to Edlin (1996).

<sup>15</sup>It can, however, be shown that an optional regime which is based on expectation damages for partial

remedy at least induce positive levels of such investments. Moreover, the first-best result could still qualify as a normative theory on how parties *should* write contracts.

## 5 SPR with renegotiation

Expectation damages require that the gains of trade be verifiable. This imposes a considerable informational burden on courts. If parties doubt whether courts possess the necessary information to enforce expectation damages, we show that they can use a remedy regime which considerably lowers informational requirements while still achieving the first best. It combines the restitution remedy (R) with specific performance (SP). Under the regime (SPR), both the seller and the buyer can have the contract enforced if the tender is conforming to the contract,  $v \geq \bar{v}$ . In this case, the seller incurs cost of  $c$ , delivers the good of quality  $v$  to the buyer, and receives the agreed upon price  $p$  in return. Whenever the court's order to perform would result in inefficient trade, the parties renegotiate and split the renegotiation surplus  $[c - v]^+$  according to their respective bargaining power.<sup>16</sup> In the case where quality is non-conforming,  $v < \bar{v}$ , the buyer can either insist on performance (such that the payoffs are as just described) or terminate the contract and ask for restitution.<sup>17</sup> Termination discharges all remaining obligations under the contract and restitution allows the buyer to recover any progress payment he might have made to the seller. As we assumed that the good does not have any value for the seller, each party would end up with 0 payoff. Yet, once again, parties will renegotiate whenever there is a positive renegotiation surplus,  $[v - c]^+$ .

In our example, this means that if the prototype is satisfactory, both the engineering firm and the car manufacturer can have the contract enforced, i.e., the second stage breach but also allows the buyer to terminate the contract if the tender is non-conforming can achieve the first best without having to write Cadillac contracts. This regime broadly applies in both common and civil law for situations where the seller is excused for non-performance.

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<sup>16</sup>As both the specific performance and restitution remedy do not automatically lead to ex-post efficient trade, there is no hope to achieve first-best unless renegotiation is possible.

<sup>17</sup>Strictly speaking, under the perfect tender rule, the court will examine if the tender corresponds to the quality features stipulated in the contract. Therefore, in theory, a buyer could terminate and ask for termination even if the non-conforming tender is better than a conforming one. Yet, courts are likely to deny termination in such a case, especially if parties have not defined in detail the product's quality features. In this case, the court has to decide ex post whether the tender is conforming, i.e., whether it corresponds to the quality features that the parties hypothetically would have written into the contract. It is inconceivable that this decision would not be strongly influenced by whether the product delivers good value to the client or not.

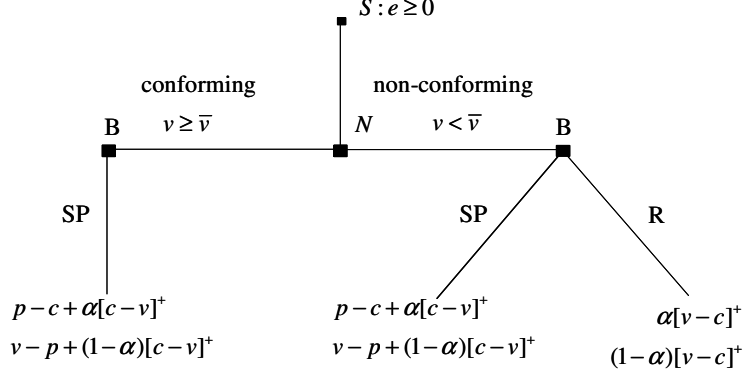


Figure 5: Subgame induced by SPR.

of the project will be realized, unless parties renegotiate. However, if the prototype is unsatisfactory, the manufacturer has the option to either terminate the contract or to continue to insist on performance. Figure 5 represents the subgame starting from the seller's investment decision. We go on to prove the following proposition:

**Proposition 3** *Consider a regime which lets the buyer choose between specific performance and restitution if the tender's value is below a certain threshold value  $\bar{v}$ , and otherwise grants the parties specific performance. Then, for any given threshold value  $\bar{v} \in [c, v_h)$ , there exists a price  $p_{SPR}$  which induces first-best cooperative investments. Under an additional assumption, the result extends to threshold values  $\bar{v} \in (0, c)$ .*

