Damage measures for breach of contract

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This article studies rules or "damage measures" that determine how much money must be paid by a party who defaults on a contract to the other party to the contract. The theme of the article is that damage measures serve as a substitute for completely specified contracts. In particular, it is shown that under an incompletely specified contract, damage measures can induce parties to behave in a way that approximates what they would have explicitly agreed upon under a fully specified contract. Moreover, it is argued on familiar lines that because it is often costly or impossible to make contractual provisions for contingencies at a very detailed level, there is an evident need for such substitutes for well-specified contingent contracts as are afforded by damage measures.

1. Introduction

■ **General remarks.** When a contract is made, there is always a possibility that one of the parties to it will fail to perform. If this happens, the defaulting party often must pay the other party "damages," the amount being determined in any of a number of ways—by law or regulation, by trade practice or custom, by a previous and explicit agreement of the parties' own device (so called liquidated damages). We shall speak here of the amount paid as depending on a *damage measure* with the understanding that this term is to be given the broadest interpretation.[1]

In considering the nature and function of damage measures, it will first be necessary to recall the notion of a *complete contingent contract*. This is an agreement that specifies the obligations of the contracting parties and the payments to be made under each conceivable circumstance or "contingency." Such an agreement can be as well tailored as is feasible to the capacities and

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[1] The reader who is interested in the economic role of damage measures may wish to refer to the following articles: Barton (1972), Birmingham (1969), Diamond and Maskin (1979), Fuller and Perdue (1937), Goetz and Scott (1977), Grossfeld (1963), Kornhauser (1979), Posner (1977, pp. 88–94), Priest (1978), and Rogerson (1980). Barton's article is the most closely related to the present one (but see footnote 17 on Rogerson), and we shall comment briefly on it as well as on some of the other articles later. The reader may also find it instructive to compare the general approach taken in most of the above references with one based on "moralist" argument; for a recent and systematic analysis of breach and other issues in contract law employing the latter approach, see Fried (1980).

needs of the parties and to the particular contingency that obtains. If the agreement is so constructed, and more specifically, if there are no (prospectively viewed) mutually beneficial changes that the parties can make, then it is said to be a *Pareto efficient* complete contingent contract.

Now it is immediate from its definition that a Pareto efficient complete contingent contract is one to which the parties would find it in their mutual interest to be *bound* to adhere. In particular, they would wish for damages for failure to meet the terms of the contract to be set sufficiently high that the terms would *always* be obeyed.[2]

However, contracts are usually enforced by means of damage measures which are not so stringent that the parties would always decide to meet their terms; contracts are frequently broken. Thus, we are led to infer that contracts must not generally be Pareto efficient complete contingent contracts. And it is, of course, the case that contracts typically do not provide for many contingencies; they leave much unsaid.[3] To understand the connection between their incompleteness and damage measures for breach, it will be convenient to consider an example.

Suppose that a buyer contracts with and pays a seller at the outset to produce and deliver a machine, that the value of having the machine to the buyer would be \$200, and that the relevant contingencies concern production cost, which will become apparent to the seller before he actually begins the production process. Assume first that the contract is Pareto efficient and depends on production cost. Such a contract would *specify* that the seller should proceed with production if the cost is less than the \$200 value of the machine to the buyer, and that the seller should not proceed with production if the cost exceeds \$200.[4] Now assume that the contract does not depend on production

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[2] Yet it should be emphasized that *according to the terms* of a Pareto efficient complete contingent contract, a party will typically be released from certain "obligations" under certain contingencies. For example, such a contract might say that a seller does not have to produce and deliver a good if his factory burns down or if his workers go on strike. Therefore, the statement that a party always obeys the terms of a Pareto efficient complete contingent contract does not mean that the party always meets a named obligation, takes a particular action.

[3] A moment's reflection or a reading of cases should convince the reader of the truth of this assertion, but reference may also be made to a well-known article by Macaulay (1968).

[4] That this really characterizes the Pareto efficient, that is, the *jointly preferred*, complete contingent contract will be proved in the paper. But a calculation may make this plausible to the reader who does not find it obvious.

What we shall illustrate is that, given a contract under which the seller must always perform, we can construct an alternative contract which both he and the buyer would prefer and under which he performs only if production cost is less than or equal to \$200 (which in strict logic should be interpreted as the value of the machine over that of available alternatives). Assume that the cost of production will be \$100 with probability .99 and \$1000 with probability .01. Suppose first that the contract requires the seller to perform regardless of production cost and that the price (recall, paid at the outset) is, say, \$150. Then the expected value of the contract to the seller is \$150 − (.99(\$100) + .01(\$1000)) = \$150 − \$109 = \$41; and the value to the buyer is \$200 − \$150 = \$50. Now suppose that the contract requires the seller to perform only if the production cost is \$100 and that the contract price is lowered to, say, \$145. Then the expected value of the contract to the seller is \$145 − .99(\$100) = \$46 and its expected value to the buyer is .99(\$200) − \$145 = \$53. Thus, *both the seller and the buyer strictly prefer the second contract, the one which allows the seller not to perform under a certain contingency*; letting the seller avoid producing when the cost of doing so exceeds the value of the machine to the buyer made it possible to reduce the price by enough to make the buyer better off (despite the chance he would not get the machine) but at the same time by sufficiently little as still to leave the seller better off.

cost. (Why it might not will be discussed subsequently.) Instead, the contract merely says that the seller "shall produce and deliver the machine," and it further stipulates that the seller shall pay the buyer, let us say, \$200 in damages in the event of breach. Clearly, under this contract, the seller would be *induced* to behave just as he was *explicitly obligated* to behave under the terms of the complete contingent contract: if the production cost is less than \$200, it would be cheaper for the seller to perform than to default and pay damages; and if the cost is greater than \$200, it would be cheaper for the seller to default and pay damages than to perform.[5] (And, equally clearly, it would not be in the mutual interests of the buyer and seller to set damages for breach so high that the seller would always satisfy his contractual obligation to "produce and deliver the machine," for then he would produce it when the production cost exceeds \$200.)

This example illustrates that a damage measure for breach of contract may create incentives for parties who have made a contract which does not provide for various contingencies to act in a way that is close to (and in the example is actually identical to) what they would have agreed upon under a Pareto efficient complete contingent contract.

If it is granted that damage measures for breach of contract can serve as a kind of substitute for complete contingent contracts, the question must still be asked why there is a need for such substitutes, and two frequently noted answers may be reviewed. The first is simply that because of the costs involved in enumerating and bargaining over contractual obligations under the full range of relevant contingencies, it is normally impractical to make contracts which approach completeness.[6] More precisely, if the probability of a contingency (or class of contingencies—an event) is low, then it may be less costly in the expected sense for the parties to resolve difficulties only on the chance that they arise than to bear with certainty the costs of providing for the contingency in the contract.[7]

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[5] Recall that we have assumed that the seller received payment from the buyer at the outset; thus the seller does not lose his payment if he defaults. (But it will be seen from the analysis that our present assumption concerning timing of payment is inessential.)

[6] It should be mentioned that this reason for a need for a substitute for complete contingent contracts explains why there is often (a) resort to renegotiation as a means of "filling in" gaps in contracts and (b) reliance on the background of custom and law to recognize certain contingencies as excuses for breach.

Renegotiation, however, has two disadvantages which limit (but, of course, hardly eliminate) its usefulness relative to damage measures. The first is that renegotiation is a costly process. And the second is that there is no strong reason to believe renegotiation will result in a Pareto efficient outcome when one party cannot verify the occurrence of a contingency. In our example the seller might wish to renegotiate owing to an increase in production costs, and let us assume that the increase is such that the total costs are still below the value of the machine to the buyer. If the buyer does not know what the production costs really are and thinks the seller is bluffing, he might refuse to accommodate the seller, and thereby cause the breakdown of what would still have been a Pareto efficient contract.

Reliance on custom and law is subject to similar disadvantages; and it can act to fill in gaps in contracts only with respect to those readily observable contingencies for which the agreement that parties would have come to can be fairly confidently imputed.

It should also be noted that since reliance on custom and law (and perhaps on renegotiation as well) amounts to an actual addition of contract terms under certain contingencies, it is to be seen as having a function that is quite distinct from damage measures, for they do not add terms in a virtual sense, but rather in an implicit sense through incentive effects.

