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ON THE DESIGN OF CONTRACTS AND REMEDIES FOR BREACH

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ABSTRACT

The implications of uncertainty for the design of contracts and of remedies for their breach are studied. After characterizing complete contingent contracts, incomplete contracts are examined. Specifically, in view of difficulties in making contingent provisions (costs of enumeration and of bargaining; verification of occurrence of events), it is shown for which contingencies provisions are made. Then, in the major part of the paper, two important implicit substitute for contingent terms are analyzed. The first is provided by remedies for breach of contract; for when a party must pay damages for breach, he will be induced to fulfill his obligations in approximately those contingencies which would have been agreed upon under the terms of a detailed contract. The second substitute for contingent terms lies in the opportunity for renegotiation in light of circumstances, since renegotiation will occur in more or less those contingencies where the contract terms would have differed under a more detailed agreement.

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On the Design of Contracts and Remedies for Breach

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The concern of this paper is with the implications of uncertainty for the design of contracts and of remedies for their breach.[1] Uncertainty is of course an inherent feature of the contractual relationship, for by definition there is always a lapse of time between the making of a contract and the promised performance. During that period the cost of production may unexpectedly increase, an offer to the buyer may be made that is more advantageous than the seller's, or any number of other problematic contingencies may arise and may result in the seller's or the buyer's failure to perform.

Our analysis of the contractual situation will begin with a consideration of agreements which provide explicitly for such problematic contingencies. Specifically, a characterization will be given of contracts which are both complete--contain terms regarding all possible contingencies--and Pareto efficient--cannot be improved in the eyes of the buyer and of the seller.

It will next be asked why contracts ordinarily should not be expected to approach true completeness. The explanation will be that because of certain difficulties in making contingent provisions and also of the existence of various substitutes for them, it is in the mutual interests of the parties to leave many things unstated. Two types of difficulty in making provisions will be emphasized in this explanation: the costs of enumerating and of bargaining over contingent arrangements; and the necessity that a party be able to verify the occurrence of a contingency claimed by the other party so that a provision depending on the contingency is workable.[2] In view of these difficulties, it will be shown for which contingencies contractual provisions are made.

Then, in the major part of the paper, two important types of substitute for contingent terms in contracts will be studied. The first is provided by legal or customary remedies for breach of contract, that is, by rules requiring a party in breach to pay money damages to the other party or perhaps requiring "specific performance." To see why remedies serve as substitutes for contingent terms, consider, for instance, that when a seller must pay damages if he defaults, he will be induced to do so only if that still would be advantageous to him, say only if his production costs were larger than he anticipated or he received a higher bid than he expected from another party before he was to perform. But that the seller not perform in such contingencies is probably what would have been agreed to in provisions for them; and that the seller make a payment might also have been agreed to in provisions so as to accomplish a desirable sharing of risk. Thus, remedies for breach can serve as implicit substitutes for explicit contractual provisions by creating appropriate incentives to perform, and sometimes by allocating risk as well. The second type of substitute for provisions for contingencies lies simply in the opportunity for renegotiation in light of circumstance. The seller who finds that it would be expensive to perform would usually be willing to pay an amount the buyer would accept for his release; so, through bargaining ex post, the parties may achieve a similar result to what they would have written into the contract. A third type of substitute for contractual provisions should also be mentioned, but it will only be adverted to in the paper; it is that certain contingencies (notably, acts of God, force majeure) may already be recognized in contract law (or trade practice or custom) as excusing[3] the obligations of one of the parties.[4]

The paper will conclude with a brief comment on the interpretation of the analysis.

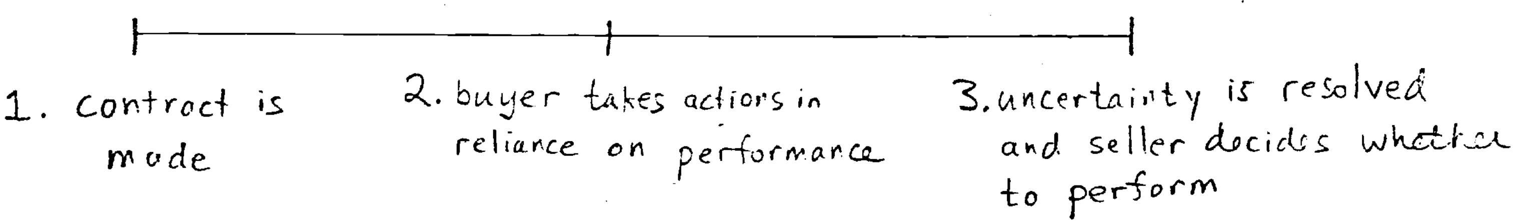
I. Outline of the Model

The concern is with two parties, a buyer and a seller, who each act so as to maximize the expected utility of a single variable, "wealth."[5] The parties are assumed already to have met[6] and not to be immediately able to make contracts with others; thus they will make a contract themselves if doing so would result in a higher expected utility for each than that of the alternative of not making any contract, and this will generally be presumed to be the case. The elements of the contractual situation faced by the parties are described in Figure 1. That is, in order to get the benefits of performance, the buyer must commit certain resources before he learns whether the seller will carry out his promise. (The buyer might have to hire and train men to be able to use a machine that is to be delivered; he may have to advertise the expected appearance of a singer at his nightclub; he may have to make various arrangements in anticipation of going on a charter hunting trip.) The amount of such resources is assumed fixed[7] and will be referred to as reliance expenditures, or simply as reliance.[8] Let

r = reliance

and assume that it is positive.

After the buyer "relies," the seller learns the uncertain contingency. In regard to production contracts, one of two types of contract to be studied, the uncertain contingency will be the seller's production cost. Let



Sequence of events

Figure 1

c = production cost, and

f(·) = probability density of c,

where f is assumed to be positive on a non-degenerate interval $[\alpha, \beta]$, with $\alpha \geqq 0$, and to be zero elsewhere.[9] The seller is assumed to learn the production cost before he actually begins the production process. In regard to contracts for transfer of possession, the other type of contract, the contingency will be the value of a bid made by another party for a good (an object of art; land) that the seller initially has in his possession. Let

b = bid,

and let f (distributed on $[\alpha, \beta]$) stand for the probability density of b as well.[10] (The next section will discuss whether the buyer is aware of the bids and would himself be able to sell the good to a bidder were the seller to deliver it to him.) It will also be assumed that the seller would get no value from consumption of the good; if he does not sell the good, its worth to him is zero.[11]

If the seller satisfies his contractual obligation, that is, if he "performs," the buyer will enjoy a benefit called the expectancy. Let

v = buyer's expectancy,

a positive variable. (This would be interpreted as the enhancement in profits (gross of reliance) due to delivery of the machine or the appearance of the singer; it would also be the monetary equivalent value (gross of reliance) to the individual of going on his hunting trip; it would be the value (gross of reliance) of the object of art or the parcel of land.) The net benefit if the buyer enjoys performance is v - r. The expectancy is assumed to be known to the parties with certainty.[12]

On the other hand, if the seller does not perform, the buyer does not get his expectancy (so his position is -r), for it is assumed that the buyer is not able to purchase immediate substitute performance; the contract good or service is not traded on a well-organized market.[13]

II. Pareto Efficient Complete Contingent Contracts

A. The case where parties are risk neutral

In this subsection a complete contingent contract will mean an enforceable agreement specifying whether or not the seller is to perform under each contingency and specifying also a price. It will be assumed that the price is paid when the contract is made and that no monetary transfers are carried out thereafter.[14] Accordingly, a complete contingent contract may be formally identified with a breach set

B = the set of contingencies under which the seller will not perform;

and with

k = the contract price.

Now let us define

$E_b(B)$ = the expected value--exclusive of price--to the buyer of a contract with breach set B

$E_s(B)$ = the expected value--exclusive of price--to the seller of a contract with breach set B.

Therefore, when price is taken into account, the expected positions of the buyer and of the seller who have made a contract are, respectively, $E_b(B) - k$ and $E_s(B) + k$. It follows that a contract (B, k) is Pareto efficient if there does not exist any other contract (B', k') under which $E_b(B') - k' > E_b(B) - k$ and $E_s(B') + k' > E_s(B) + k$. We will denote the breach set of a Pareto efficient contract by B^*.[15] Before characterizing Pareto efficient complete contingent contracts of the various types of interest to us, let us first state several facts about such contracts in general.[16]

Remark. A complete contingent contract is Pareto efficient if and only if it is described by either of the following equivalent conditions.

(a) The sum of the buyer's and of the seller's expected values is maximized by the contract (i.e., $E_b(B)+E_s(B)$ is maximized by B^*).

(b) The sum of the buyer's and of the seller's values given each contingency is maximized by the contract--the seller performs in a contingency if and only if that would increase or leave equal the sum.[17]

This implies

Proposition 1. Under a Pareto efficient production contract, the seller will not perform when production cost exceeds the buyer's expectancy (i.e., $B^* = \{c|c > v\}$).

Note. The result may be explained as follows. Suppose that the parties contemplated making a contract calling for the seller to perform in some contingency where his cost c exceed the expectancy v. Then the seller would be willing to accept a reduction in the contract price sufficient to induce the buyer to agree to change the contract so as to allow the seller not to perform in the contingency. Similarly, a contract allowing the seller not to perform in a contingency where $c < v$ would be altered so as to require the seller to perform in the contingency. These two statements are in turn true because there is a loss (in the sum of values) if either the seller performs when $c > v$ or fails to perform when $c < v$.

Reliance r does not affect whether it is Pareto efficient for there to be performance because reliance is like a "sunk cost."

Proof. By part (b) of the Remark, it suffices to show that when $c > v$, the sum of values is increased by failing to perform. Now if the seller does not perform, his wealth is k and the buyer's is $- k - r$, so the sum is $- r$. If the seller does perform, his wealth is $k - c$ and the buyer's is $v - k - r$, so the sum is $v - r - c$. Hence the sum is increased by failing to perform when $- r > v - r - c$ or when $c > v$. Q.E.D.