**Proof.** Assume that the quality threshold is set above or equal to variable cost,  $\bar{v} \geq c$ . For conforming quality,  $v \geq \bar{v}$ , this implies that no renegotiation surplus arises under specific performance. Payoffs are simply  $p - c$  and  $v - p$  for the seller and the buyer, respectively. For non-conforming quality,  $v < \bar{v}$ , termination will be optimal for the buyer if:

$$(1 - \alpha)[v - c]^+ > v - p + (1 - \alpha)[c - v]^+ \iff v < \frac{p - (1 - \alpha)c}{\alpha} \equiv \check{v}(p). \quad (11)$$

Let  $p_{SPR1}$  be the optimal price and assume that it will be high enough such that:

$$\bar{v} < \check{v}(p_{SPR1}) \iff p_{SPR1} \geq p_L \equiv \alpha\bar{v} + (1 - \alpha)c \geq c. \quad (12)$$

Then, whenever quality is non-conforming, we have  $v < \bar{v} < \check{v}(p_{SPR1})$  implying that the

buyer will choose termination. Hence, the seller's expected payoff is:

$$U_{SPR1}(e, p) \equiv \alpha \int_c^{\bar{v}} (v - c) F_v(v|e) dv + \int_{\bar{v}}^{v_h} (p - c) F_v(v|e) dv - e. \quad (13)$$

Integrating by parts and partially differentiating with respect to  $e$ , gives us:

$$U'_{SPR1}(e, p) = \left[ -\alpha \int_c^{\bar{v}} F_e(v|e) dv - 1 \right] + [p_L - p] F_e(\bar{v}|e). \quad (14)$$

Given that  $e_0$  is the first-best investment decision, it follows from expression (14), assumption 2 and the benchmark condition (2) that  $U'_{SPR1}(e_0, p_L) < 0$ . As  $U'_{SPR1}(e_0, p) \rightarrow \infty > 0$  for  $p \rightarrow \infty$  and observing that  $U'_{SPR1}(e_0, p)$  is continuous in  $p$ , we can argue by the intermediate value theorem that there exists a price  $p_{SPR1} \in (p_L, \infty)$  such that  $U'_{SPR1}(e_0, p_{SPR1}) = 0$ . As it follows from  $p_{SPR1} > p_L$  and assumption 2 that  $U''_{SPR1}(e, p_{SPR1}) < 0$  for all  $e \geq 0$ , investment decision  $e_0$  must be a global maximum of the seller's expected payoff function  $U_{SPR1}(e, p_{SPR1})$ . Hence, price  $p_{SPR1}$  induces the first-best investment decision for  $\bar{v} \geq c$ . (Note that assumption (12) is satisfied as  $p_{SPR1} > p_L$ ). The extension of the result to threshold levels below variable cost,  $\bar{v} < c$ , is relegated to Appendix B. ■

The intuition of the proof is as follows: If it were possible to always terminate and ask for restitution, the seller would underinvest due to buyer hold-up. Indeed, his payoff would be  $a(v - c)$  just as in the no-contract case. Yet, under SPR, termination is not available if the seller's tender is conforming to the contract. Indeed, if the seller produces high quality, the contract is enforced, and the seller derives a payoff of  $p - c$ . Hence,  $p - c$  acts as a *quality premium* for the seller. The higher this premium, the higher will be the seller's investment, as, by investing, he can increase the probability of exceeding the quality threshold. Therefore, by choosing an appropriate price  $p$ , it is possible to counterbalance the underinvestment effect due to hold-up.<sup>18</sup> In fact, the regime works like an incentive contract stipulating two different payoffs for the agent, depending on whether the output is above or below some threshold level.

In order to enforce this regime, the court has to observe 1) the contract price, 2) whether delivery took place, and 3) whether the value of the good exceeds the quality

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<sup>18</sup>Note, however, that price will have to become extremely high for  $F_e(\bar{v}|\cdot) \rightarrow 0$ . This will often be the case for  $\bar{v} \rightarrow v_h$  and  $\bar{v} \rightarrow 0$ .

threshold. Obviously, the third requirement is the most problematic. It should be clear, however, that less information is needed than under expectation damages where the whole range of possible realizations of the tender's value has to be verifiable. In our example, the court would have to observe the exact value that the proposed motor design will have to the manufacturer. Under SPR, it suffices that the court can observe whether the prototype is better or worse than some *arbitrarily* chosen threshold.