[7] This might be put as follows. Suppose that t_1 is the cost of including in the contract a Pareto efficient provision for a contingency that will occur with probability p, that e is the cost of en-

The second reason there is a need for substitutes for complete contingent contracts is that it may be difficult or impossible for a party to verify the occurrence of certain contingencies and therefore to tell whether the other party is adhering to the contract.[8] In the example we might imagine that the buyer is unable to determine what the true production cost is—perhaps this would require of him a detailed knowledge of the production process or of the prices of material inputs; thus the buyer would not know whether production cost exceeds \$200; this would render meaningless a contract that depends on production costs. The importance of the problem of some party not easily being able to verify the occurrence of contingencies may be appreciated as substantial when one begins to reflect on the types of contingencies which may be pertinent in a contractual situation. There are usually many aspects of a seller's position which matter to him and which the buyer cannot observe or sometimes even recognize;[9] and the converse is true of the buyer's position.[10]

The arguments of the last two paragraphs should justify interest in the program of the paper, which is to ask how damage measures for breach of contract function and how they compare, given the assumption that contracts do not explicitly provide for *any* contingencies. This is an extreme assumption, but it is appropriate if the goal is to clarify understanding about the role of damage measures as a substitute for Pareto efficient complete contingent contracts.[11]

□ **Informal summary.** In the model to be examined,[12] a risk neutral buyer makes a contract with a risk neutral seller for the delivery of a good or the performance of a service.[13] And, as we have just explained, the contract con-

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forcing the provision if the contingency occurs, that $t_2 > e$ is the cost of dispute resolution if there is no contract provision for the contingency and it occurs, and that b is the cost attributable to deviation from Pareto efficiency under the system for dispute resolution. Then there will be no provision for the contingency included in the contract if the expected cost of making a provision, $t_1 + pe$, exceeds the expected cost of not doing so, $p(t_2 + b)$, or, equivalently, if $t_1 > p(t_2 + b - e)$. *Hence, a low probability of occurrence* (or a low cost due to deviation from Pareto efficiency, etc.) *militates against including a provision for the contingency in the contract.*

[8] This point was first emphasized in the economics literature by Radner (1968).

[9] These include (a) not only determinants of the production cost for a good to be produced, but also (b) determinants of how the seller would turn out to value for his own use a good to be produced (a machine, a portrait to be painted) or one already held (a house, a car, a piece of jewelry) and also (c) bids for the seller's good from alternative buyers.

[10] These aspects include (a) determinants of how the buyer would turn out to value the good and (b) offers of the good from alternative sellers.

[11] A more complete analytical approach than ours would ask (on the basis of factors which we have just discussed) exactly when contingencies would fail to be included in a contract; and presumably, under such an approach damage measures would play the same role in relation to these contingencies as damage measures do generally under our approach.

[12] This model is similar to Barton's (1972), the first of which I am aware to be used in a formal study of damage measures. Barton asks in a series of examples how the use of different damage measures would affect contracting parties' behavior and whether it would lead to maximization of "total value." His analysis touches on several issues which we do not, but it says relatively little about reliance (to be defined shortly), and in any event it is not explicitly directed at showing that damage measures serve as a substitute for Pareto efficient complete contingent contracts.

[13] Issues concerning contract formation (encompassing how parties meet and, if so, whether they reach agreement) are not studied here. However, such issues and others (but not the one of concern to us) are emphasized in Diamond and Maskin (1979), who analyze a model of a market for exchange according to contract of an indivisible commodity (say, homes) in which buyers and sellers decide how long to engage in costly search for contracting partners.

tains no provisions for contingencies; however, the parties understand that if someone defaults, he will have to pay an amount determined by a damage measure.[14] Once the contract is made, the buyer or the seller may have to decide about his level of *reliance*, that is, actions taken before and in anticipation of contract performance.[15] In our example the buyer of the machine might make various expenditures in expectation of delivery; he might hire and train workers to operate the machine or advertise the good to be produced with it. Likewise, the seller might make certain expenditures on the assumption of the buyer's accepting delivery; he would presumably bear some costs of production or might make advance outlays for transportation. After one or the other of the parties decides on and engages in reliance, whatever uncertainty there is in the environment is resolved: the seller learns about production cost or about alternative bids and the buyer realizes how valuable performance will be or learns about alternative offers. Then the contract is either performed or is broken.[16] The possibilities of partial performance or of renegotiation[17] are not considered.

How will these decisions about reliance and about breach be made and, in particular, how will they be influenced by the damage measure? The decision about breach depends on the damage measure in the obvious way: a party will default if and only if his position, given that he does so and pays damages, will be better than that if he performs. On the other hand, the decision about reliance depends on the damage measure in a more complicated and in some respects rather subtle manner. Consider first the possibility that a party who is deciding about reliance may *himself* wish to default. In thinking about this he will take into account the fact that if he turns out to default, he would typically fail to realize the full "benefits" of reliance; in our example, the buyer's expenditures on the hiring and training of workers, etc., might be wasted in whole or in part if he defaults, and similarly with the seller's expenditures on production costs and so forth if he defaults. Since the probability that a party will wish to default is influenced by the damage measure, it follows that his decision about reliance will also be. Next, with regard to the possibility that a party who is deciding about reliance may find himself the *victim* of a breach, the damage measure must be considered for three distinct reasons. The first is analogous to what was just mentioned: the damage measure helps to determine the probability of becoming a victim of breach, and, therefore, the likelihood that the party may not realize the full benefits of his reliance. Second, the

[14] We do not ask whether the damage measure is decided on by the parties, originates in custom, or is a matter of law. We should note in the latter case that it need not be imagined that the parties would actually go to court were there a breach, for if they agree about the damages the court would award, they would generally avoid risk and save time and legal costs by reaching an out-of-court settlement.

[15] Our usage of the term reliance is standard. See Fuller and Perdue (1937) or Dawson and Harvey (1977).

[16] Our view of the sequence of events is of course overly simple—in reality, it is often true that reliance is engaged in in a continuous fashion over time and that the same is true of the resolution of uncertainty. However, our view does allow study of what seems to be the issue of interest concerning reliance, that it is to an important extent an investment made under conditions of uncertainty as to the final outcome of the contract.

[17] Rogerson (1980) employs the model introduced in this paper in an interesting study of the situation when parties renegotiate if that would be to their mutual advantage. We did not choose to study this situation (and therefore we implicitly assume "high" costs of renegotiation) just because of a desire to study the situation when a party might default, even though this would not be Pareto efficient, or when he might perform, even though that would not be Pareto efficient.

amount of damages he receives if a victim of breach may be a function of his level of reliance. Third, because the damages he receives may be a function of his level of reliance, he may in effect change the probability that the other party defaults by varying his level of reliance.

Knowing how the decisions about reliance and about breach depend on the damage measure and given also the contract price, the expected values of a contract to the buyer and to the seller can be determined. Thus, damage measures can be compared not only in a descriptive sense—in how they differentially affect reliance and breach—but also as to their mutual desirability to the contracting parties. Specifically, one damage measure is *Pareto superior* to another in a given contractual situation if both parties could assure themselves of higher expected values with a contract, quite possibly with a different price, under which the first rather than the second damage measure is to be employed.

Several commonly used damage measures are to be studied. Under the *expectation measure*, the defaulting party pays an amount that puts the other party in the position he would have been in had the contract been performed. Under the *reliance measure*, the defaulting party compensates the other party for his reliance expenditures and returns to the other party payments that he made; thus except for foregone opportunities, the victim of breach is put in the position he was in before he made a contract.[18] Under the *restitution measure* the defaulting party returns only the payments made to him;[19] he does not compensate the other party for reliance expenditures. In addition, the case of *no damages*—when a defaulting party pays nothing—is considered. We may view this measure as being employed in the many instances in which the various costs of seeking damages are large enough to make doing so impractical.[20] (Other damage measures can certainly be imagined, and something is said about them too.)

Let us now sketch our results, beginning with the description of a Pareto efficient complete contingent contract. Under the terms of such a contract a party would fail to perform when and only when, given the contingency and the level of reliance, the sum of the values to the buyer and to the seller would thereby be raised. For instance, in our example it would be Pareto efficient for the seller to default whenever his production cost would exceed the value of the machine to the buyer, given his reliance. Further, under such a contract the Pareto efficient level of reliance would reflect the probability of Pareto efficient breach (itself determined as just noted). In particular, because in the event of a breach the full benefits of reliance would not be realized, the greater the probability of breach, the lower will be the Pareto efficient

[18] The reliance measure is sometimes considered to include foregone opportunities; see Fuller and Perdue (1937) or Dawson and Harvey (1977). When this is so, the reliance measure may shade into the expectation measure. For instance, if the buyer could have made an identical contract with another seller, one might say that the foregone opportunity was the "expectancy." Thus, to isolate the effect of compensation for actions taken in reliance after the making of the contract from protection of the expectancy, it seems best to analyze the version of the reliance measure that we do.

[19] Readers familiar with contract law will note that because we ignore the possibility of partial performance, we shall not be concerned with restitution for benefits conferred by the seller to the buyer before a breach.

[20] This interpretation ignores the moral factors and the harm to reputation that enter into decisions about breach.

level of reliance, other things equal. In our example the greater the probability of high production costs and, consequently, of Pareto efficient breach by the seller, the lower will be the Pareto efficient amount committed by the buyer for training of workers, advertising, and so forth.