In regard to contracts for transfer of possession, two situations will be distinguished. In the first, it is assumed that bids b are made only to the seller; they are not available to the buyer; were the good delivered to him, the buyer could not then sell to the bidder.[18] By contrast, in the second situation, it is assumed that bids are available to the buyer; were the good delivered to him, the buyer could sell to the bidder and would do so if $v < b$. In both situations it is assumed for simplicity that if the seller does not perform and sells to the bidder, then that is the end of the matter; the buyer does not attempt to make a purchase from the bidder.[19]

Proposition 2. (a) If bids are made only to the seller, then under a Pareto efficient contract for transfer of possession, the seller will not perform when the bid exceeds the expectancy (i.e., $B^* = \{b | b > v\}$). However, (b) if bids are available to the buyer as well, then a contract in which the seller always performs is Pareto efficient; and, more generally, any contract in which the seller performs at least whenever the bid is less than or equal to the expectancy is Pareto efficient (i.e., B^* can be any set which is included in $\{b | b > v\}$).[20]

Note. Result (a) is analogous to Proposition 1, and is based on the fact that if either the seller performs when b > v or fails to perform when b < v, there is a loss in the sum of values. Result (b) is different from (a) because under our assumptions there is no loss in the sum of values if the seller performs when b > v; for in that case the buyer would himself sell to the bidder.

Proof. We again apply part (b) of the Remark. To prove (a), note that if the seller does not perform (selling instead to the bidder), his wealth is k + b and the buyer's is - k - r, so the sum is b - r. If the seller does perform, his wealth is k and the buyer's is v - k - r, so the sum is v - r. Hence the sum is increased by failing to perform when b - r > v - r or when b > v.

To prove (b), note that if the seller does not perform, his wealth is, as before, k + b and the buyer's is - k - r, so the sum is b - r. However, if the seller does perform, whereas the seller's wealth is still k, the buyer's is now max(b, v) - k -r, so the sum is max(b, v) - r. The difference between these sums is b - max(b, v), which is negative for v > b and is 0 otherwise. Hence, for the sum to be maximized, the only requirement is that the seller perform when v > b. Q.E.D.

B. The case where parties are risk averse

Let us very briefly consider the possibility that parties might be risk averse. The first observation that should be made is that parties' attitudes toward risk do not alter the conclusions (in Propositions 1 and 2) whether it is Pareto efficient for the seller to perform. The only effect of the parties' attitudes toward risk is to make it Pareto efficient for money transfers to be made ex post. These transfers will be designed so as to accomplish a mutually beneficial sharing of risk.[21]

Thus, if the buyer is risk averse and the seller risk neutral, it will be Pareto efficient for the seller to act as a perfect insurer of the buyer; the transfers must therefore be such as to leave the buyer with an unvarying level of wealth.[22] In particular, when under a Pareto efficient contract the seller does not perform, he will pay the buyer his expectancy.[23]

Conversely, if the buyer is risk neutral and the seller is risk averse, it will be Pareto efficient for the buyer to act as the perfect insurer, and the transfers must therefore be such as to leave the seller with an unvarying level of wealth. Hence, under a Pareto efficient contract, the buyer will absorb the entire risk in production cost or bids, as the case may be.[24]

If both the buyer and the seller are risk averse, then of course it will not be Pareto efficient for either to act as a perfect insurer of the other. The transfers made will accomplish a sharing of risk in accord with the parties' degrees of risk aversion, etc., and the situation will be an appropriate compromise between those described in the last two paragraphs.

III. Why Contracts Are Incomplete

As stated in the introduction, the view that will be taken here is that it is in the mutual interests of parties to leave contracts incomplete. This will be so because the possible adverse consequences of failure to provide for certain contingencies may not be sufficient to justify bearing the sure costs of including terms for those contingencies in the contract plus the expected costs of verifying their occurrence.

A. The case where parties are risk neutral

Let us make the following assumptions. First, the parties must choose a set S of contingencies for which to write explicit provisions: Only if a contingency θ is in S does the contract specify whether or not the seller shall perform; and let $B \subset S$ be the subset of contingencies under which according to the contract the seller does not perform. If θ is not in S, then something outside the contract (e.g., contract law, custom, renegotiation) determines what will happen should θ occur. (It will of course turn out that θ will be in S only if the provision for θ would alter what would otherwise happen if θ occurs.)

Second, there is a positive rate of cost for each party of $1/2\alpha(\theta)$ of providing for θ; for each party $1/2\int_S \alpha(\theta)d\theta$ is therefore the cost of including contingent terms. Third, there is also a positive cost $\beta(\theta)$ that the buyer would bear in order to verify the occurrence of θ, and it is assumed that he will do so whenever the contract calls for the seller not to perform. Thus, if $h(\theta)$ is the probability density of θ, then $\int_B \beta(\theta)h(\theta)d\theta$ is the expected verification cost .

Under these assumptions, what will be a Pareto efficient selection of contingencies for which to include terms and a determination concerning the seller's performance? In other words, what will be a Pareto efficient incomplete contract (S, B, k)? The next Proposition answers this question, making use of the easily shown fact that an incomplete contract is Pareto efficient if and only if S and B are chosen so as to maximize the sum of the buyer's and the seller's expected values. In stating and proving the Proposition the following additional terms are needed: $x(\theta)$,the sum of the buyer's and seller's values given θ if the contract provides for performance; $y(\theta)$,the sum of values (exclusive of verification costs) given θ if the contract allows non-performance; $z(\theta)$, the sum of values given θ if the contract does not provide for θ.[25]

Proposition 3. Under a Pareto efficient incomplete contract, (a) suppose that there is a provision for a contingency θ. Then the provision will call for performance when $x(\theta) \geqq y(\theta) - \beta(\theta)$.

Hence, (b) the set of contingencies for which there will be provisions in the contract is

(1) $S = \{\theta \mid \alpha(\theta) < h(\theta)[\max(x(\theta),\ y(\theta) - \beta(\theta)) - z(\theta)]\}$.

Note. The formula (1) implies that the following factors militate against making a provision for a contingency: a high cost $\alpha(\theta)$ of making a provision, a low probability density $h(\theta)$ of occurrence, a high cost $\beta(\theta)$ of verification (should the provision call for non-performance), and a high sum of values $z(\theta)$ in the absence of a provision.

Proof. The sum of expected values is [26]

(2) $$E_b(S, B) + E_s(S, B) = -\int_S \alpha(\theta)d\theta + \int_B (y(\theta) - \beta(\theta))h(\theta)d\theta + \int_{S\sim B} x(\theta)h(\theta)d\theta + \int_{\sim S} z(\theta)h(\theta)d\theta.$$

Now suppose θ is chosen in S. Then if θ is also chosen in B, the sum of integrands is $-\alpha(\theta) + y(\theta) - \beta(\theta)$; and if θ is chosen in $S\sim B$, the sum of integrands is $-\alpha(\theta) + x(\theta)$. Thus, since a Pareto efficient contract maximizes (2), part (a) is true. And from part (a) and (2), part (b) similarly follows. Q.E.D.

B. The case where parties are risk averse

If one or both parties are risk averse, although an analogue to the Proposition can be proved according to which the same qualitative results are valid (a high $\alpha(\theta)$ or a low $h(\theta)$ or a high $\beta(\theta)$ militate against including θ in S, etc.), there is no simple formula determining whether a provision for a contingency will be made.[27]

IV. Remedies for Breach of Contract and Renegotiation as Substitutes for Contingent Provisions

The last Proposition motivates interest in the question to be asked here, namely, if there are no contingent terms whatever in a contract, will the incentives to perform that are inherent in remedies for breach and will the possibilities for renegotiation result in outcomes which approximate the Pareto efficient outcomes of a completely specified contract? As indicated in the introduction, the answer to the question will be a qualified, "Yes." This, and consideration of the costs and difficulties in making contingent provisions just discussed will help to explain the observed incompleteness of contracts, the use of remedies for breach, and resort to renegotiation.

Since the assumption here is that a contract contains no provisions for contingencies, it will merely be a statement of the form "the seller promises to deliver a good" or to "perform a service" and an agreement over price. As before, the price will be assumed to be paid at the outset. The parties will be assumed to be aware that there is a remedy available for breach of contract[28] and that there may be an opportunity for renegotiation if a problem arises.

As noted in the beginning, two types of remedy will be considered. The first is specific performance, under which the seller must do what he promised, and the second is payment of an amount of money as determined by a damage measure. Three measures will be compared. Under the first, the restitution measure, if the seller commits a breach he must return the payment k that he had received from the buyer. Under the reliance measure, the defaulting seller must return the payment and compensate the buyer for reliance expenditures, so the buyer gets $r + k$ in damages; thus the buyer is put in the position he was in before he made a contract. Under the expectation measure, the defaulting seller must pay the buyer what the court perceives to be the expectancy; thus, were the expectancy accurately estimated, the buyer would be put in the position he would have enjoyed had the seller performed.[29] Interest in the possibility of the court's misperceiving the expectancy is due to the commonly held belief that because the determination of the value of performance to the buyer requires the court to answer a hypothetical question, it is easy for errors to be made. By contrast, the determination of the contract price or of reliance do not require the courts to engage in such speculation; the price paid and money spent in reliance should usually be fairly readily assessed. Now let

u = court's estimate of the expectancy v

and

$q(\cdot, u)$ = joint probability density of u and other random variables--either b or c, as specified,

where q is assumed to be positive when and only when u is in a non-degenerate interval $[\underline{u}, \bar{u}]$. Moreover, it is assumed that v is contained in $(\underline{u}, \bar{u})$ and this interval is itself contained in $[\alpha, \beta]$. Last, it is assumed that $\underline{u} > r + k$, in keeping with the idea that the court knows that v must certainly be higher than $r + k$--the buyer would never be willing to make a contract if what he had to spend, $r + k$, was greater than or equal to the value of performance, v.[30]

In what follows, the behavior of the parties under the various remedies will be determined and compared with that under Pareto efficient complete contracts. Also the factors that would make a particular remedy Pareto superior to another will be determined. The definition of this term in the present context is that one remedy is Pareto superior to a second if given any contract price and use of the second remedy, both parties would prefer to make some adjustment in the price and to employ instead the first remedy.

A. The case where parties are risk neutral

The first situation to be analyzed is that where parties do not engage in renegotiation of the contract because it is assumed to be too costly to do so. (Thus the seller decides about performance only on the basis of whether this would make him better off given the buyer's remedy for breach.) Then the more complicated situation with renegotiation will be analyzed.