A natural threshold could be the quality of a reference product. Suppose that a competitor already has his car on the market. Then it is clear that a prototype that does not at least match this existing product should be deemed unsatisfactory. While it is difficult, even for an expert, to assess the absolute value of some new design, it should be relatively easy to assess whether it is better or worse than some well chosen benchmark.<sup>19</sup>

This has an interesting implication for contracting: Parties can privately stipulate breach remedies - and frequently do so for important projects. Yet, even then, they will not normally design a mechanism from scratch but rather use basic legal remedies which courts are familiar with.<sup>20</sup> Our analysis suggests that the SPR regime might be an attractive choice: It achieves the first best but, compared to the default expectation damages regime, it lowers informational requirements.

Common law courts have, however, traditionally limited the parties' power to privately stipulate specific performance (Farnsworth, 2004, §12.7, p. 751). The same restrictions generally apply for stipulating very high damage payments in the event of breach (liquidated damages) on the ground that they indirectly achieve the same goal. The reason is the "fundamental principle that the law's goal on breach of contract is not to deter breach by compelling the promisor to perform, but rather to redress breach by compensating the promisee" (id, § 12.18 p. 811). The modern trend, however, is in favor of the extension of specific performance (id, §12.4 p. 743). Revised article 2 of the Uniform Commercial Code gives effect to such agreements. California amended §1671 of its Civil Code as early

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<sup>19</sup>Note that parties could stipulate a threshold with the explicit goal of making it convenient for courts to decide whether the tender's value is higher or lower than the threshold. For any such threshold, they could subsequently find a price such that first-best incentives are provided. So, even if cases are heterogenous, one would expect parties to choose thresholds from the same set of conveniently verifiable threshold levels.

<sup>20</sup>As courts are specialized in ruling on standard breach remedies, enforcing them will probably be reliable and relatively cheap (Che and Chung, 1999).

as 1977, to make liquidated damages provisions valid.

Finally, it is inconceivable how courts should be able to verify whether a widget was traded or not, without being able to tell a widget from a non-widget. In other words, by assuming that courts can observe whether trade has occurred or not, Che and Hausch (1999) and other papers in the spirit of Hart and Moore (1988) *implicitly* assume that courts are able to verify whether the good in question exceeds a certain minimal quality threshold. Yet, as we have seen, this is enough for their “irrelevance of contracting result” to no longer apply and, to even achieve first-best levels of cooperative investments. It should, however, be mentioned that the problems identified in Che and Hausch (1999) are likely to reappear, if quality is multidimensional and courts fail to take into account all quality dimensions when deciding whether the good exceeds minimal quality. The same is true if the production technology is captured by a density function which might become zero for some values on the interval  $[0, v_h]$ .<sup>21</sup>

## 6 Conclusion

Our paper makes the following three points: 1) The existing default legal regime of common law, expectation damages, is already able to induce first-best cooperative investments. Hence, there is no urgent need for privately stipulated remedies in order to induce cooperative investments. 2) If the contracting parties doubt whether the court possesses enough information to apply expectation damages, they can create legal remedies of their own. Che and Chung (1999) suggest that they use reliance damages. We argue that, in some cases, it is easier for courts to verify whether the buyer’s valuation exceeds some well-chosen quality threshold than to verify the absolute value of the seller’s investment. Then, parties should prefer a regime combining specific performance and restitution (SPR) over reliance damages. 3) In order to apply the SPR regime, no more information needs to be verifiable than is *implicitly* assumed in Che and Hausch (1999).

Moreover, papers by Chung (1991), Aghion, Dewatripont, and Rey (1994) and Edlin and Reichelstein (1996) have already argued that the specific performance remedy per-

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<sup>21</sup>See expression (14). We owe the insight of this last paragraph to discussions with Patrick Schmitz and Yeon-Koo Che.

forms very well in inducing relationship-specific investments of the selfish type. By showing that a regime based on specific performance also provides first-best incentives for cooperative investments, our analysis lends further support to the broader trend of expanding the use of specific performance in common law. Specifically, it should be in the power of the parties to enlarge the availability of specific performance by dispensing with the adequacy test and other criteria for such relief.