With respect to the damage measures, the following points are made. (1) The payment of damages for breach of contract tends to promote Pareto efficient breach behavior. It implicitly forces a party contemplating breach to take account of the loss that breach would impose on the other party. (2) The receipt of damages by the victim of a breach often results in his choosing a level of reliance that exceeds the Pareto efficient level. The reason is that the receipt of damages serves to insure him against losing the benefits of reliance; thus, in deciding on his level of reliance, he does not properly recognize that reliance is in fact like an investment which does not pay off in the event of breach.[21] (3) The expectation measure is generally Pareto superior to the reliance measure. Yet neither of these measures can be unambiguously compared with the restitution measure or the no damages case; their relationship depends on the nature of the contractual situation. (4) There does not exist a damage measure which leads to Pareto efficient decisions concerning both breach and reliance independent of the type of contractual situation; in other words, there is no damage measure which acts as a perfect substitute for complete contingent contracts.

These four points, however, provide only a relatively rough description of the results. Therefore, even those readers who are not interested in the details of the analysis will want to look at the formal statements of propositions in the next part of the paper; and they will probably wish to look also at the concluding comments, which are of a general nature.

2. Analysis of the model

■ **Preliminaries.** As explained above, it will be assumed that a contract is made between a risk neutral buyer and a risk neutral seller,[22] and then that reliance is chosen, that the contingency becomes known (to whom will be specified later), and that the contract is or is not performed. For simplicity, it will be supposed that only one of the parties decides about reliance and only one—possibly the same one—decides about breach. Therefore, two cases will be considered: that in which one party decides about reliance and the other party about breach and that in which the same party decides about both.

Now define

r = level of reliance;
θ = contingency;
$p(\cdot)$ = probability density over θ; and
B = breach set, that is, $\{\theta \mid \text{the contract will not be performed}\}$.

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[21] The legal requirement that a victim of a breach make a reasonable effort to make his losses as small as possible is aimed at solving a different problem from the one we are pointing out, for our problem concerns the initial choice of reliance, not the "mitigation of damages" *ex post*.

[22] More precisely, each party acts so as to maximize his expected (von Neumann-Morgenstern) utility, and his utility simply equals the level of a single variable called wealth or value or, often (in this paper) "position"; thus we shall say that each party acts so as to maximize his expected wealth or expected value or expected position.

Here r is a nonnegative amount and will be endogenously determined; θ is a scalar, to be variously interpreted; $p(\cdot)$ is differentiable[23] and is given exogenously; and B will be endogenously determined.

In what follows it will be seen how, given a damage measure, each party maximizes (over r and B, as the case may be) his own expected position,[24]

$$\int_{\sim B} (\text{position given performance})p(\theta)d\theta + \int_{B} (\text{position given breach})p(\theta)d\theta, \quad (1)$$

while taking into account that the other party is doing the same. Reliance and the breach set will be determined by the resulting (Nash) equilibrium behavior of the two parties.

□ **First case: one party decides about reliance and the other about breach.** Let us define the values enjoyed by the two contracting parties as a function of reliance, of the contingency, and of whether the contract is performed. These values are to be understood as *exclusive of any monetary transfers* between the parties; they are exclusive of payment of the contract price and of payment of damages for breach. Let

$v(r)$ = value enjoyed by the party who chooses reliance, provided that the contract is performed;
$\bar{v}(r)$ = value enjoyed by this party if the other party defaults;
$w(\theta)$ = value enjoyed by the other party if he performs and θ is the contingency; and
$\bar{w}(\theta)$ = value enjoyed by this party if he defaults and θ is the contingency.

Notice here that the party who chooses reliance does not face uncertainty in a direct way and that the other party does. This means that the party who decides about reliance is not the one who decides about breach.

If we are considering a situation in which a new party—an alternative buyer or an alternative seller—might be involved in a breach with one of the original contracting parties, then we will need to refer to $\bar{z}(\theta)$:

$\bar{z}(\theta)$ = bid made by an alternative buyer—or minus the offer made by an alternative seller—if such a new party is involved in a breach and if θ is the contingency.[25]

The bids and offers are assumed to be nonnegative.

[23] We shall also assume, without further comment, that other functions to be defined and considered here are differentiable.

[24] $\sim B$ stands for the complement of B.

[25] Note that these bids or offers are taken as exogenous to the model. This assumption seems apt if one is thinking of situations in which new parties would for some reason make their bids or offers relatively quickly, without real inquiry into the position of the original contracting party and without real negotiation. The assumption does not seem appropriate if one is considering situations in which the new parties' bids or offers would be influenced by aspects of the position of the original contracting party. (For example, if an alternative buyer met a seller who had already made a contract, this new buyer might well bid more if the seller would have to pay a large amount in damages for breach than if he would only have to pay a small amount.) However, in a previous version of this paper the assumption was relaxed, and new parties' bids and offers were endogenously determined; the qualitative nature of the results was then much the same, but since the complications which arose in the analysis were tangential to our purposes, it seemed best to make the present simplifying assumption.

It will be helpful to describe in terms of this notation several types of examples.

(a) The buyer relies and the seller faces uncertainty over production cost: If he carries out certain activities before the production cost becomes known to the seller, the gross value v of contract performance to the buyer will be enhanced; r is the level of these reliance activities, so that $v(r) - r$ is the buyer's net value, given performance. However, if the seller defaults, the buyer gets only $\bar{v}(r)$ (scrap value of reliance; or its value if the buyer can find an alternative seller of the good—who will presumably deliver it later), so that $\bar{v}(r) - r$ is his net value in this situation. The seller's production cost is influenced by random factors and is given by $c + \theta$, where c is a constant expenditure that must be made before θ becomes known and where θ is the additional amount necessary for completing production. If on learning θ the seller defaults, he gets a scrap value of s. Therefore, $w(\theta) = -c - \theta$ and $\bar{w}(\theta) = -c + s$. As there are no new parties involved, $\bar{z}(\theta) \equiv 0$.

(b) The buyer relies and the seller faces uncertainty over bids from alternative buyers: The description of the buyer is as in (a), but here the seller has the good in inventory and the uncertainty is over how much an alternative buyer would bid for the good. If θ denotes this amount, then $\bar{z}(\theta) = \theta$ and $w(\theta) \equiv \bar{w}(\theta) \equiv 0$ (since there are no production costs).

(c) The seller relies and the buyer faces uncertainty over the value of the contract: It is advantageous for the seller to begin the production process early, before the value of contract performance becomes known to the buyer. That is, up to a point, the more the seller does during this initial period, the lower will be his total production costs. Total production costs are therefore the sum of the initial costs r made in reliance plus whatever are the costs $c(r)$ that have to be borne to complete production. Since the seller's net value, given performance, is $-c(r) - r$, the interpretation is that $v(r) = -c(r)$. If the buyer defaults, the seller's unfinished good has scrap value $\bar{v}(r)$. The value of contract performance to the buyer is θ. Consequently, $w(\theta) = \theta$, and since the buyer does not get the good if he defaults, $\bar{w}(\theta) \equiv 0$. Also, because no new party is involved, $\bar{z}(\theta) \equiv 0$.

(d) The seller relies and the buyer faces uncertainty over offers from alternative sellers: The description of the seller is as in (c), but here the value of contract performance to the buyer is fixed at w. The uncertainty is over the price at which an alternative seller would offer the good to the buyer. If θ is this offer, then $\bar{z}(\theta) = -\theta$ and $w(\theta) = \bar{w}(\theta) = w$.

With these types of examples in mind, we make the following assumptions: $v'(r) > 1$ for nonnegative r sufficiently low (otherwise it would never be advantageous to engage in reliance), $v''(r) < 0$ (diminishing returns), and $\bar{v}'(r) < 1$ and $\bar{v}(r) < r$ (in keeping with the notion that reliance turns out to be unprofitable in the event of a breach).

Given these assumptions, we are almost ready to consider damage measures and how they perform as substitutes for Pareto efficient complete contingent contracts. What we wish to do first is to determine the nature of such complete contingent contracts, and to this end let k be the contract price. In the proof of the Proposition that follows and in the discussion and proofs of subsequent results of this subsection, we shall consider only situations in which the buyer relies and the seller might commit breach, for the analysis of situations in which the seller relies and the buyer might commit breach is either analogous or identical. However, to avoid the possibility of confusion, the statements of Propositions will mention any differences between the two kinds of situations (in Propositions 1 and 2, it happens that there are no differences). Moreover, occasional comments will be made in footnotes about the situations in which the seller relies and the buyer might commit breach.