1. performance and breach when there is no renegotiation. Consider initially production contracts. Under specific performance, the breach set is by definition empty. Thus there is too little breach relative to the Pareto efficient breach set $B^* = \{c \mid c > v\}$; whenever production cost exceeds the expectancy, there ought to be breach but there is not. The expected value to the buyer of the contract under specific performance is

(3) $E_b(sp) - k = v - r - k$

and to the seller it is

(4) $E_s(sp) + k = -\int_{\alpha}^{\beta} cf(c)dc + k.$

Under the restitution measure, the breach set is $B_{res} = \{c \mid c > k\}$. But $k < v - r < v$, for otherwise the buyer would not have made the contract.[31] Thus B_{res} contains B^*, and there is too much breach; whenever production cost exceeds k and is less than v, there ought not to be breach but there is. The expected values of the contract to the buyer and the seller are, respectively,

(5) $E_b(res) - k = vPr\{c|c \leq k\} - r + kPr\{c|c > k\} - k$, and

(6) $E_s(res) + k = -\int_{\alpha}^{k} cf(c)dc - kPr\{c|c > k\} + k.$

(It should be noted here that $k > \alpha$, otherwise the seller would not have made the contract.[32]) Under the reliance measure, the breach set is $B_{rel} = \{c|c > r + k\}$, which contains B* since $r + k < v$.[33] Thus there is again too much breach (but, given k, less than under restitution). The buyer's and seller's expected values are

(7) $E_b(rel) - k = vPr\{c|c \leq r + k\} - r + (r + k)Pr\{c|c > r + k\} - k$, and

(8) $E_s(rel) + k = -\int_{\alpha}^{r+k} cf(c)dc - (r + k)Pr\{c|c > r + k\} + k.$

Last, under the expectation measure, the breach set is $B_{exp} = \{c, u|c > u\}$ since the seller will default and pay the court's estimate u of the expectancy when the production cost is higher. Thus, if u were accurate and equalled v, B_{exp} would equal B* and breach would occur when it ought to. However, if u is an underestimate of v, then there might be breach when there ought not; and if u is an overestimate, there might be performance when there ought not. The expressions for the buyer's and seller's expected values are[34]

(9) $E_b(exp) - k = vPr\{c, u|c \leq u\} - r + \iint_{\{c>u\}} uq(c,u)dcdu - k$, and

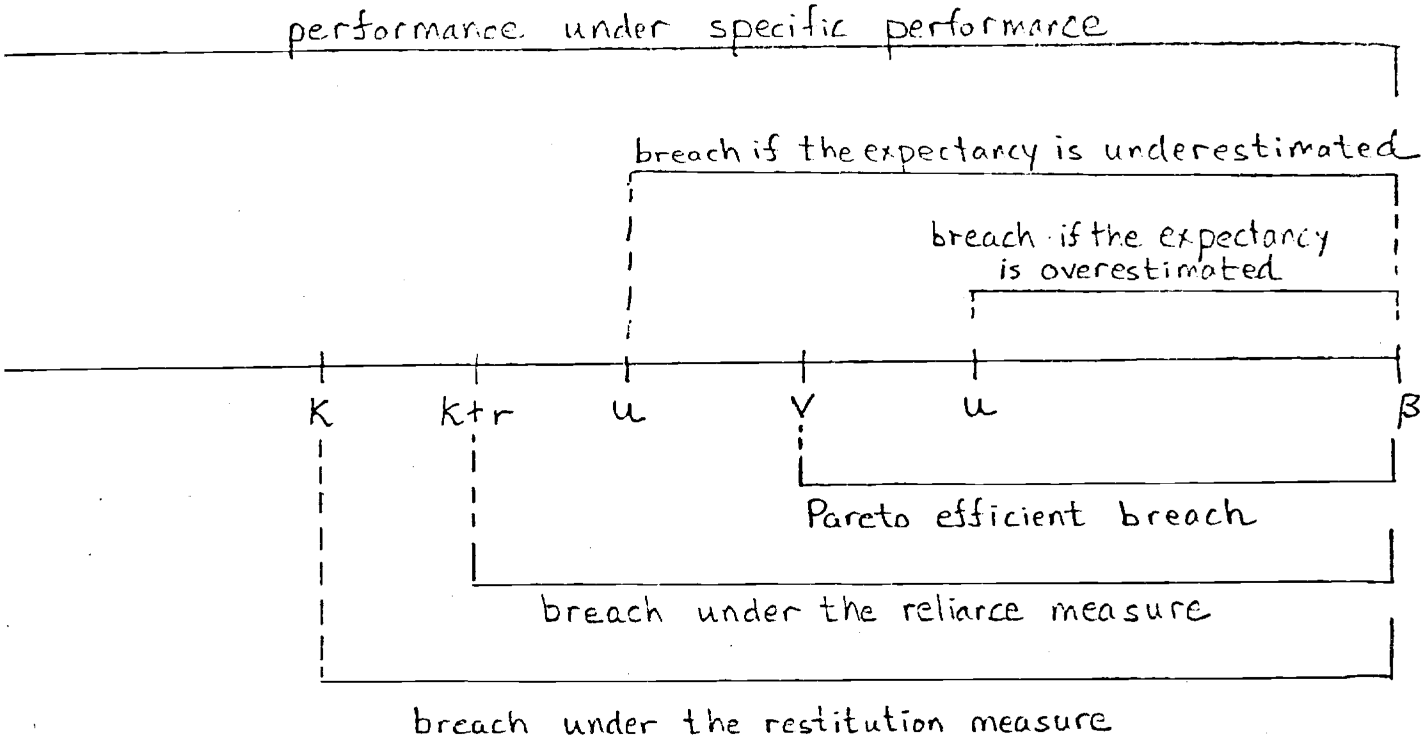
(10) $E_s(exp) + k = -\iint_{\{c\leq u\}} cq(c, u)dcdu - \iint_{\{c>u\}} uq(c,u)dcdu + k.$

Figure 2 summarizes the relationship between breach and performance under the four remedies and under a Pareto efficient complete contingent contract, and will help in comparing the remedies as to their mutual desirability.

Proposition 4. In a production contract (a) the reliance measure is always Pareto superior to the restitution measure. However, the relationship among the other remedies depends on the nature of the contractual situation: (b) The expectation measure is Pareto superior to the other remedies if the estimate of the expectancy is sufficiently precise (i.e, if $\underline{u}$ and $\bar{u}$ are sufficiently close to v). (c) The reliance measure is Pareto superior to the other remedies if the problem of excessive performance under specific performance and under the expectation measure (due to overestimation of the expectancy) is more important than the problem of inappropriate breach.[35] (d) Specific performance is Pareto superior to the other remedies if the problem of excessive breach under the expectation measure (due to underestimation of the expectancy) and under the reliance measure is more important than the problem of excessive performance.

Note. Because the reliance measure induces even more excessive breach than the restitution measure, part (a) is true.[36] And because the expectation measure induces Pareto efficient breach if the expectancy is accurately estimated, part (b) is clear. The other two results are self-explanatory.

Proof. To demonstrate (a), we must show that for any price k_1 of a contract under the restitution measure, there exists a price k_2 such that both parties are better off under the reliance measure. To do this we will show several facts that will enable us to employ a graphical



Performance and breach under different remedies (as a function of the uncertain production cost–or alternative bids)

Figure 2

proof. Let $E(res)=E_b(res) + E_s(res)$ and define similarily $E(rel)$, $E(exp)$, and $E(sp)$; and observe that for any k such that $r + k \leqq v$,

$$(11)\quad E(rel) - E(res) = vPr\{c|k < c \leqq r + k\} - \int_k^{r+k} cf(c)dc = \int_k^{r+k} (v - c)f(c)dc > 0.$$

In particular, this must be true at k_1 since we noted before that under the restitution measure the buyer would not be willing to make a contract unless $r + k < v$. Additionally, we have for any k

$$(12)\quad (E_s(res) + k) - (E_s(rel) + k) = \int_k^{r+k} cf(c)dc$$

$$+ (r + k)Pr\{c|c > r + k\} - kPr\{c|c > k\}$$

$$= \int_k^{r+k} (c - k)f(c)dc + rPr\{c|c > r + k\} > 0,$$

and this also must be true at k_1. Moreover,

$$(13)\quad \frac{dE(rel)}{dk} = vf(r + k) - (r + k)f(r + k) = (v - r - k)f(r + k) > 0$$

for $k < v - r$, and

$$(14)\quad \frac{d(E_s(rel) + k)}{dk} = - (r+k)f(r+k) + (r+k)f(r+k) - Pr\{c|c>r+k\} + 1 > 0.$$

Finally, since at $k = v - r$

$$(15)\quad E_b(rel) - k = vPr\{c|c \leqq v\} - r + vPr\{c|c > v\} - (v - r) = 0,$$

we must have at $k = v - r$, $E_s(rel) + k = E(rel)$. These facts justify the relationship among the points above k_1 in Figure 3 and also our having drawn $E(rel)$ and $E_s(rel) + k$ as rising and meeting above the point $v - r$. Now if given k_1 the reliance measure is employed rather than restitution, the seller is made worse off; he moves from A to $E_s(rel) + k_1$. Suppose then that the price is raised to k_2, which is the point at which the seller becomes just as well off as he had been under restitution. But at k_2, the buyer is strictly better off than he had