Finally, it could be a promising avenue for future research to devise incentive schemes by using common breach remedies of contract law as basic building blocks in optional remedy regimes. With the notable exception of Avraham (2006) the opportunities offered by the optional structure of real world legal regimes has so far largely been ignored.

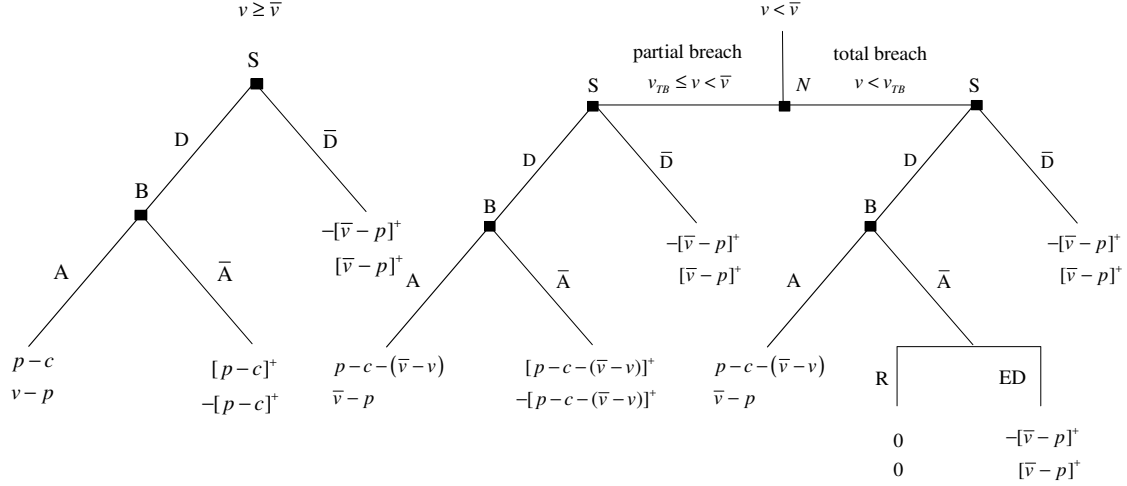


Figure 6: ED without renegotiation if the buyer is allowed to breach.

## 7 Appendix

### 7.1 Appendix A: Allowing for buyer's breach

#### 7.1.1 ED without renegotiation

Rather than assuming ad hoc that the buyer never breaches the contract we will now show that legal remedies of contract law *induce* the buyer to accept delivery.<sup>22</sup>

**Conforming quality,  $v \geq \bar{v}$ .** If quality is conforming non-acceptance ( $\bar{A}$ ) of the supplier's tender constitutes breach. Hence, the supplier can recover damages of  $[p - c]^+$  (Figure 6). Under the natural assumption that the price is set such that  $p \in (c, \bar{v})$ , we see that  $v - p > -[p - c]^+$  for all  $v \geq \bar{v}$ . Hence, the buyer will accept delivery in equilibrium. Under the substantial performance doctrine, different remedies will be available depending on whether the non-conformity amounts to total breach or not.

**Non-conformity constitutes partial breach,  $v_{TB} \leq v < \bar{v}$ .** If quality is non-conforming it is less clear why the buyer should be obliged to accept delivery. Yet, if breach due to non-conforming quality is non-material,  $v_{TB} \leq v \leq \bar{v}$ , the buyer is indeed only allowed to

<sup>22</sup> Although Che and Chung (1999) make the opposite simplifying assumption, namely, that the *seller* never refuses to deliver, the underlying sequence of decisions is the same as in our paper. Obviously, trade can only occur if the seller decides to deliver *and* the buyer decides to accept. Their analysis, like ours, does not change by taking account of this extensive version of the game (see footnote 11 of their paper). Also note, that it is straightforward to show that the timing of delivery and acceptance decisions does not matter.



demand damages for partial breach. Therefore, if the buyer rejects delivery, the supplier can recover the full price, minus cost saved, minus damages to which the buyer would have been entitled:  $[p - c - (\bar{v} - v)]^+$ . For  $p \in (c, \bar{v})$ , we see that  $\bar{v} - p > 0 \geq -[p - c - (\bar{v} - v)]^+$ . Hence, the buyer will accept delivery in equilibrium.