Proposition 1. Under the terms of a Pareto efficient complete contingent contract, (i) the sum of the expected values of the contract to the buyer and to the seller is maximized. This implies that (ii) there is failure to perform in a contingency if and only if that would raise the sum of the values enjoyed by the buyer and the seller (plus the bid or the offer of any new party). More precisely, the Pareto efficient breach set equals $B^*(r^*)$, where

$$B^*(r) = \{\theta \,|\, \bar{v}(r) + \bar{w}(\theta) + \bar{z}(\theta) \geqq v(r) + w(\theta)\} \tag{2}$$

is the Pareto efficient breach set given r, and where (iii) r^* is the Pareto efficient level of reliance. This is determined by the condition

$$v'(r) = \frac{1 - \bar{v}'(r)\,\Pr(B^*(r))}{1 - \Pr(B^*(r))}\,. \tag{3}$$

Thus, in particular, r^* satisfies

$$v'(r^*) > 1. \tag{4}$$

Notes: Part (i) is true for familiar reasons: if the sum of expected values is not maximized, it is possible to construct a different contract with a larger sum under which both the buyer's and the seller's expected positions are higher. Part (ii) follows obviously from (i), and let us illustrate it with an example in which the buyer relies and the seller faces uncertainty over production cost. (Refer to examples of type (a) above.) If we assume for simplicity that the values $\bar{v}(r)$ and s, given failure to perform, are zero and that the seller bears no cost c before learning θ, then (2) reduces to $B^*(r) = \{\theta \,|\, \theta \geqq v(r)\}$, which says that it is Pareto efficient for the seller to default whenever he determines that production cost would exceed the value of performance to the buyer, given his reliance.[26] With regard to part (iii), observe that (4) is in keeping with our previous remarks. Inasmuch as reliance may be viewed as an investment with an uncertain payoff, maximizing the sum of expected values requires that one stop short of the point where the marginal product of reliance conditional on performance is unity. Carrying reliance to the point where $v'(r) = 1$ would be appropriate only if performance were a certainty; and to avoid discussion of uninteresting cases, we assume that $0 < \Pr(B^*(r)) < 1$.[27]

Proof: To verify (i), denote the expected value of a contract, exclusive of the price, to the buyer by $X(r,B)$. Thus, the expected value to him (inclusive of

[26] Consider one further illustration. In regard to examples of type (d), assume that the scrap value $\bar{v}(r)$ is zero. Then (2) reduces to $B^*(r) = \{\theta | c(r) \geqq \theta\}$, which says that it is Pareto efficient for the buyer to default and purchase the good for θ from an alternative seller if θ is less than $c(r)$, the cost to the contracting seller of completing production of the good.

[27] We shall, without further mention, make similar assumptions about the breach sets in the propositions that follow.

price) is $X(r,B) - k$. Similarly, denote the expected value, exclusive of price, to the seller by $Y(r,B)$, so that the expected value of the contract to him is $Y(r,B) + k$. Denote the sum of the expected values by $Z(r,B)$, that is $Z(r,B) = X(r,B) - k + Y(r,B) + k = X(r,B) + Y(r,B)$. If a contract specified by r_1, B_1, and k_1 is such that Z is not maximized, there is some r_2 and B_2 and a $\delta > 0$ such that $Z(r_2,B_2) - Z(r_1,B_1) = \delta$. Now under the contract specified by r_2, B_2, and $k_2 = k_1 + X(r_2,B_2) - X(r_1,B_1) - \delta/2$, the buyer is better off since

$$X(r_2,B_2) - k_2 = X(r_1,B_1) - k_1 + \delta/2 > X(r_1,B_1) - k_1 \tag{5}$$

and the seller is better off since

$$\begin{aligned} Y(r_2,B_2) + k_2 &= Y(r_2,B_2) + k_1 + X(r_2,B_2) - X(r_1,B_1) - \delta/2 \\ &= Z(r_2,B_2) - Z(r_1,B_1) + Y(r_1,B_1) + k_1 - \delta/2 \\ &= Y(r_1,B_1) + k_1 + \delta/2 > Y(r_1,B_1) + k_1. \end{aligned} \tag{6}$$

To confirm (ii), note now that

$$X(r,B) = \int_{\sim B} v(r)p(\theta)d\theta + \int_{B} \bar{v}(r)p(\theta)d\theta - r \tag{7}$$

and that

$$Y(r,B) = \int_{\sim B} w(\theta)p(\theta)d\theta + \int_{B} (\bar{w}(\theta) + \bar{z}(\theta))p(\theta)d\theta. \tag{8}$$

Thus

$$Z(r,B) = \int_{\sim B} (v(r) + w(\theta))p(\theta)d\theta + \int_{B} (\bar{v}(r) + \bar{w}(\theta) + \bar{z}(\theta))p(\theta)d\theta - r, \tag{9}$$

from which it follows immediately that the B that maximizes Z, given r, is indeed $B^*(r)$.

From (i) and (ii) it is clear that r^* is determined by maximizing $Z(r,B^*(r))$ over r. Let us assume that $B^*(r)$ is an interval of the form $[\theta(r),\infty)$. (This is the case in examples of type (a) and (b). However, our argument may be verified to hold for $B^*(r)$ of a general form.[28]) Differentiating, and using the fact that $\Pr(\sim B^*(r)) = 1 - \Pr(B^*(r))$, we obtain

$$\begin{aligned} \frac{dZ(r,B^*(r))}{dr} &= (1 - \Pr(B^*(r)))v'(r) + \Pr(B^*(r))\bar{v}'(r) - 1 + \theta'(r)[v(r) + w(\theta(r)) \\ &\quad - \bar{v}(r) - \bar{w}(\theta(r)) - \bar{z}(\theta(r))]p(\theta(r)) \\ &= (1 - \Pr(B^*(r)))v'(r) + \Pr(B^*(r))\bar{v}'(r) - 1. \end{aligned} \tag{10}$$

The term in brackets is zero because the characterization (2) of $B^*(r)$ implies $v(r) + w(\theta) = \bar{v}(r) + \bar{w}(\theta) + \bar{z}(\theta)$ at the boundary point $\theta(r)$ of $B^*(r)$. Setting the derivative equal to zero, we get (3); and (4) then follows since we assumed $\Pr(B^*(r)) > 0$ and since $\bar{v}'(r) < 1$. *Q.E.D.*

Let us proceed to consider damage measures. Define

$d(\cdot)$ = the damage measure determining damages paid by a defaulting party to the other party; d will be various functions of the variables k, r, v, and $\bar{v}$ and will be specified below.

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[28] If $B^*(r)$ is the union of intervals with endpoints which are differentiable in r, the argument is the same, and we shall assume that $B^*(r)$ is of that form.

Notice that we do not consider damage measures that depend on the contingency θ; this is in line with the stated purpose of the paper and the assumption that the contract does not provide for contingencies.[29] Except in the case of no damages, we shall assume without loss of generality that the contract price k is paid when the contract is made.[30]

We can now describe the positions of the contracting parties and derive their behavior. We have[31]

$$\begin{aligned} v(r) - r - k &= \text{buyer's position, given contract performance;} \\ \bar{v}(r) - r - k + d &= \text{buyer's position, given breach;} \\ w(\theta) + k &= \text{seller's position, given performance; and} \\ \bar{w}(\theta) + k - d + \bar{z}(\theta) &= \text{seller's position, given breach } (\bar{z} = 0 \text{ unless an alternative buyer is involved).} \end{aligned}$$

It follows that the seller will default whenever $\bar{w}(\theta) + k - d + \bar{z}(\theta) \geqq w(\theta) + k$, that is, whenever $\bar{w}(\theta) + \bar{z}(\theta) - w(\theta) \geqq d$; equivalently, the breach set is

$$B(r) = \{\theta \,|\, \bar{w}(\theta) + \bar{z}(\theta) - w(\theta) \geqq d\}. \tag{11}$$

(The dependence on r comes about because d may be a function of r.)

The buyer will choose reliance so as to maximize his expected position, $\int_{\sim B(r)} v(r)p(\theta)d\theta + \int_{B(r)} (\bar{v}(r) + d)p(\theta)d\theta - r - k$, which reduces to

$$(1 - \Pr(B(r)))v(r) + \Pr(B(r))(\bar{v}(r) + d) - r - k. \tag{12}$$

We shall assume that for the damage measures considered, this maximization problem has a solution which is uniquely identified by setting the derivative of (12) equal to zero. Moreover, we shall assume that both the buyer and the seller are at least as well off with the contract as without it. Thus, as we shall assume that the position of each would be zero if no contract were made,[32] the contract must be such that the expected positions of the buyer and the seller are nonnegative: (12) must be nonnegative (given the buyer's optimal choice of r), and the seller's position

$$\int_{\sim B(r)} w(\theta)p(\theta)d\theta + \int_{B(r)} (\bar{w}(\theta) + \bar{z}(\theta) - d)p(\theta)d\theta + k \tag{13}$$

must also be nonnegative.

What knowledge must the parties have about each other so as to be able to act in the way just described? To decide about breach, the seller needs to know the measure of damages, and as stated above, this may depend on the buyer's reliance and on the value he attaches to performance. (Of course, the seller is presumed to observe θ in the first place.) To decide about reliance, the buyer needs to know $B(r)$ and its probability. This requires that he understand the

[29] If d depended on θ, our assumption would have to be that θ can be observed by both parties, which conflicts with the assumption that the contract itself does not provide for contingencies.