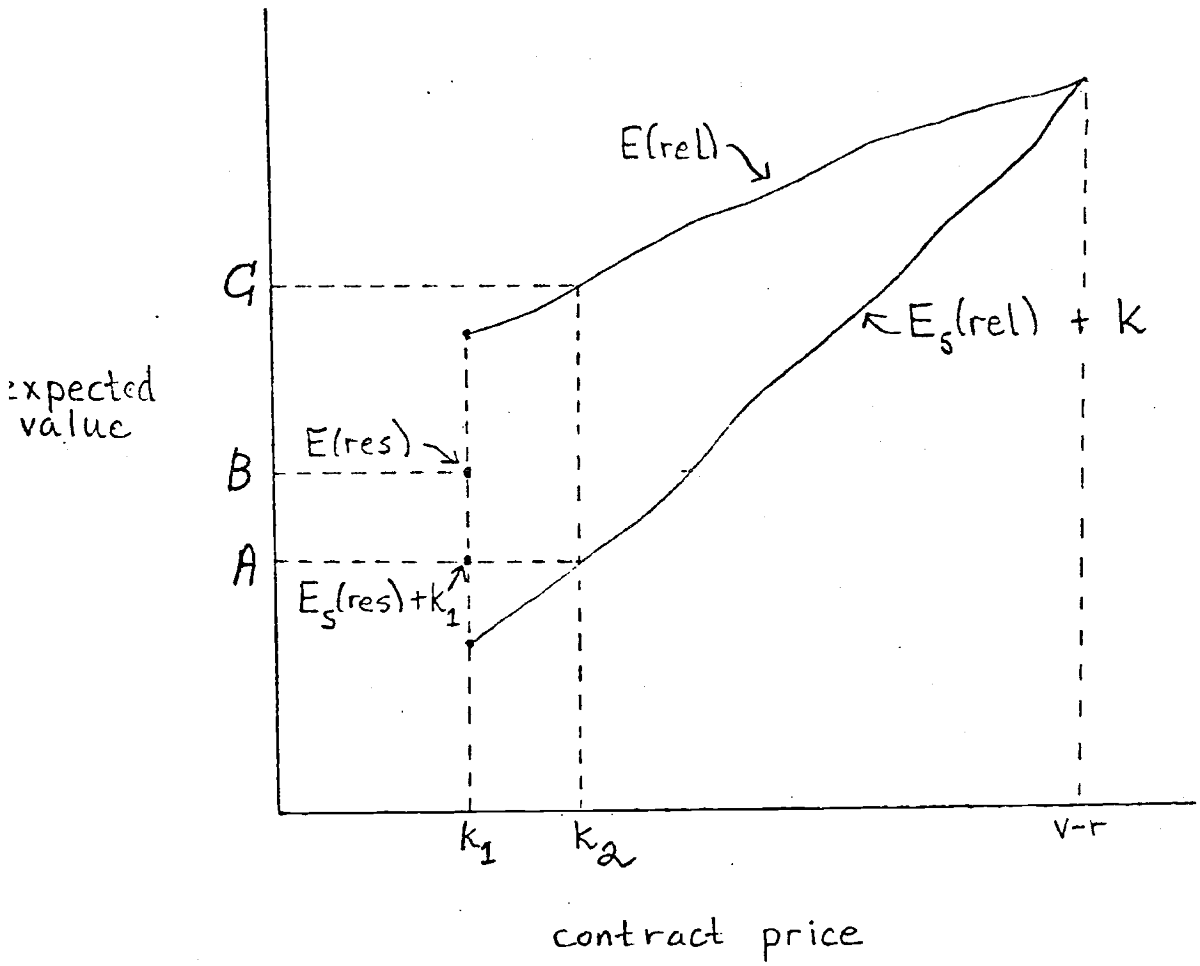

E(rel)
E_s(rel) + k
G
B
A
E(res)
E_s(res)+k_1
expected value
k_1
k_2
v-r
contract price

Figure 3

been, for $E_b(\text{rel}) - k_2 = C - A$ which exceeds $B - A = E_b(\text{res}) - k_1$. Hence, if the price is raised a little above k_2, both buyer and seller are made better off by use of the reliance measure.

To demonstrate (b), since the contract price does not affect the breach set and thus the sum of expected values under the expectation measure, it suffices to prove that E(exp) exceeds E(sp) and E(rel) if $\underline{u}$ and $\bar{u}$ are sufficiently close to v. Now $E(\exp) \to v\Pr\{c|c \leqq v\} - r - \int_{\alpha}^{v} cf(c)dc$ as $\underline{u}$ and $\bar{u} \to v$, whereas E(sp) and E(rel) are unaffected. Hence $E(\exp) - E(sp) \to -v(1 - \Pr\{c|c \leqq v\}) + \int_{v}^{\beta} cf(c)dc = \int_{v}^{\beta}(c - v)f(c)dc > 0$.

Also $E(\exp) - E(\text{rel}) \to v\Pr\{c|r + k < c \leqq v\} - \int_{r+k}^{v} cf(c)dc = \int_{r+k}^{v}(v - c)f(c)dc > 0$ since it was noted that under the reliance measure the buyer would not be willing to make the contract unless $r + k < v$.

To show (c), let us first compare E(rel) assuming that $k = 0$ with E(sp) (which is independent of k). Then

$$(16)\quad E(\text{rel}) - E(sp) = -v\Pr\{c|c > r\} + \int_{r}^{\beta} cf(c)dc = \int_{r}^{\beta}(c - v)f(c)dc$$

$$= \int_{v}^{\beta}(c - v)f(c)dc - \int_{r}^{v}(v - c)f(c)dc.$$

The first term after the last equal sign is positive and represents the waste of excessive performance under specific performance, while the second term is negative and corresponds to the loss due to excessive breach under reliance. Our assumption will be that the first term is sufficiently large to exceed the second. Now consider a contract with price k_1 under which specific performance is the remedy for breach. To prove that there is a price k_2 such that both parties would be better off under the reliance measure, consider Figure 4. Since our assumption is that C > B and since from (13) E(rel) rises with k, we know that D > B. And observe that at k_2 the seller is just as well off under the reliance measure as he was under specific performance at k_1, but the buyer is strictly better off since D - A > B - A. Consequently, at a price slightly above k_2 both parties will be better off under the reliance measure. The argument for Pareto superiority of the reliance measure over the expectation measure is analogous: We have (after some manipulation) that

$$(17)\quad E(rel) - E(exp) = \iint_{\{u \geq c > v\}} (c - v)q(c,u)dcdu - \iint_{\{u \geq c, v \geq c > r+k\}} (v - c)q(c,u)dcdu,$$

where the first term is positive, representing the relative gain when there is appropriate breach under reliance but excessive performance under the expectation measure, and where the second term is negative, corresponding to the relative loss when there is inappropriate breach under reliance and worthwhile performance under the expectation measure. Employing, then, the assumption that the first term exceeds the second, we can use a graph similar to that of Figure 3 to complete the argument.

To prove (d), because E(sp) does not depend on the contract price, it will suffice to show that E(sp) exceeds E(rel) and E(exp). Observe first that

$$(18)\quad E(sp) - E(rel) = vPr\{c \mid c > r + k\} - \int_{r+k}^{\beta} cf(c)dc = \int_{r+k}^{\beta} (v - c)f(c)dc$$

$$= \int_{r+k}^{v} (v - c)f(c)dc - \int_{v}^{\beta} (c - v)f(c)dc.$$

This will be positive if the first term, the cost of excessive breach under the reliance measure, exceeds the second, the cost of excessive performance under specific performance. Likewise,

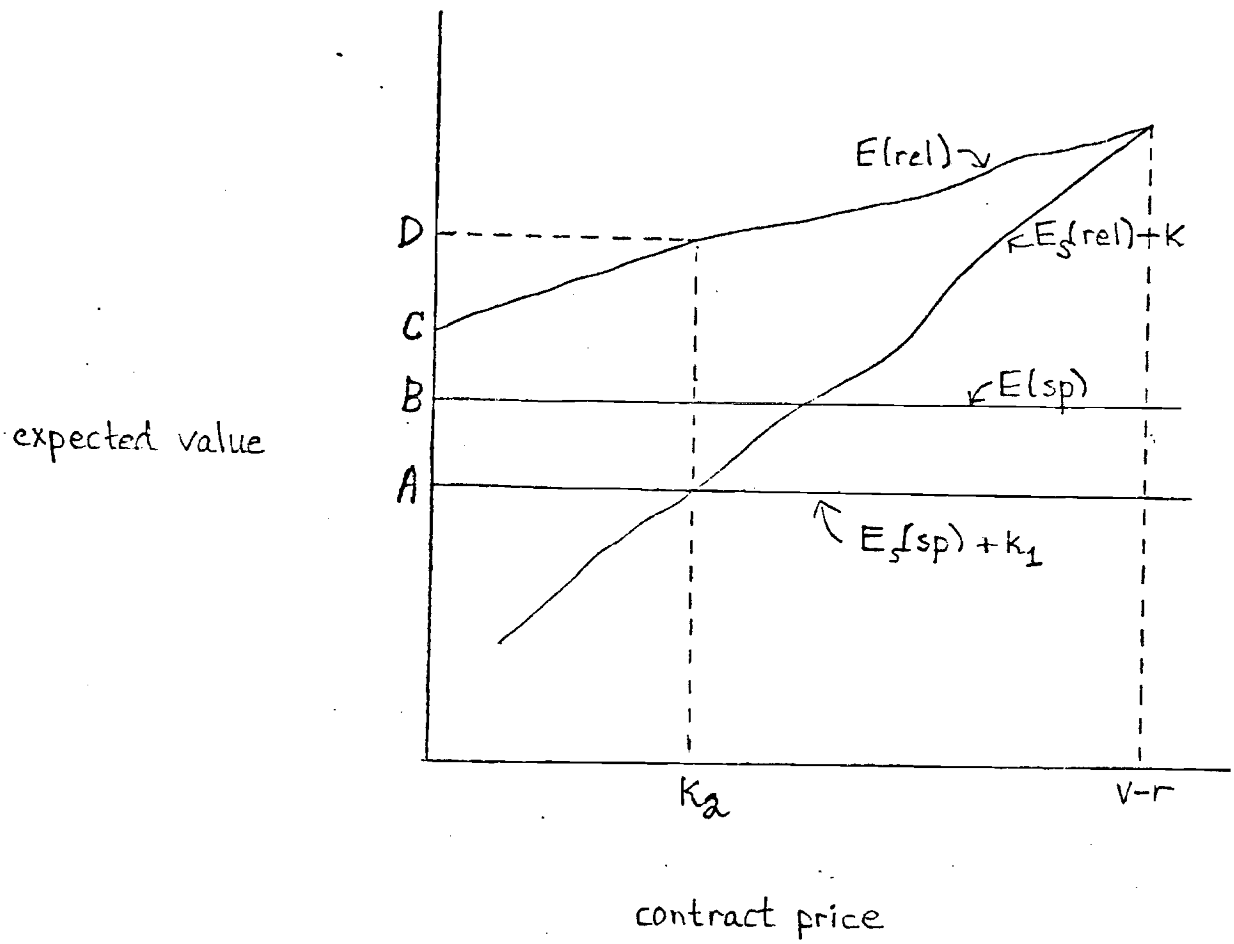

E(rel)
D
$E_s(\text{rel})+k$
C
B
E(sp)
expected value
A
$E_s(\text{sp})+k_1$
k_2
v-r
contract price

Figure 4

(19) $E(sp) - E(exp) = \iint_{\{v \geq c > u\}} (v - c)q(c,u)dcdu - \iint_{\{c>v,\ c>u\}} (c - v)q(c,u)dcdu,$

which will be positive if the first term, the cost of excessive breach under the expectation measure, exceeds the second, the relative cost of excessive performance under specific performance. Q.E.D.