**Non-conformity constitutes total breach,  $v < v_{TB}$ .** If, however, the non-conformity is material,  $v < v_{TB}$ , the buyer can terminate the contract. In this case he can ask for restitution ( $R$ ) under which he can recover any progress payment that he might have made to the seller. Both parties end up with 0 payoff as the good has no value to the seller. Alternatively, the buyer can recover damages for total breach,  $[\bar{v} - p]^+$ . Assuming that the parties will coordinate on the Pareto efficient equilibrium and  $p \in (c, \bar{v})$ , the buyer will accept for  $v - c > 0$  and reject for  $v - c \leq 0$ . It is optimal for the seller to refuse to deliver if  $v - c \leq 0$ . Hence, an equilibrium exists where the buyer will choose acceptance on the equilibrium path.<sup>23</sup>

### 7.1.2 ED with renegotiation

If we assume that parties renegotiate towards the ex-post efficient trade decision, adjustments to the payoffs in Figure 6 need to be made: If e.g. the buyer rejects the seller's tender, although trade is efficient  $v > c$ , parties will renegotiate splitting the resulting surplus of  $v - c$  according to their respective bargaining power. Similarly the parties will renegotiate if the buyer accepts the tender, although  $c \geq v$  (Figure 7, note that we continue to assume  $p \in (c, \bar{v})$ ). If the tender is conforming,  $v \geq \bar{v}$ , the buyer will accept in equilibrium as  $-(p - c) + (1 - \alpha)(v - c) = v - p - \alpha(v - c) < v - p$  is true for all  $p \in (c, \bar{v})$  and  $\bar{v} \leq v$ . We make one additional assumption which is crucial: Under the substantial performance doctrine of common law the buyer may only treat the non-conformity as total breach if  $v < v_{TB}$ . In civil law countries a similar provision requires non-conformity to be "fundamental". One test for concluding that non-conformity cannot be treated as total breach is whether the buyer still has an "interest" in the good despite non-conformity. We will assume that the court will conclude that such an interest

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<sup>23</sup>There is of course another payoff equivalent equilibrium where the seller announces delivery and the buyer rejects. Hence, strictly speaking, we have only established that we can model the game "as if" the buyer always chooses acceptance.

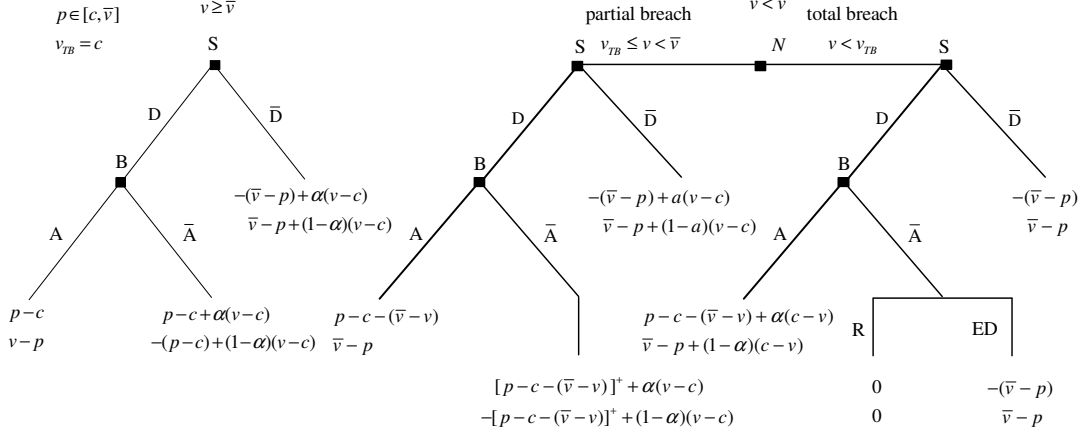


Figure 7: ED with renegotiation if the buyer is allowed to breach.

exists whenever the parties would freely renegotiate to trade:  $v > c$ . This implies setting  $v_{TB} = c$ . We distinguish two cases:

**Non-conformity constitutes partial breach:  $c = v_{TB} \leq v < \bar{v}$ .** As  $-[p - c - (\bar{v} - v)]^+ + \alpha(v - c) < \bar{v} - p - (1 - \alpha)(v - c) < \bar{v} - p$  for all  $v \geq c$ , it is always optimal for the buyer to accept delivery.