[30] The reader will easily be able to satisfy himself that for any damage measure d applying if k is paid when the contract is made, there is an equivalent damage measure which can be used if k is instead paid when the contract is performed: the equivalent measure is just $d - k$ in situations in which the seller might default and $d + k$ in situations in which the buyer might default.

[31] In situations in which the seller relies and the buyer might default, $v(r) - r + k$ is the seller's position given performance, $\bar{v}(r) - r + k - d$ is his position given breach, and so forth.

[32] In other words, here we abstract from issues concerning foregone opportunities.

nature of the seller's problem (in particular, the *functions* $w(\cdot)$, $\bar{w}(\cdot)$, $\bar{z}(\cdot)$ and the density $p(\cdot)$), but *not* that he be able to observe θ.

Let us apply the general characterization, given by (11) and (12), of the parties' behavior in examining the several damage measures of particular interest, and let us begin with the expectation measure. Recall that under this damage measure, the victim of a breach is put in the position he would have been in had the contract been performed. Thus, under the expectation measure

$$d = v(r) - \bar{v}(r); \tag{14}$$

for if there is a breach, the buyer's position is $\bar{v}(r) - r - k + (v(r) - \bar{v}(r)) = v(r) - r - k$ as claimed. We now have

Proposition 2. Under the expectation measure, (i) the breach set, given reliance, is $B^*(r)$; breach is therefore Pareto efficient given reliance.[33] However (ii), reliance, r_e, is determined by

$$v'(r) = 1 \tag{15}$$

so that

$$r_e > r^*; \tag{16}$$

reliance exceeds the Pareto efficient level.

Notes: Part (i) is easily understood. The seller will default if and only if his gain exceeds the buyer's "expectancy," $v(r)$ which is to say, if and only if the sum of the values enjoyed by both parties is increased. Referring to the example of type (a) mentioned in the notes accompanying the previous proposition, since $d = v(r)$, it is clear that the seller will default whenever his production cost θ would exceed the value of the good to the buyer; so the breach set is indeed $B^*(r) = \{\theta \,|\, \theta \geqq v(r)\}$. With regard to (ii), consider the fact that under the expectation measure the buyer is in effect guaranteed his expectancy, and hence he sees reliance as an investment with a certain payoff. Therefore, he engages in reliance up to the point where its marginal product conditional on performance is driven down to one. This exceeds Pareto efficient reliance since, as has been emphasized, that level is such that the marginal product conditional on performance is greater than one and reflects the probability that the investment in reliance will not pay off in terms of the sum of values if there is a breach.

Proof: Using (14) to substitute for d in (11), we get

$$\begin{aligned} B(r) &= \{\theta \,|\, \bar{w}(\theta) + \bar{z}(\theta) - w(\theta) \geqq v(r) - \bar{v}(r)\} \\ &= \{\theta \,|\, \bar{v}(r) + \bar{w}(\theta) + \bar{z}(\theta) \geqq v(r) + w(\theta)\} = B^*(r), \end{aligned} \tag{17}$$

establishing (i). And using (14) to substitute for d in (12), we see that r is chosen to maximize

$$\begin{aligned} &(1 - \Pr(B(r)))v(r) + \Pr(B(r))(\bar{v}(r) + v(r) - \bar{v}(r)) \\ &\qquad - r - k = v(r) - r - k, \end{aligned} \tag{18}$$

[33] The notion that the expectation measure is somehow socially desirable, because it induces a party to default whenever doing so is worth more to him than the value of performance to the other party was, as far as I can determine, first stated in the 1972 edition of Posner (1977). However, that this is an aspect of Pareto efficiency is, to my knowledge, first stated here.

so that r must satisfy (15). Also, (16) follows from (4), (15), and the assumption that v is strictly concave in r. *Q.E.D.*

Let us now examine the reliance measure. Under this measure, the party must be compensated for expenditures (net of their value, given nonperformance) made in anticipation of performance and his payment must be returned; equivalently, he must be put in the position he would have been in had he not made a contract, namely zero. Thus, under the reliance measure, the buyer must receive from a defaulting seller[34]

$$d = r - \bar{v}(r) + k; \tag{19}$$

for then the buyer's position becomes $\bar{v}(r) - r - k + (r - \bar{v}(r) + k) = 0$ as claimed. The result concerning the reliance measure is

Proposition 3. Under the reliance measure, (i) the breach set is given by[35]

$$B(r) = \{\theta \,|\, \bar{w}(\theta) + \bar{v}(r) + \bar{z}(\theta) \geqq w(\theta) + r + k\} \supset B^*(r). \tag{20}$$

(In situations in which the buyer might default, the sign preceding k is negative.) Thus breach occurs more often, given reliance, than would be Pareto efficient.[36] (ii) Reliance, r_r, is determined by

$$v'(r) = 1 + \frac{\dfrac{d\ \Pr(B(r))}{dr}(v(r) - r - k)}{1 - \Pr(B(r))}. \tag{21}$$

(The sign preceding k is positive in situations in which the buyer might default.) Thus r_r satisfies

$$v'(r_r) \leqq 1 \tag{22}$$

so that

$$r_r \geqq r_e, \tag{23}$$

the level of reliance generally exceeds the level under the expectation measure (and therefore the Pareto efficient level).

Notes: The claim of part (i) is explained as follows. The seller will commit breach if and only if his gain exceeds the buyer's reliance, which as will be seen, must be less than his expectancy. Thus, the seller might commit breach when his gain, although larger than reliance, is less than the buyer's expectancy; this would not be Pareto efficient, since the sum of values enjoyed by both parties would be reduced. Referring again to our simple example of type (a), suppose that the buyer has paid a contract price of \$4 to the seller, that the buyer has spent \$1 in reliance, and that he will enjoy a value of \$10 if the seller delivers the good. Under the reliance measure, the seller will have to pay \$5 if he defaults (the \$4 price plus the \$1 reliance); thus, he will default whenever his production cost θ exceeds \$5, rather than only when θ exceeds \$10, which would be Pareto efficient. Notice here that the higher the price paid by the buyer, the

[34] In situations in which the buyer might default, $d = r - \bar{v}(r) - k$.

[35] In (20) it will be seen that $B(r)$ will typically properly include $B^*(r)$; and the same will be true whenever we use the set inclusion symbol elsewhere in this paper.

[36] Essentially this fact has been stated by Posner (1977).

lower the probability that the seller will default.[37] This means that the price has a role other than that of splitting the "surplus" from the transaction; the price also affects the total value of the transaction through its influence on breach behavior.

The plausibility of part (ii) follows from two considerations. First, because the buyer is compensated for his reliance in the event of a breach, he sees reliance as an investment in which at worst he will break even. This immediately suggests that he will choose a higher level of reliance than would be Pareto efficient. Second, because the buyer is made worse off if there is a breach (he gets reliance rather than the larger expectancy), he would like to reduce the probability of breach; and he can do so by increasing his reliance, for that raises the measure of damages. This second motive is absent under the expectation measure, which suggests why reliance is higher under the reliance measure.

Proof: Using (19) to substitute for d in (11), we immediately get $B(r)$ as given in (20). To prove that $B(r) \supset B^*(r)$, we need to show that $w(\theta) + r + k \leqq w(\theta) + v(r)$, or that $r + k \leqq v(r)$. But since the expected value to the buyer must have been nonnegative, we have, using (19) and (12),

$$0 \leqq (1 - \Pr(B(r))v(r) + \Pr(B(r))(\bar{v}(r) + r - \bar{v}(r) + k) - r - k$$
$$= (1 - \Pr(B(r))(v(r) - r - k), \tag{24}$$

which implies that $0 \leqq v(r) - r - k$ or that $r + k \leqq v(r)$. To derive (21), differentiate the last expression in (24) with respect to r and set it equal to zero:

$$(1 - \Pr(B(r)))(v'(r) - 1) - \frac{d \Pr(B(r))}{dr}(v(r) - r - k) = 0. \tag{25}$$

This gives (21). And (22) (which is generally a strict inequality) follows because $0 \leqq v(r) - r - k$ and because $d \Pr(B(r))/dr \leqq 0$. The latter is true because $B(r)$ may be rewritten as $\{\theta | \bar{w}(\theta) + \bar{z}(\theta) - w(\theta) - k \geqq r - \bar{v}(r)\}$ and $d/dr(r - \bar{v}(r)) = 1 - \bar{v}'(r) > 0$; thus the set $B(r)$ shrinks in size with increases in r. Finally, (23) follows from strict concavity of v in r and our previous results. *Q.E.D.*

Under the restitution measure the seller must return to the buyer the payment he made, so $d = k$. The results under this measure and in the case of no damages are given in

Proposition 4. If there are no damages for breach of contract, (i) the parties will agree that the price will be paid when the contract is performed. Thus, the results when there are no damages are identical with those under restitution: (ii) The breach set is given by

$$B = \{\theta | \bar{w}(\theta) + \bar{z}(\theta) - w(\theta) \geqq k\} \supset B^*(r). \tag{26}$$

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[37] It might, therefore, seem that our claim about breach's occurring too often could be contradicted. For instance, if in the example the contract price were sufficiently high, say \$9.25, breach would occur too seldom (for d would then be \$10.25 under the reliance measure). However, the proof shows (as it must) that the contract price cannot be high enough to cause this to happen; the argument is that the buyer would not have been willing to pay so high a price in the first place.