Consider now contracts for transfer of possession and assume initially that bids are made only to sellers. Then the situation is essentially the same as it was for production contracts: Figure 2 still applies (but with the axis representing bids rather than production cost); there is excessive performance under specific performance, excessive breach under the restitution measure, etc. For completeness, however, we will write the various expected values. Under specific performance, they are simply

(20) $E_b(sp) - k = v - r - k$, and

(21) $E_s(sp) + k = k$.

Under the restitution measure, since the seller defaults and sells to the bidder when the bid b exceeds k, the expected values are

(22) $E_b(res) - k = vPr\{b|b \leq k\} - r + kPr\{b|b > k\} - k$, and

(23) $E_s(res) + k = \int_k^\beta bf(b)db - kPr\{b|b > k\} + k.$

Similarly, under the reliance measure, the formulas are

(24) $E_b(rel) - k = vPr\{b|b \leq r + k\} - r + (r + k)Pr\{b|b > r + k\} - k$, and

(25) $E_s(rel) + k = \int_{r+k}^\beta bf(b)db - (r + k)Pr\{b|b > r + k\} + k.$

And under the expectation measure, the formulas are

(26) $E_b(exp) - k = vPr\{b, u|b \leq u\} - r + \iint_{\{b>u\}} uq(b,u)dbdu - k$, and

(27) $E_s(exp) + k = \iint bq(b,u)dbdu - \iint uq(b,u)dbdu + k.$

When bids made to the seller are available to the buyer also, some of the buyer's expected values are changed since if he had the good he would sell to the bidder whenever $b > v$. (Of course, the seller's behavior and expected values are as before.) To be precise, under specific performance,

$$(28)\quad E_b(sp) - k = v\Pr\{b \mid b \leqq v\} + \int_v^{\beta} bf(b)db - r - k,$$

and under the expectation measure,

$$(29)\quad E_b(\exp) - k = v\Pr\{b, u \mid b \leqq u,\ b \leqq v\} + \iint_{\{u \geqq b > v\}} bq(b, u)dbdu - r + \iint_{\{b > u\}} uq(b, u)dbdu - k.$$

Under the restitution measure, however, the buyer's expected value is unchanged; since he will get delivery only when $b \leqq k$ and since $k < v$ (otherwise it can be shown that he would not have been willing to make the contract), the buyer will never wish to sell the good to the bidder. Similarly, the buyer's expected value is unchanged under the reliance measure.

With these formulas, the next result may be proved.

Proposition 5. In a contract for transfer of possession, (a) if it is assumed that bids are made only to the seller, then the relationship among remedies for breach is exactly as described (in Proposition 4) in respect to production contracts. However, (b) if it is assumed that bids are available to the buyer as well, then specific performance is Pareto superior to the expectation measure, which is Pareto superior to the reliance measure, which is Pareto superior to the restitution measure.

Note. As remarked, part (a) is true for reasons analogous to those explaining the previous Proposition; and since the proof is virtually the same as that of the Proposition (with (20)-(27) playing the role of (3)-(10)), it is omitted. With regard to part (b), it is obvious that when bids are available to the buyer, specific performance is Pareto superior to the other remedies. On the one hand, Proposition 2 (b) states that the seller's behavior is actually Pareto efficient under specific performance because there is no problem of excessive performance; if the seller is delivered the good when the bid is higher than the expectancy, he will sell it. On the other hand, under the other remedies, there is a possibility that the seller will default when the bid is less than the expectancy. And since the likelihood of this is higher under the reliance measure than under the expectation measure, and higher still under the restitution measure than under the reliance measure, the relative ranking of the remedies is explained.

Proof. To prove (b), it suffices to show that $E(sp) > E(exp) > E(rel)$, for $E(sp)$ and $E(exp)$ do not depend on k. (We already know by appeal to part (a) that the reliance measure is Pareto superior to the restitution measure, since we observed that under these two measures neither the buyer's nor the seller's behavior changes on account of the availability of bids to the buyer.) Now, recalling that $E(sp)=E_b(sp)+E_s(sp)$ and that $E(exp)$ and $E(sp)$ are defined similarly, we have from (28), (21), (29), and (27),

$$(30)\quad E(sp) - E(exp) = v(\Pr\{b \mid b \leqq v\} - \Pr\{b, u \mid b \leqq u,\ b \leqq v\})$$

$$+ \int_v^{\beta} bf(b)db - \iint_{\{u \geqq b > v\}\ \{b > u\}} bq(b, u)dbdu = v\Pr\{b, u \mid u < b \leqq v\} - \iint_{\{u < b \leqq v\}} bq(b, u)\,dbdu$$

$$= \iint_{\{u < b \leqq v\}} (v - b)q(b, u)dbdu > 0,$$

as required. Also, from (23) and (24),

$$(31)\ E(\exp) - E(\text{rel}) = v(\Pr\{b, u \mid b \leqq u, b \leqq v\} - \Pr\{b \mid b \leqq r + k\})$$

$$+ \iint_{\{u \geqq b > v\}\ \{b > u\}} bq(b, u)dbdu - \int_{r+k}^{\beta} bf(b)db = v\Pr\{b, u \mid b \leqq u, r + k < b \leqq v\}$$

$$- \iint_{\{b \leqq u,\ r+k<b\leqq v\}} bq(b, u)dbdu = \iint_{\{b \leqq u,\ r+k<b\leqq v\}} (v - b)q(b, u)dbdu > 0.$$

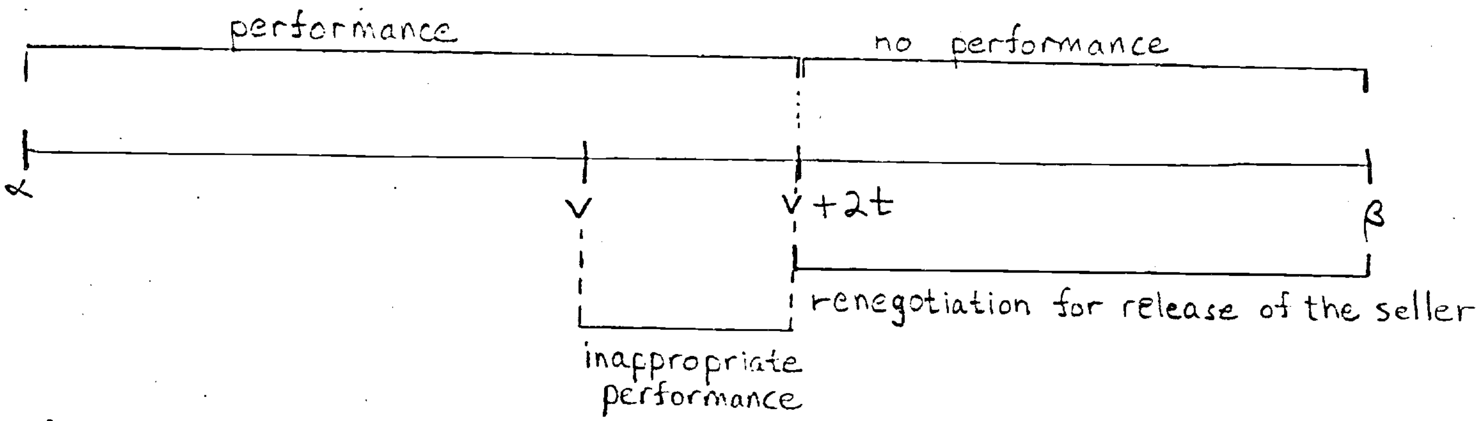
Note here that in combining terms to get the second equality, we made use of the fact that u must exceed r + k, for we had assumed that $\underline{u}$ > r + k. Q.E.D.

2. <u>performance and breach when there is renegotiation</u>. It will be assumed here that the parties will engage in renegotiation if (given the contingency) the resulting benefits would exceed the costs. Specifically, it will be assumed that if the buyer and the seller engage in renegotiation, each will bear a positive cost t in the process; and they will agree on whether the seller is to perform or to be released on the basis of which would maximize the sum of values (i.e., they will agree on the Pareto efficient outcome). Further, if they engage in renegotiation, they will split equally the gain in the sum of values from having done so; this will be done by means of a sidepayment.[37] Last, they will decide to engage in renegotiation if and only if the resulting increase in the sum of values exceeds the joint costs of 2t (i.e., the decision whether to renegotiate is Pareto efficient).

It will be seen that <u>the possibility of renegotiation does not alter the qualitative nature of the results of the last subsection; Propositions 4 and 5 remain valid</u>. This is because when there was no renegotiation, the mutual desirability of a remedy depended on how well it functioned as a device to induce the seller to behave in a Pareto efficient way; a remedy was undesirable to the extent that it resulted in Pareto inefficient breach or Pareto inefficient performance. In the present case, such departures from Pareto efficiency under a remedy are still undesirable: if a departure would be large, then the parties will engage in the costly process of renegotiation; and if the departure would not be so large as to justify renegotiation, the departure will be observed to occur. In sum, then, the possibilites for renegotiation mitigate but do not eliminate losses that would otherwise occur under the remedies.

Consider for example the functioning of specific performance in respect to production contracts. When there was no renegotiation, the problem with this remedy was that if the production cost c exceeded the expectancy v, enforced performance involved a loss to the parties of c - v. In the present case, if c - v exceeds the costs of renegotiation of 2t, the parties will find it worthwhile to bear the costs of that process, and the result will be that the seller will pay the buyer for release from his obligation to perform. Or, consider the remedy of restitution. Before, the problem was one of excessive breach; if c exceeded the price k but was less than v, there was a loss of v - c. In the present case, if the loss v - c exceeds 2t, then the parties will decide to renegotiate, and the buyer will pay the seller to perform.