**Non-conformity constitutes total breach:  $v < v_{TB} = c$ .** As  $\bar{v} - p + (1 - \alpha)(c - v) > (\bar{v} - p) > 0$  for  $v < c$  the buyer will always choose acceptance if given the choice. Anticipating this decision by the buyer, the seller will choose to breach the contract.

## 7.2 Appendix B: Extension to $\bar{v} \in (0, c)$ .

**Proof.** Consider the case where the quality threshold is set below variable cost,  $\bar{v} < c$ . Again, we assume that the optimal price is high enough such that

$$\bar{v} < \check{v}(p_{SPR2}) \implies p_{SPR2} > p_L. \quad (15)$$

This implies that the buyer will always choose termination if quality is non-conforming,  $v < \bar{v}$ . The seller's payoff will then be 0. If quality is conforming but the buyer's valuation is below variable cost,  $\bar{v} \leq v < c$ , the buyer will initially ask for specific performance but then agrees to renegotiate towards the ex-post efficient trade decision. The seller's payoff is  $p - c + \alpha(c - v)$ . If valuation is above variable cost, trade takes place as stipulated in

the contract and the seller's payoff will be  $p - c$ . Hence, the seller's expected payoff will be:

$$U_{SPR2}(e, p) \equiv \int_{\bar{v}}^c (p - c) + \alpha(c - v) F_v(v|e) dv + \int_c^{v_h} (p - c) F_v(v|e) dv - e. \quad (16)$$

Integrating by parts and taking partial derivatives with respect to  $e$ , gives us:

$$U'_{SPR2}(e, p) = \alpha \int_{\bar{v}}^c F_e(v|e) dv - 1 + [p_L - p] F_e(\bar{v}|e). \quad (17)$$

It follows from the benchmark condition (2) and Assumption 2 that  $U'_{SPR2}(e_0, p_L) < 0$ . As  $U'_{SPR2}(e_0, p) \rightarrow \infty > 0$  for  $p \rightarrow \infty$  and observing that  $U'_{SPR2}(e_0, p)$  is continuous in  $p$ , it follows by the intermediate value theorem that there must exist a  $p_{SPR2} \in (p_L, \infty)$  such that  $U'_{SPR2}(e_0, p_{SPR2}) = 0$ . In order for  $e_0$  to be a global maximum of the seller's expected payoff function, the following second order condition must hold for all  $e \geq 0$ :

$$U''_{SPR2}(e, p_{SPR2}) = \alpha \int_{\bar{v}}^c F_{ee}(v|e) dv + [p_L - p_{SPR2}] F_{ee}(\bar{v}|e) < 0. \quad (18)$$

Solving  $U'_{SPR2}(e_0, p_{SPR2}) = 0$  for  $p_{SPR2}$  and inserting into (18) gives us:

$$\alpha \int_{\bar{v}}^c F_{ee}(v|e) dv - \frac{\alpha \int_{\bar{v}}^c F_e(v|e_0) dv - 1}{F_e(\bar{v}|e_0)} F_{ee}(\bar{v}|e) < 0. \quad (19)$$

Multiplying with  $F_e(\bar{v}|e_0)$  and dividing by  $F_{ee}(\bar{v}|e)$  and rearranging we get:

$$\int_{\bar{v}}^c \frac{F_e(\bar{v}|e_0)}{F_{ee}(\bar{v}|e)} F_{ee}(v|e) - F_e(v|e_0) dv > -\frac{1}{\alpha}. \quad (20)$$

which we assume to hold true. ■

**Remark 2** *The assumption will always be fulfilled if the seller's bargaining power  $\alpha$  is sufficiently low or if the quality threshold  $\bar{v}$  is only slightly lower than variable cost. Interestingly, it will also hold for sufficiently low(!) threshold levels, as  $F_e(\bar{v}|\cdot) \rightarrow 0$  for  $\bar{v} \rightarrow 0$ . A sufficient condition for the assumption to hold true is that  $-F_e(v|e_0)/F_{ee}(v|\cdot)$  is non-decreasing in  $v \in [\bar{v}, c)$ . Then the integrand will be non-negative. This will e.g. be the case for the class of separable distribution functions:  $F(v|e) = k(v)g(e) + h(v)$ . An explicit example would be the function  $F(v|e): [0, 10] \times [0, \infty] \rightarrow [0, 1]$ :*

$$F(v|e) = v(10 - v) \left( \frac{10^{-3}}{e + 0,1} \right) + \left( \frac{v}{10} \right)^3. \quad (21)$$

where  $F_e(v|0) \rightarrow \infty$  can be approximated by replacing 0,1 with an ever lower positive number.