(The sign preceding k is negative in situations in which the buyer might default.) Thus, breach occurs more often, given reliance, than would be Pareto efficient.[38] (iii) Reliance, r_n, is determined by

$$v'(r) = \frac{1 - \Pr(B)\bar{v}'(r)}{1 - \Pr(B)} \tag{27}$$

so that

$$v'(r_n) > 1 \tag{28}$$

and

$$r_e > r_n; \tag{29}$$

reliance is less than under the expectation measure. Moreover, (iv) reliance is Pareto efficient, given the breach set.

Notes: In the case of no damages, if the buyer were to pay the seller when the contract was made, there would be nothing to keep the latter from defaulting and from holding on to the buyer's money, whereas if the buyer pays only at contract performance, the seller would have something to lose from a breach. (We do not consider the possibility of partial payment at the outset and the remainder at performance.) This explains part (i). The claim of part (ii), that breach occurs too often, is true because the seller defaults if and only if his gain exceeds the contract price, but this must be less than the buyer's expectancy (otherwise the buyer would not have been willing to pay the price). Notice here, as under the reliance measure, that the higher the price, the lower the probability of breach;[39] again, the price affects the total value of the transaction. With regard to part (iv), it is clear that since the buyer sees reliance as an investment which pays off if and only if the contract is performed, he will engage in reliance in a Pareto efficient way, given the probability of breach. Part (iii) is similarly explained.

Proof: The first part of the Proposition is obvious from the comment about it in the Notes. In addition, given that k is paid at performance, it follows that in the case of no damages and under the restitution measure, the seller will default if and only if his position if he defaults, $\bar{w}(\theta) + \bar{z}(\theta)$, is larger than that if he performs, $w(\theta) + k$; thus the breach set B in (26) is correct. To prove that $B \supset B^*(r)$, note that the condition that the expected value of the contract to the buyer must be nonnegative is

$$(1 - \Pr(B))(v(r) - k) + \Pr(B)\bar{v}(r) - r \geqq 0. \tag{30}$$

This and the assumption that $r > \bar{v}(r)$ imply that $v(r) - \bar{v}(r) > k$. From the latter inequality, the expression for B, and the fact that $B^*(r) = \{\theta \mid \bar{w}(\theta) + \bar{z}(\theta) - w(\theta) \geqq v(r) - \bar{v}(r)\}$, the result immediately follows. To get (27) set the derivative of the left-hand side of (30) equal to zero. Equation (28) follows from (27) since $\bar{v}'(r) < 1$, and (29) follows from (28), (15), and the strict concavity of r. To establish (iv), note that the Pareto efficient level of reliance, given B, is found by maximizing over r

[38] Actually, as we show later, it is also true that given r and k, $B \supset B(r)$, breach occurs more often than under the reliance measure.

[39] This raises the possibility that the buyer might actually prefer to pay (within some range) a "high" price to the seller; that would be especially likely if the surplus the buyer would derive from contract performance were large.

$$\int_{\sim B} (v(r) + w(\theta))p(\theta)d\theta + \int_B (\bar{v}(r) + \bar{w}(\theta) + \bar{z}(\theta))p(\theta)d\theta - r$$
$$= (1 - \Pr(B))v(r) + \Pr(B)\bar{v}(r) - r + \text{terms independent of } r, \quad (31)$$

which differs from the left-hand side of (30) by the terms that do not depend on r. Thus, r_n must equal the Pareto efficient level of reliance, given B. *Q.E.D.*

Let us next compare the four damage measures that we have studied.

Proposition 5. (i) The expectation measure is Pareto superior to the reliance measure independent of the nature of the contractual situation. Yet (ii) there is no necessary Pareto relationship between either of these measures and restitution or no damages; the relationship depends on the features of the particular contractual situation.

Notes: Recall that under the expectation measure, but not the reliance measure, breach is Pareto efficient, given reliance. Furthermore, under the expectation measure, reliance is less excessive than under the reliance measure. This indicates why part (i) is true. I am indebted to William Rogerson for a step of the proof of (i) under general conditions. With regard to part (ii), note first that it was shown that if there are no damages for breach or under the restitution measure, then reliance is Pareto efficient, given the breach set. Thus, if in a certain contractual situation the reliance decision is sufficiently more important (in terms of raising the sum of expected values) than the breach decision, restitution and no damages will be Pareto superior to the expectation and the reliance measures. On the other hand, if in a contractual situation the breach decision is sufficiently more important than the reliance decision, the expectation or the reliance measure will be Pareto superior to both no damages and restitution, because breach is more likely under the latter measures.

Proof: Note first (see (9)) that $Z(r,B^*(r))$ is the sum of expected values as a function of r, given that breach is Pareto efficient, and suppose that

$$Z(r_e,B^*(r_e)) \geqq Z(r_r,B^*(r_r)). \quad (32)$$

By Proposition 2(i), $Z(r_e,B^*(r_e))$ equals the sum of expected values under the expectation measure; and by Proposition 3(i), $Z(r_r,B^*(r_r))$ is greater than or equal to the sum of expected values under the reliance measure. From this and (32), it follows that the sum of expected values under the expectation measure is at least that under the reliance measure. Hence part (i) follows by an argument analogous to that used to show Proposition 1(i), if we can show that (32) is true. Now $Z(r,B^*(r))$ may be written $\int \max\,(v(r) - r + w(\theta),$ $\bar{v}(r) - r + \bar{w}(\theta) + \bar{z}(\theta))p(\theta)d\theta$. But since (see (18)) r_e maximizes $v(r) - r$, we have $v(r_e) - r_e \geqq v(r_r) - r_r$; and since (see (23)) $r_r \geqq r_e$ and $\bar{v}'(r) < 1$, we have $\bar{v}(r_e) - r_e \geqq \bar{v}(r_r) - r_r$. Thus for any θ, $\max\,(v(r_e) - r_e + w(\theta), \bar{v}(r_e) - r_e + \bar{w}(\theta) + \bar{z}(\theta)) \geqq \max\,(v(r_r) - r_r + w(\theta), \bar{v}(r_r) - r_r + \bar{w}(\theta) + \bar{z}(\theta))$, so that indeed $Z(r_e,B^*(r_e)) \geqq Z(r_r,B^*(r_r))$. (It should also be noticed that since (32) holds strictly if $r_r > r_e$, the expectation measure is generally strictly Pareto superior to the reliance measure.)

Part (ii) should be obvious from our comments in the Notes, except for the assertion that the reliance measure could be Pareto superior to no damages and restitution. To justify this, it will suffice to show that breach behavior under the reliance measure is closer to Pareto efficient, given r and k, than when there are no damages for breach or under restitution. Under the reliance measure the seller's breach set is $B(r) = \{\theta | \bar{w}(\theta) + \bar{z}(\theta) - w(\theta) \geqq r - \bar{v}(r) + k\}$, and when there are no damages or under restitution, the breach set is $B = \{\theta | \bar{w}(\theta) + \bar{z}(\theta) - w(\theta) \geqq k\}$. And since $r > \bar{v}(r)$, we have $B \supset B(r)$. *Q.E.D.*

We conclude this subsection by proving a fact about the general class of damage measures.

Proposition 6. There does not exist a damage measure which always induces Pareto efficient behavior; equivalently, any damage measure will lead either to Pareto inefficient reliance or to Pareto inefficient breach in some contractual situations.[40]

Notes: The logic of the proof is, more or less, as follows. If there were a damage measure which always induced Pareto efficient behavior, then in particular it would have to induce Pareto efficient breach. But this turns out to imply that the damage measure must essentially be the expectation measure,[41] and we know from Proposition 2(ii) that this measure induces Pareto inefficient reliance. Thus, the assumption that there exists a damage measure which induces Pareto efficient behavior is seen to lead to a contradiction.

Proof: Assume such a damage measure d does exist. Then, given an arbitrary contractual situation, we must have that

$$d(k,r^*,v(r^*),\bar{v}(r^*)) = v(r^*) - \bar{v}(r^*), \tag{33}$$

because d is presumed to induce the buyer to choose r^* and to induce the seller to default in a Pareto efficient way, given r^*. That is, the chosen breach set $B(r^*)$ must equal $B^*(r^*)$. Since from (11), $B(r^*) = \{\theta | \bar{w}(\theta) + \bar{z}(\theta) - w(\theta) \geqq d(k,r^*,v(r^*), \bar{v}(r^*))\}$, and from (2), $B^*(r^*) = \{\theta | \bar{w}(\theta) + \bar{z}(\theta) - w(\theta) \geqq v(r^*) - \bar{v}(r^*)\}$, (33) follows.