Let us now describe precisely how the opportunity to renegotiate affects the behavior of parties and the expected value formulas. This will be done only for production contracts, as the situation for contracts for transfer of possession is similar and may easily be understood by analogy to the previous subsection. Under specific performance, the situation is shown in Figure 5. As we just noted, the buyer and the seller will renegotiate for release of the seller when c - v > 2t,



Performance, breach, and renegotiation under specific performance (as a function of production cost–or alternative bids)

Figure 5

or when $c > v + 2t$; and the seller will pay the buyer $v + 1/2\,(c - v)$ for his release.[38] Thus, the expected value formulas are [39]

$$(32)\quad E_b(sp) - k = vPr\{c \mid c \leqq v + 2t\} - r + \int_{v+2t}^{\beta}(v + 1/2(c - v))f(c)dc - tPr\{c \mid c > v + 2t\} - k, \text{ and}$$

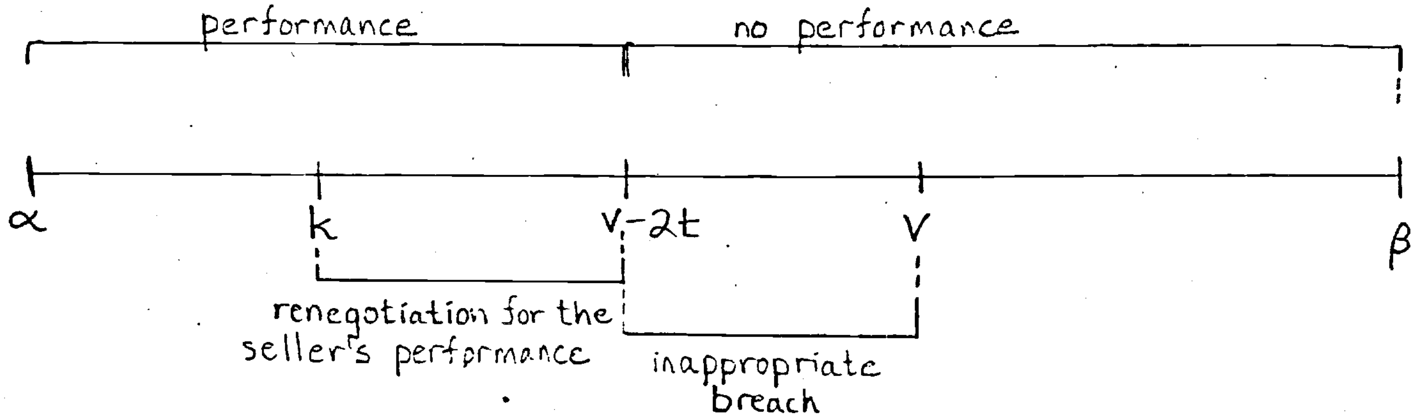
$$(33)\quad E_s(sp) + k = -\int_{\alpha}^{v+2t} cf(c)dc - \int_{v+2t}^{\beta}(v + 1/2(c - v))f(c)dc - tPr\{c \mid c > v + 2t\} + k.$$

Under the restitution measure, since the seller can default and pay k, the situation is as illustrated in Figure 6. Here, as remarked, the parties will renegotiate only when there would be breach--when both $k < c$ and when the consequent loss $v - c$ would exceed 2t, that is, when $k < c < v - 2t$. (Thus, if $k \geqq v - 2t$, the parties will never renegotiate; as this was analyzed in the last subsection, we assume that $k < v - 2t$). Given that this occurs, under our assumptions the buyer will pay the seller $c + 1/2\,(v - c) - k$ to perform.[40] If $c \geqq v - 2t$, the seller will default and pay damages. Therefore, the expected value formulas are

$$(34)\quad E_b(res) - k = vPr\{c \mid c < v - 2t\} - r - \int_{k}^{v-2t}(c + 1/2\,(v - c) - k)f(c)dc - tPr\{c \mid k < c < v - 2t\} + kPr\{c \mid c \geqq v - 2t\} - k, \text{and}$$

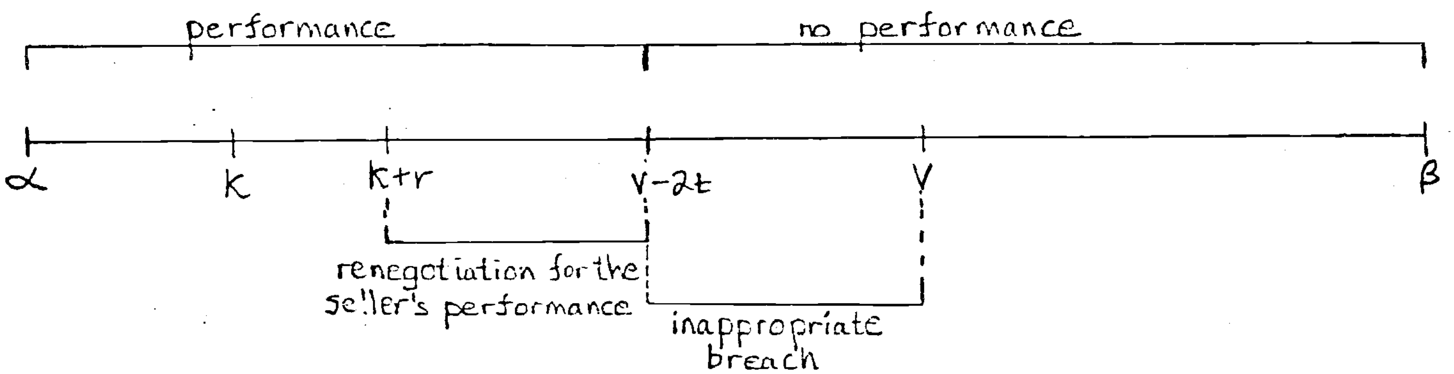
$$(35)\quad E_s(res) + k = -\int_{\alpha}^{v-2t} cf(c)dc + \int_{k}^{v-2t}(c + 1/2(v - c) - k)f(c)dc - tPr\{c \mid k < c < v - 2t\} - kPr\{c \mid c \geqq v - 2t\} + k.$$

Under the reliance measure, the situation is pictured in Figure 7 and is similar to that under the restitution measure. There will be renegotiation when $r + k < c < v - 2t$ (we assume that $r + k < v - 2t$ to avoid



Performance, breach, and renegotiation under the restitution measure (as a function of production cost-or alternative bids)

Figure 6



'erformance, breach, and renegotiation under the reliance measure (as a function of production cost—or alternative bids)

Figure 7

the case treated before when there was no renegotiation) and the buyer will pay the seller $c - r + 1/2\,(v - c) - k$ to perform.[41] Hence

$$(36)\ E_b(\text{rel}) - k = v\Pr\{c|c < v - 2t\} - r - \int_{r+k}^{v-2t}(c - r + 1/2(v - c) - k)f(c)dc$$

$$- t\Pr\{c|r + k < c < v - 2t\} + (r + k)\Pr\{c|c \geqq v - 2t\} - k, \text{ and}$$

$$(37)\ E_s(\text{rel}) + k = - \int_{\alpha}^{v-2t}cf(c)dc + \int_{r+k}^{v-2t}(c - r + 1/2(v - c) - k)f(c)dc$$

$$- t\Pr\{c|r + k < c < v - 2t\} - (r + k)\Pr\{c|c \geqq v - 2t\} + k.$$

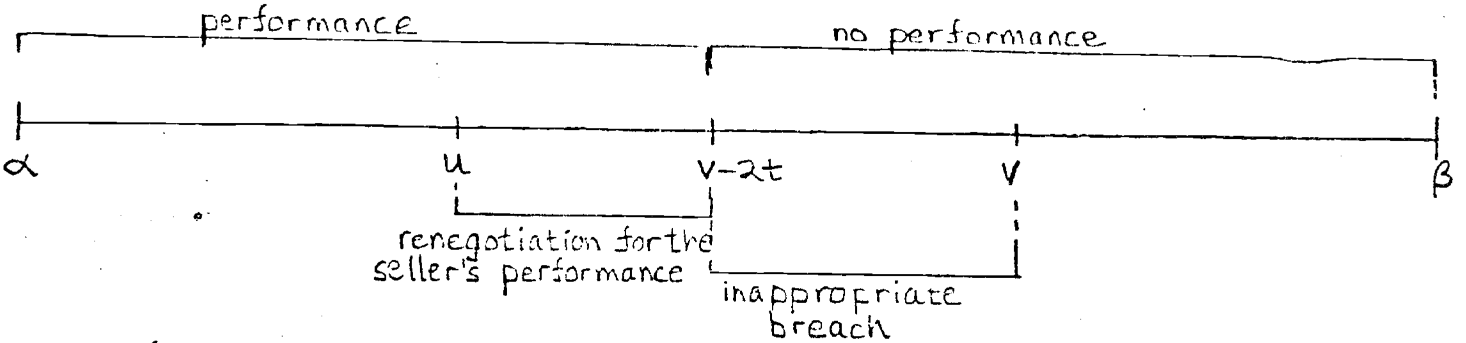
Last, under the expectation measure, the situation depends on whether the court's estimate u is within $2t$ of v. If it is, there is never renegotiation, and the seller will default and pay u when $c > u$. However, if $u < v - 2t$, then Figure 8a applies. Here, there will be renegotiation when $u < c < v - 2t$ and the buyer will pay the seller $c - u + 1/2\,(v-c)$ to perform;[42] when $c \geqq v - 2t$ the seller will commit breach and pay damages. On the other hand, if $u \geqq v - 2t$, then the relevant situation is shown in Figure 8b. In this instance, there will be renegotiation when $v + 2t < c \leqq u$ and the seller will pay the buyer $v + 1/2\,(c - v)$ to be released;[43] when $c \geqq u$ the seller will default and pay u in damages. It follows from our description of behavior under the expectation measure that[44]

$$(38)\ E_b(\exp) - k = v(\Pr\{c|c \leqq v - 2t\} + \Pr\{c, u|\ v - 2t < c \leqq v + 2t,\ c \leqq u\})$$

$$- r - \iint_{\{u<c<v-2t\}}(c - u + 1/2(v - c))q(c, u)dcdu - t\Pr\{c,u\backslash u<c<v-2t\}$$