## References

- AGHION, P., M. DEWATRIPONT, AND P. REY (1994): “Renegotiation Design with Unverifiable Information,” *Econometrica*, 62(2), 257–282.
- AVRAHAM, R. (2006): “Incomplete Contracts with Asymmetric Information: Eclusive Versus Optional Remedies,” *American Law and Economics Review*, 8 No 3, 523–561.
- CHE, Y. K., AND T. Y. CHUNG (1999): “Contract Damages and Cooperative Investments,” *RAND Journal of Economics*, 30(1), 84–105.
- CHE, Y. K., AND D. B. HAUSCH (1999): “Cooperative Investments and the Value of Contracting,” *American Economic Review*, 89(1), 125–147.
- CHUNG, T. Y. (1991): “Incomplete Contracts, Specific Investments, and Risk Sharing,” *Review of Economic Studies*, 58(5), 1031–1042.
- EDLIN, A., AND B. HERMALIN (2000): “Contract Renegotiation and Options in Agency Problems,” *Journal of Law, Economics, and Organization*, 16(2), 395–423.
- EDLIN, A. S. (1996): “Cadillac Contracts and Up-front Payments: Efficient Investment Under Expectation Damages,” *Journal of Law, Economics & Organization*, 12(1), 98–119.
- EDLIN, A. S., AND S. REICHELSTEIN (1996): “Holdups, Standard Breach Remedies, and Optimal Investment,” *American Economic Review*, 86(3), 478–501.
- FARNSWORTH, E. A. (2004): *Contracts*. Aspen Publishers, New York, 4 edn.
- GROSSMAN, S. J., AND O. D. HART (1986): “The costs and benefits of ownership - A theory of vertical and lateral integration,” *Journal of Political Economy*, 94(4), 691–719.
- GROUT, P. (1984): “Investment and Wages in the Absence of Binding Contracts: A Nash Bargaining Approach,” *Econometrica*, 52 (2), 449–460.
- GURIEV, S. (2003): “Incomplete Contracts with Cross-Investments,” *Contributions to Theoretical Economics*, 3 (1) Article 5.
- HART, O., AND J. MOORE (1988): “Incomplete Contracts and Renegotiation,” *Econometrica*, 56(4), 755–785.
- HOLMSTRÖM, B. (1979): “Moral Hazard and Observability,” *The Bell Journal of Economics*, 10, No. 1, 74–91.
- KARPOFF, J. L. D. S., AND V. P. VENDRYK (1999): “Defense Procurement Fraud, Penalties, and Contractor Influence,” *Journal of Political Economy*, 107, 809–842.
- MACLEOD, W. B., AND J. M. MALCOMSON (1993): “Investments, Holdup, and the Form of Market Contracts,” *American Economic Review*, 83(4), 811–837.
- NÖLDEKE, G., AND K. M. SCHMIDT (1995): “Option Contracts and Renegotiation - a Solution to the Hold-Up Problem,” *RAND Journal of Economics*, 26(2), 163–179.

- ROGERSON, W. P. (1984): “Efficient Reliance and Damage Measures for Breach of Contract,” *RAND Journal of Economics*, 15(1), 37–53.
- SCHWEIZER, U. (2006): “Cooperative Investments Induced by Contract Law,” *RAND Journal of Economics*, Spring 37-1, 134–145.
- SHAVELL, S. (1980): “Damage Measures for Breach of Contract,” *Bell Journal of Economics*, 11, 466–490.
- (1984): “The Design of Contracts and Remedies for Breach,” *Quarterly Journal of Economics*, 94, 121–148.
- WILLIAMSON, O. E. (1979): “Transaction-Cost Economics: The Governance of Contractual Relations,” *Journal of Law and Economics*, 22, 233–61.
- (1985): *The Economic Institutions of Capitalism*. Free Press, New York.