What we have just shown may be restated as follows: if a 4-tuple $(k,r,v,\bar{v})$ corresponds to a Pareto efficient outcome for *some* contractual situation, then $d(k,r,v,\bar{v})$ must equal $v - \bar{v}$ (the expectation measure). Now it is clear that the set of such 4-tuples has a nonempty interior. Consider a contractual situation such that an associated Pareto efficient 4-tuple $(k,r^*,v(r^*),\bar{v}(r^*))$ is in the interior. Then, in particular, for all r in some neighborhood of r^*, we must have that $d(k,r,v(r),\bar{v}(r)) = v(r) - \bar{v}(r)$. Thus, from (12), the derivative of the buyer's expected position evaluated at r^* is $v'(r^*) - 1$. But since, from (4), $v'(r^*) - 1 > 0$, d could not have induced the buyer to choose r^*. *Q.E.D.*

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[40] Lest the result be misinterpreted, it should be kept in mind that a damage measure is assumed here to depend only on the *values of variables* (other than θ—see footnote 29). Were it assumed instead that a damage measure could depend on the complete *functions* ($r(\cdot)$, $v(\cdot)$, $\bar{v}(\cdot)$, $w(\cdot)$, $\bar{w}(\cdot)$, $\bar{z}(\cdot)$, and $p(\cdot)$) that describe a contractual situation, a damage measure leading to Pareto efficient behavior could easily be designed: with its then perfect knowledge of the contractual situation, the court might simply determine Pareto efficient reliance and breach and threaten to punish severely any deviation from Pareto efficient behavior; the parties would thus be led to act in a Pareto efficient manner. Our having assumed that damage measures depend on the values of variables and not on the functions is justified to the extent that courts' knowledge of the nature of contractual situations is limited.

[41] It should be mentioned that this step of the proof implies that *there does not exist a damage measure which is always Pareto superior to the expectation measure*. The argument is that any other damage measure would be Pareto inferior to the expectation measure in contractual situations in which the breach decision is sufficiently more important than the reliance decision.

□ **Second case: the same party decides about both reliance and breach.**[42] In this subsection one party, the "active" party, decides about the level of reliance and also faces uncertainty in a direct way, which means that he decides about breach as well. The other, "passive" party makes no decisions. Let us define the values enjoyed by the two parties, where, as in the last subsection, these are to be understood as exclusive of any monetary transfers:

$v(r,\theta)$ = the value exclusive of reliance r enjoyed by the active party, given that he performs;

$\bar{v}(r,\theta)$ = the value exclusive of reliance enjoyed by this party, given that he defaults;

w = the value enjoyed by the passive party if the contract is performed; and

$\bar{w}$ = the value enjoyed by the passive party if the contract is not performed.

We may think of relevant examples by combining aspects of the examples of the previous subsection: the buyer might engage in reliance and also face uncertainty about the value to him of the contracted for good or about offers to be made by alternative sellers; the seller might engage in reliance and face uncertainty about production cost or about bids to be made by alternative buyers. We should also comment on a matter of interpretation concerning the passive party. Although he does not make any decision, under our definitions he might in some cases be imagined to engage in a level of reliance which is effectively fixed in the nature of things. For instance, he might be a seller who must spend exactly c_1 to set up production and, if the buyer were not to default on learning θ, exactly c_2 to complete production; thus we would have $w = -c_1 - c_2$ and $\bar{w} = -c_1$ (assuming that scrap value is zero).

We shall also make several assumptions which are similar to those made before, namely $v_r(r,\theta) > 1$ for nonnegative r sufficiently low, $v_{rr}(r,\theta) < 0$, $\bar{v}_r(r,\theta) < 1$, and $\bar{v}_r(r,\theta) < v_r(r,\theta)$.

We shall now state several propositions corresponding to those of the last subsection. When a proof (or a step of a proof) would be obvious from what was done previously, it will be omitted; moreover, as before, when an argument is supplied, it will suffice that the argument apply only for one of the two possible types of situations (here for those in which the buyer is the active party).

Proposition 7. Under the terms of a Pareto efficient complete contingent contract, (i) the sum of the expected values of the contract to the buyer and to the seller is maximized. This implies that (ii) there is failure to perform in a contingency if and only if that would raise the sum of the values enjoyed by the buyer and the seller (plus the bid or the offer of any new party). More precisely, the Pareto efficient breach set equals $B^*(r^*)$, where

$$B^*(r) = \{\theta \mid \bar{v}(r,\theta) + \bar{w} + \bar{z}(\theta) \geqq v(r,\theta) + w\} \tag{34}$$

is the Pareto efficient breach set given r, and where (iii) r^* is the Pareto efficient level of reliance. This is determined by the condition

[42] Unless otherwise noted, the assumptions and definitions of the last subsection will apply here as well.

$$\int_{\sim B^*(r)} v_r(r,\theta)p(\theta)d\theta = 1 - \int_{B^*(r)} \bar{v}_r(r,\theta)p(\theta)d\theta. \tag{35}$$

Thus, in particular, r^* satisfies

$$\int_{\sim B^*(r^*)} v_r(r^*,\theta) \frac{p(\theta)}{\Pr(\sim B^*(r^*))} d\theta > 1. \tag{36}$$

Notes: The explanation for this Proposition is much the same as that for Proposition 1; and in this respect, the only remark that may need to be made is that since (36) means that the expected marginal product of reliance conditional on performance exceeds one, it is indeed the analog of (4). Likewise, the proof of the result is similar to that of Proposition 1.

Given a damage measure d, the positions of the parties if the buyer is the active party are as follows:[43]

$v(r,\theta) - r - k$ = buyer's position if he performs;
$\bar{v}(r,\theta) - r - k + \bar{z}(\theta) - d$ = buyer's position if he defaults ($\bar{z}(\theta) = 0$ unless an alternative seller is involved);
$w + k$ = seller's position given performance; and
$\bar{w} + k + d$ = seller's position given breach.

Thus, the breach set is

$$B(r) = \{\theta \,|\, \bar{v}(r,\theta) + \bar{z}(\theta) - v(r,\theta) \geqq d\} \tag{37}$$

and the buyer chooses r so as to maximize his expected position

$$\int_{\sim B(r)} v(r,\theta)p(\theta)d\theta + \int_{B(r)} (\bar{v}(r,\theta) + \bar{z}(\theta) - d)p(\theta)d\theta - r - k. \tag{38}$$

Under the expectation measure $d = w - \bar{w}$, for this is the amount necessary to bring the passive party to the position he would have been in had the contract been performed, and we have

Proposition 8. Under the expectation measure, (i) the breach set and (ii) the level of reliance are Pareto efficient; the expectation measure is therefore a perfect substitute for a Pareto efficient complete contingent contract.

Notes: Part (i) is explained just as was part (i) of Proposition 2. Part (ii) is true because the active party sees reliance as an investment which pays off if and only if he performs. (Unlike in the previous subsection, here the party who relies does not receive damages if there is a breach, since he is the one who defaults.)

Proof: The proof of part (i) will be omitted. The argument for part (ii) is simply that from part (i) and (38). It follows that r is chosen to maximize

$$\int_{\sim B^*(r)} v(r,\theta)p(\theta)d\theta + \int_{B^*(r)} (\bar{v}(r,\theta) + \bar{z}(\theta) - w + \bar{w})p(\theta)d\theta - r - k. \tag{39}$$

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[43] If the seller is the active party, then $v(r,\theta) - r + k$ is the seller's position if he performs, $\bar{v}(r,\theta) - r + k + \bar{z}(\theta) - d$ is his position if he defaults, $w - k$ is the buyer's position, given performance, and $\bar{w} - k + d$ is his position, given breach. Thus, the breach set is given by (37), and the seller's expected position is given by (38), except that the sign of k in that expression must be changed from negative to positive.

But (39) differs from

$$Z(r,B^*(r)) = \int_{\sim B^*(r)} (v(r,\theta) + w)p(\theta)d\theta + \int_{B^*(r)} (\bar{v}(r,\theta) + \bar{z}(\theta) + \bar{w})p(\theta)d\theta - r \quad (40)$$

by a term that is independent of r—by $-w - k$. Thus, as r^* is the r which maximizes (40), it must also be the r which maximizes (39). *Q.E.D.*

Under the reliance measure, $d = -\bar{w} - k$ if the buyer is the active party[44] since this is the amount necessary to restore the seller to the position he would have been in had the contract not been made, and we have

Proposition 9. Under the reliance measure, (i) the breach set is given by

$$B(r) = \{\theta \mid \bar{v}(r,\theta) + \bar{w} + \bar{z}(\theta) \geqq v(r,\theta) - k\} \supset B^*(r). \quad (41)$$

(The sign preceding k is positive when the seller is the active party.) Thus, breach occurs more often given reliance than would be Pareto efficient. (ii) Reliance is determined by

$$\int_{\sim B(r)} v_r(r,\theta)p(\theta)d\theta + \int_{B(r)} \bar{v}_r(r,\theta)p(\theta)d\theta = 1 \quad (42)$$

so that

$$r^* \geqq r_r; \quad (43)$$

reliance is generally less than the Pareto efficient level.