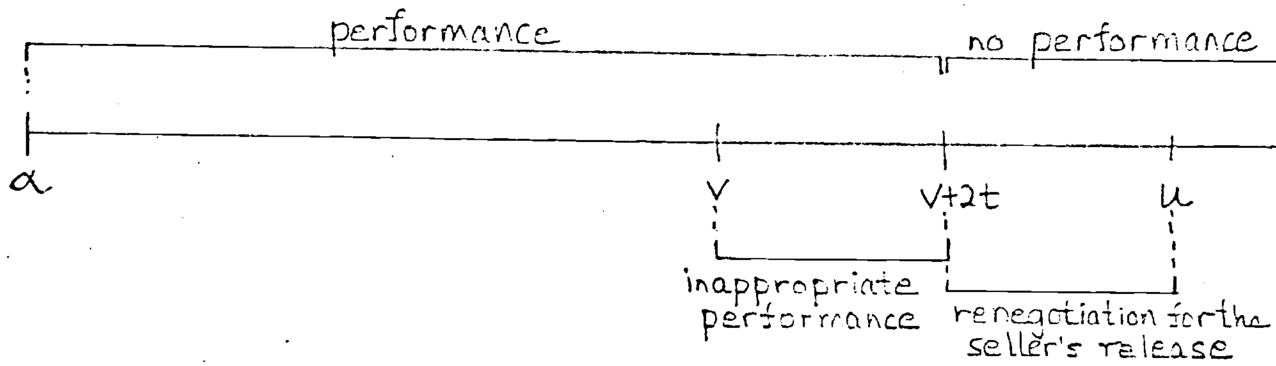
$$+ \iint_{\{v+2t<c\leqq u\}}(v + 1/2(c - v))q(c, u)dcdu - t\Pr\{c, u|v + 2t < c \leqq u\}$$

$$+ \iint_{\{c>u,c>v-2t\}}uq(c, u)dcdu - k, \text{and}$$



Performance, breach, and renegotiation when the expectancy is underestimated by at least 2t (as a function of production cost—or alternative bids)

Figure 8a



Performance, breach, and renegotiation when the expectancy is overestimated by at least 2t (as a function of production cost – or alternative bids)

Figure 8b

$$(39)\ E_s(\exp) + k = -\iint_{\{c\leqq v-2t\}\cup\{v-2t<c\leqq v+2t,\, c\leqq u\}} cq(c, u)\,dc\,du$$

$$+ \iint_{\{u<c<v-2t\}} (c - u + 1/2(v - c))q(c, u)\,dc\,du - t\Pr\{c, u \mid u < c < v - 2t\}$$

$$- \iint_{\{v+2t<c\leqq u\}} (v + 1/2(c - v))q(c, u)\,dc\,du - t\Pr\{c, u \mid v + 2t < c \leqq u\}$$

$$- \iint_{\{c>u,\ c>v-2t\}} uq(c, u)\,dc\,du + k.$$

Using these formulas, we show in the Appendix that parts (a) and (b) of Proposition 4 remain true, leaving the verification of parts (c) and (d) to the interested reader; and as remarked, it is straightforward to determine the expected value formulas for contracts for transfer of possession and to check that Proposition 5 remains valid.

B. The case where parties are risk averse[45]

In considering the role of remedies for breach as implicit substitutes for well specified contracts when one or both of the parties is risk averse, the allocation of risk must be taken into account along with incentives to perform. The general conclusions that emerge from considering this dual role of remedies are simple to state. First, suppose that the buyer is more risk averse than the seller. Then, other things equal, the case for specific performance is strengthened over that for the expectation measure, the case for it is in turn strengthened over that for the reliance measure, and the case for it is stengthened over that for the restitution measure. The reasons for these conclusions are of course that specific performance is by definition perfect insurance for the buyer; the expectation measure provides only imperfect insurance due to the courts' imperfect knowledge of the expectancy; and the reliance and restitution measures leave respectively greater gaps in coverage against loss of the expectancy (and create respectively greater probabilities of such loss).

Suppose on the other hand, that the buyer is better able to bear risk than the seller. Then our conclusions depend on the type of contract in question. In production contracts specific performance appears to be least desirable, and the expectation measure, the reliance measure, and the restitution measures seem to be successively more desirable remedies on grounds of risk-sharing. Specific performance makes the seller absorb (or renegotiate to be released from) the potentially great risks associated with variation of the production cost; the expectation measure limits the risk to the (estimated) expectancy; the reliance and restitution measures limit the risk to lower amounts. Thus what is a mutually desirable remedy from the point of view of risk sharing may be an undesirable remedy from the point of view of the creation of incentives to perform. In regard to contracts for transfer of possession, the situation seems different; specific performance appears to be most desirable, and the expectation measure, the reliance measure, and the restitution measure seem to be successively less desirable remedies on grounds of risk sharing. Under specific performance, there is, as is advantageous, no variability in the seller's position--he gets his payment and delivers the good which he has in his possession to the buyer. Under the expectation measure, there is variability in the seller's final position, for he might default, pay damages, and sell to a high bidder. Under the reliance and restitution measures, this variability is greater, since the difference between a bid and damages paid grows larger.

V. Comment

a. Our general point that it is in the mutual interests of parties to leave agreements incomplete and to rely instead on various substitutes for contingent terms is confirmed by consideration of a broad range of type of agreement. Certainly parties making informal verbal contracts typically omit to mention possible contingencies unless these are very likely or very important; and even parties carefully drawing up formal contracts frequently do not provide explicitly for many contingencies. It is generally appreciated from the outset that if an unexpected event occurs leading a party to wish to default on his contractual obligation, the difficulties that then arise will usually be settled in a reasonably satisfactory way through use of recognized excuses, renegotiation, or remedies for breach of contract.[46]

b. Moreover, our particular results concerning the relative desirability of remedies for breach of contract are consonant with two general facts about their actual use.[47] First, the expectancy is the favored measure of damages, provided that it can be fairly accurately assessed. (This is, of course, in accord with our result that the expectation measure induces performance when it would be mutually desirable.) And second, specific performance (rather than a damage measure) is employed as the remedy for breach primarily for certain types of contracts for transfer of possession, notably for contracts for the conveyance of land. (This is in accord with our result on the mutual desirability of specific performance as a remedy for breach of contracts for transfer of possession when the buyer has access to bids made to the seller; and as was explained, it also appears sensible on grounds of the allocation of risk.)

Footnotes

* Assistant Professor, Harvard Law School and Research Associate, National Bureau of Economic Research. I wish to thank the National Science Foundation (grant nos. SOC 76-20862 and SES 8014209) for financial support and S. Grossman, A.M. Polinsky, and R. Posner for comments.

1. The first systematic formal analysis of damage measures for breach is presented in Shavell [1980]; but see extensions and additions made in Rogerson [1980]. See also Kornhauser [1980]; and see Posner [1977] for informal analysis of contracts and breach that will be of interest to economists.

2. The necessity of verification of a contingency was first emphasized by Radner [1968].

3. While this substitute for provisions is of undeniable significance, it is subject to the important limitation that it can be successfully employed only in respect to those contingencies that are easily observed and for which the agreement that the parties would have made can be confidently imputed.

4. The contribution of this paper to the formal literature on contracts would appear to lie in the analysis of contractual incompleteness; the distinctions drawn between production contracts and contracts for transfer of possession; the consideration of specific performance; the treatment of imperfect knowledge of the courts; and the allowance for costly renegotiation (but see Rogerson [1980] on costless renegotiation).

5. Any non-monetary variable affecting the well-being of a party is thus assumed to have a monetary equivalent.

As the level of initial wealth will have no bearing on the analysis, initial wealth will be suppressed in the notation; thus it will appear as if initial wealth is zero.

6. Thus issues concerning the effort devoted to search for contractual partners are not studied here; for analysis of these issues, see Diamond and Maskin [1979].

7. This is determined endogenously in Shavell [1980], where it is a focus of interest.

8. This and other terminology to be introduced below conforms to standard usage; see for example Fuller and Perdue [1937] or Dawson and Harvey [1977].

9. The function f and other functions to be defined will also be assumed continuous.

10. Note that the bids are taken as exogenous to the model. This simplifying assumption is appropriate if one is thinking of cases in which bids are made without real negotiation with the contracting party. Were the assumption relaxed, it can be shown that the qualitative nature of the results would not be altered.

11. It will be seen that none of the results depend on this assumption, and that only inessential modification of the proofs would be required to account for the possibility of a positive consumption value (but one less than the expectancy (to be defined shortly)).

12. This will be seen to imply that the buyer will never himself wish to commit a breach (whereas he might if his expectancy suddenly fell); only the seller will be led to do so. Relaxing this assumption

would not change the qualitative nature of our results, as is evident from Shavell [1980].

13. If the good or service were traded on a well-organized market, the only reason for parties to make a contract would be to share the risk of fluctuations in the future market price; and because such problems of pure risk-sharing are well understood, they are not examined here. However, Rogerson [1980], and Shavell [1981], an earlier version of this paper, briefly discuss contracts in a market setting.

14. This assumption is inessential. Were payment to be made only if there was performance, the contract price could be raised as if to compensate the seller for the chance he would not be paid, and so forth. See Shavell [1980].

However, if one or both parties are risk averse, we would not wish to make the assumption (and do not--see subsection B). This is because subsequent monetary transfers would clearly matter; they would allocate risk, about which risk averse parties care, by definition.

15. B^* may not be unique; but when this is so it will be noted and there will be no cause for confusion.

16. The proof of the following Remark is obvious and is therefore omitted (but it is presented in Shavell [1981], and the proof of a similar result is presented in Shavell [1980]).

17. This statement is not quite precise, for it does not matter what the seller does if the sum of values is not affected by whether the seller performs. In that case, we will adopt the convention that the seller performs; and we will adopt similar conventions later on in the paper without comment.

18. This assumption seems appropriate if one is considering cases in which bidders would find it costly to identify the contract buyer, or when they would find it best to look elsewhere if the seller reported that he was obligated to deliver to the contract buyer, etc.

19. Were we to complicate the model so as to allow for such purchases, it will be clear that the next Proposition would still be true. This is because there would be a loss in the sum values if the buyer purchased from the bidder rather than receiving delivery directly from the contract seller; for it is natural to assume that the buyer would have to pay more than b--what the seller received--to induce the bidder to sell. (Moreover, the purchase would involve additional transaction costs.)

20. It is also easy to show that the parties should be indifferent as between making contracts with distinct Pareto efficient breach sets: Suppose that $B_1 \neq B_2$ are each Pareto efficient. Then for any contract (B_1, k_1) we must show that there exists a k_2 such that under (B_2, k_2), both parties are equally well off. To do this, let $k_2 = E_b(B_2) - E_b(B_1) + k_1$. Hence, $E_b(B_2) - k_2 = E_b(B_1) - k_1$ and $E_s(B_2) + k_2 = (E_s(B_2) + E_b(B_2)) - E_b(B_1) + k_1 = (E_s(B_1) + E_b(B_1)) - E_b(B_1) + k_1 = E_s(B_1) + k_1$.

21. Specifically, if we let θ denote a contingency, then a complete contingent contract is specified not only by k and B, but also by a function, say $g(\theta)$, indicating how much (positive or negative) the seller is to pay the buyer given the contingency θ. It is easy to show that a necessary condition for Pareto efficiency of a contract $(B, K, g(\cdot))$ is that B be such that for each θ, the sum of values is

maximized. Thus, by the Remark, the choice of B is the same as when parties are risk neutral. And given this choice of B, g must be such as to share risk in a Pareto efficient way, that is, (as Borch [1962] originally showed) the ratio of the buyer's marginal utility to the seller's must be maintained constant over θ.

22. This is of course a well known aspect of Pareto efficient risk sharing.

23. If this is true, the buyer will get his expectancy whether or not the seller performs, so that the buyer's final wealth will be constant (and will equal $v - k - r$).

24. For example, under a contract for transfer of possession, if it is Pareto efficient for the seller to sell to a bidder, the buyer will get the proceeds from the sale. (Of course, because the seller expects to give up these proceeds in such circumstances, he will have received a higher contract price than otherwise.)

25. Thus $z(\theta)$ might equal either $x(\theta)$ or $y(\theta)$, depending on what the seller would do in the absence of a contingent term in the contract. Also, $z(\theta)$ might be less than either or both of $x(\theta)$ and $y(\theta)$ if given θ there would be costs involved in settling disputes.

26. $S \sim B = \{\theta | \theta \varepsilon S, \theta \notin B\}$.

27. There is no simple formula because the decision whether to include a particular contingency depends (as it did not in the risk neutral case) on whether there are provisions for <u>other</u> contingencies. Such interdependence may come about through the following kind of "wealth effect": If provisions are made for other contingencies, a

party's wealth will be lowered due to the costs $\int_S \alpha(\theta)d\theta$. This could in turn increase his need for "insurance" against an adverse θ and thus his desire to include a provision allowing for an appropriate sharing of risk given θ.

28. With one exception, it will make no difference whether one thinks of the parties as being aware of the remedy the courts will apply (the interpretation made in the paper) or as having specified in the contract which remedy (so called liquidated damages) will apply. The exception concerns the expectation measure; see note 29.

29. If the reader wishes to consider the situation where the parties set out in the contract the amount to be paid for breach, then it might be appropriate to assume that $u \equiv v$ since the seller would often have a better idea of the expectancy than the court (and, in any event, we have assumed here that the seller knows v).

30. It can easily be shown that $v > r + k$ must hold for the buyer to be willing to make a contract (i.e., for $E_b - k > 0$) under any of the remedies considered. See for example note 31 below.

31. For the buyer to make the contract, we must have $E_b(\text{res}) - k > 0$. Thus, using the next equation, we have $v\Pr\{c|c \leqq k\} - r + k\Pr\{c|c > k\} - k > 0$ or $v\Pr\{c|c \leqq k\} - r - k\Pr\{c|c \leqq k\} > 0$ or $(v - r)/\Pr\{c|c \leqq k\} > k$, which implies that $v - r > k$.

32. If $k \leqq \alpha$, the seller will commit breach with probability one under restitution, so that the expected value of the contract to the seller would be zero (and to the buyer it would be negative). It will also follow by similar reasoning that k must exceed α under the other remedies as well, and we will not bother to mention this fact again.

33. This follows from the condition $E_b(rel) - k > 0$ by an argument analogous to that in note 31.

34. In the double integral in (9), it will be convenient to indicate the set over which integration is performed by the shorthand $\{c > u\}$ rather than by $\{c, u | c > u\}$ or by upper and lower limits of integration. We will also employ similar shorthands in other integral expressions.

35. The precise meaning of "the problem of excessive performance" and "the problem of inappropriate breach" is best explained in the proof.

36. As the reader who examines the proof will see, there is a complication in the argument showing part (a) (and (c)) due to the fact that under the reliance measure, the contract price affects breach behavior and thus the sum of expected values of the contract. (The higher the price, the less frequent is breach and the higher the sum of values.) This means that to show that the reliance measure is Pareto superior to another measure, one must use the definition of Pareto superiority directly; it does not suffice to demonstrate that the sum of expected values is higher under the reliance measure.

37. The assumptions that they split the gain equally and that they bear equal costs of renegotiation are not important to our results.

38. If we let z be the payment made by the seller for his release, then the improvement in the buyer's position will be $(z - t - r - k) - (v - r - k) = z - t - v$. But we assumed that the parties split equally the gain in the sum of values from renegotiation, and these gains are $(c - v) - 2t$. Hence z must satisfy $z - t - v = 1/2 (c - v) - t$, or $z = v + 1/2(c - v)$. (Note therefore that the higher

the seller's cost of production would be, the more he pays the buyer for release.)

39. In (32), the first term on the right hand side is the expected benefit from performance, the third is expected payments made by the seller when renegotiation occurs, and the fourth is the expected cost of renegotiation. The other formulas below are similarly explained.

40. Let z be the buyer's payment. Then the improvement in the seller's position if he does not default is $(z - c - t + k) - (k - k) = z - c - t + k$ and this must equal $1/2(v - c) - t$. Hence $z = c + 1/2(v - c) - k$.

41. If z is again the buyer's payment, then the improvement in the seller's position if he does not commit breach is $(z - c - t + k) - (k - (r + k)) = z - c - t + k + r$, which must equal $1/2(v - c) - t$, so $z = c - r + 1/2(v - c) - k$.

42. If z is the buyer's payment, then the improvement in the seller's position if he does not default is $(z - c - t + k) - (k - u) = z - c - t + u$, which must equal $1/2 (v - c) - t$, so $z = c - u + 1/2 (v - c)$.

43. Let z equal the seller's payment, so the buyer's improvement in position if the seller is released is $(z - t - r - k) - (v - r - k) = z - t - v$, which must equal $1/2(c - v) - t$. Thus $z = v + 1/2(c - v)$.

44. The terms on the right hand side of (38) are the expected value of performance, reliance, expected payments made to the seller to induce him to perform (when the expectancy is significantly underestimated), the expected cost of such renegotiations, expected payments received from the seller for his release (when the expectancy is significantly overestimated), etc.

45. On this case, see also Kornhauser [1980], Polinsky [1981], and the remarks in Shavell [1980].

46. See the well known article by Macaulay [1963] for an interesting discussion that emphasizes the incompleteness of contracts and settlement of disputes through renegotiation and other informal or extralegal means.

47. Shavell [in process] relates the theoretical results of this paper to contractual practice and to legal commentators' views about contract law.

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APPENDIX

verification of Proposition 4 when parties might renegotiate: To prove (a), we may employ the argument given when the parties did not renegotiate. The analogs of (11) and (12) are

$$\text{(A1)}\quad E(rel) - E(res) = 2tPr\{c|k < c \leqq r + k\} > 0, \text{ and}$$

$$\text{(A2)}\quad E_s(res) - E_s(rel) = \int_k^{v-2t}(c + 1/2(v - c) - k)f(c)dc$$

$$- \int_{r+k}^{v-2t}(c - r + 1/2(v - c) - k)f(c)dc - tPr\{c|k < c \leqq r + k\}$$

$$+ rPr\{c|c \geqq v - 2t\} = \int_k^{r+k}(c + 1/2(v \quad c) - k - t)$$

$$+ \int_{r+k}^{v-2t} rf(c)dc + rPr\{c|c \geqq v - 2t\} > 0,$$

for the last two terms are clearly positive, and so is the first term. (To see that the first term is positive, note that since $k \leqq c \leqq r + k$, the integrand is greater than or equal to $k + 1/2(v - (r + k)) - k - t = 1/2(v - (r + k)) - t$. But this exceeds zero, for we had assumed $v - 2t > r + k$.)

Also

(A3) $\frac{dE(rel)}{dk} = 2tf(r+k) > 0.$

These inequalities justify a graph similar to that of Figure 3, from which the result follows.

To prove (b), note that as $\underline{u}$ and $\bar{u} \to v$, there is never any renegotiation-- $Pr\{u|u < v - 2t \text{ or } u > v + 2t\} = 0$-- so that

$$\text{(A4)}\quad E(exp) \to v(Pr\{c|c \leqq v - 2t\} + Pr\{c|v - 2t < c < v + 2t,\ c \leqq v\}) - r - \int_{\{c\leqq v-2t\}\cup\{v-2t<c<v+2t,c\leqq v\}} cf(c)dc = vPr\{c|c \leqq v\} - r - \int_{\{c\leqq v\}} cf(c)dc.$$

However, E(rel) and E(sp) are unaffected as $\underline{u}$, $\bar{u} \to v$. Hence,

$$\text{(A5)}\quad E(exp) - E(sp) \to -vPr\{c|v < c \leqq v + 2t\} + \int_{v}^{v+2t} cf(c)dc + 2tPr\{c|c > v + 2t\} = \int_{v}^{v+2t}(c-v)f(c)dc + 2tPr\{c|c > v + 2t\} > 0, \text{ and}$$

$$\text{(A6)}\quad E(exp) - E(rel) \to vPr\{c|v - 2t < c \leqq v\} - \int_{v-2t}^{v} cf(c)dc + 2tPr\{c|r + k < c < v - 2t\} = \int_{v-2t}^{v}(v - c)f(c)dc + 2tPr\{c|r + k < c < v - 2t\} > 0,$$

which establishes the result.

Similarly, parts (c) and (d) follow in a straightforward way from the former proof.