Notes: Part (i) is explained in the same way as part (i) of Proposition 3. Part (ii) follows from part (i), for the latter means that the active party's reliance pays off less often than would be Pareto efficient; and this, in turn, makes it seem reasonable that the chosen level of reliance is lower than would be Pareto efficient. However, an additional assumption (that the active party's expected payoff is strictly concave in r) is needed in the actual proof.

Proof: The proof of part (i) will be omitted. With regard to the proof of part (ii), use (38) to write the expected position of the buyer

$$\int_{\sim B(r)} v(r,\theta)p(\theta)d\theta + \int_{B(r)} (\bar{v}(r,\theta) + \bar{z}(\theta) + \bar{w} + k)p(\theta)d\theta - r - k \quad (44)$$

and differentiate with respect to r to get (by the type of logic employed in (10))

$$\int_{\sim B(r)} v_r(r,\theta)p(\theta)d\theta + \int_{B(r)} \bar{v}_r(r,\theta)p(\theta)d\theta - 1. \quad (45)$$

Setting this equal to zero gives (42). To get (43), note from (35) that

$$\begin{aligned} 0 &= \int_{\sim B^*(r^*)} v_r(r^*,\theta)p(\theta)d\theta + \int_{B^*(r^*)} \bar{v}_r(r^*,\theta)p(\theta)d\theta - 1 \\ &\geqq \int_{\sim B(r^*)} v_r(r^*,\theta)p(\theta)d\theta + \int_{B(r^*)} \bar{v}_r(r^*,\theta)p(\theta)d\theta - 1. \quad (46) \end{aligned}$$

[44] If the seller is the active party, $d = -\bar{w} + k$.

The inequality (which would generally be strict) holds since $B(r^*) \supset B^*(r^*)$ and since $v_r(r^*,\theta) > \bar{v}_r(r^*,\theta)$. But this last expression is, from (45), just the derivative of (44) evaluated at r^*. Hence, assuming that (44) is strictly concave, we have $r^* \geqq r_r$. *Q.E.D.*

In the case when there are no damages for breach or under restitution, the conclusion is much the same as described in Proposition 4, and we shall refrain from formally stating its analog. With regard to a comparison of damage measures, it is true here, as in the previous subsection, that the expectation measure is Pareto superior to the reliance measure. However, unlike the result in the last subsection, the expectation measure is also Pareto superior to no damages and to restitution. Both these statements follow from the fact that the expectation measure was shown to induce both Pareto efficient reliance and Pareto efficient breach.

3. Concluding comments

■ The results of the paper should help in understanding the functioning of damage measures in situations which combine the features of the last two subsections, that is, when the buyer and the seller may each decide about both reliance and breach. For example, under the expectation measure, our results indicate that to the extent that each party believes he will be the victim of a breach, he will engage in excessive reliance (Proposition 2(ii)); but to the extent that he believes he himself will default, he will engage appropriately in reliance (Proposition 8); and however much he and the other party engage in reliance, he will decide on a correct basis whether or not to default (Propositions 2(i) and 8). However, a formal study of damage measures in the more general situations would require a more complicated type of analysis than ours, especially because of the interdependence of the two parties' decisions about reliance.

□ Although we assumed that the buyer and the seller were risk neutral, the willingness and abilities of the two parties to bear risk may, in fact, differ; and analysis allowing for this possibility would thus recognize issues of the allocation of risk as well as of the allocation of resources in determining how well damage measures for breach of contract serve as a substitute for Pareto efficient complete contingent contracts.[45]

In some instances, the allocation of risk is the principal aspect of a contractual arrangement, and when this is so, the role of damage measures should be seen in this light. Suppose that a risk averse buyer contracts with a risk neutral seller for future delivery of a fixed amount of a perishable commodity which trades on a spot market (and which is not traded on an organized futures market). If we further suppose that the seller is a middleman (not a producer), then we need think only about the issue of the allocation of risk. It is apparent that under a Pareto efficient complete contingent contract, the risk averse buyer would get the commodity at a fixed price—he would be insured by the risk

[45] In the "law and economics" literature, see a recent unpublished manuscript, Kornhauser (1979), which considers how damage measures for breach of contract allocate risk (as well as allocate resources); and see also Joskow (1977), Posner and Rosenfield (1977), and Perloff (1979), which focus on the allocation of risk in analyzing impossibility and related doctrines of excuse in contract law.

neutral seller against fluctuations in the future spot price (the contingency). It is also apparent that the expectation measure would act as a perfect substitute for the complete contingent contract, for under that measure the buyer would be effectively guaranteed the commodity at the agreed price.[46]

But in most contractual relationships, both the allocation of risk and the allocation of resources will need to be considered with respect to the role of damage measures. Were the risk neutral seller of the commodity its producer rather than a middleman, then the expectation measure would serve not only to allocate risk appropriately, but also to allocate resources, and in a way similar to that described in this paper.

□ Two points of qualification should be made in regard to our result that the expectation measure is Pareto superior to the reliance measure (Propositions 5, 8, 9). First, as just emphasized, the allocation of risk may enter into an evaluation of damage measures; and while consideration of this factor would strengthen the case for the expectation measure if the buyer (or whoever is the likely victim of a breach) is more risk averse than the seller (or whoever is the likely defaulting party), it would work in favor of the reliance measure if the seller is more risk averse than the buyer. Second, the court's (or other authority's) information may be sufficiently limited as to make it unable to apply one or the other damage measure. Although one can imagine circumstances in which the court knows the expectancy but not reliance, circumstances in which the reverse is true are perhaps more likely to occur.[47]

□ When the use of an incomplete contract together with a damage measure would lead to significant inefficiency—when it would induce the parties to act in a way that departs substantially from how they would act under a Pareto efficient complete contingent contract—then we would generally expect there to be some pressure for a more fully specified contract, despite the attendant costs. (As discussed in the introduction, these costs explain the tendency toward incompleteness in the first place.) To illustrate, suppose that the applicable damage measure is the reliance measure (perhaps the expectancy would be particularly hard for the court to infer), that the buyer spends virtually nothing in reliance on delivery of a good to be manufactured by the seller, and that the value of the good to the buyer would be very large. Then to prevent the seller from defaulting too often (for he would pay very little in damages for breach), it might be stipulated in the contract that the seller cannot default unless his production cost is large, even though this provision would entail certain costs (that of literal inclusion in the contract and, especially, that of buyer's verification of the magnitude of the seller's production cost, should he claim it is large).

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[46] If the seller defaulted and the buyer bought the commodity at a higher price on the spot market, then under the expectation measure the seller would have to pay the buyer the excess of his cost over the cost at the contract price.

[47] This results because the determination of reliance (exclusive of foregone opportunities) is concerned with fact (actions actually taken), whereas the determination of the expectancy is concerned with a hypothetical (what a firm's profits would have been; what the value of having his portrait painted would have been to an individual).

□ Finally, it may be worthwhile to compare the view of this paper with the often expressed view that damage measures have a *socially advantageous* economic role.[48] Under the latter view, the role of damage measures is seen as deriving from the two direct effects of their use, namely, that parties are motivated to adhere to contracts but, at the same time, that they have the option to escape their obligations and will decide to do so in certain atypical circumstances. These two effects are recognized as having two socially beneficial roles: adherence to contracts promotes trade, both private and commercial (it would be an inconvenient and much encumbered world in which there could be little assurance of contract performance); and the option not to perform means that contracts will be broken when performance would involve "waste" or excessive expense, or when performance would prevent resources from flowing to their most valued use (as when an alternative buyer is willing to pay much more to the contract seller than would the contract buyer).

The view elaborated here is in strict logic a different but complementary one, for, as stressed, we showed that the use of damage measures is in the *mutual interest* of the particular contracting parties.[49] The utility of damage measures to contracting parties themselves is no doubt a and perhaps *the* major aspect in which the social advantage of damage measures inheres. Furthermore, it affords a more appealing explanation of the observed use of damage measures than an explanation based on the notion that they are in the diffuse social interest.

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[48] This view is reflected in (but not fully or exactly expressed by), for example, Birmingham (1969) and Fuller and Perdue (1937).

[49] That adherence to a contract in typical circumstances is in the mutual interest of the parties is obvious. For an example illustrating the argument behind the claim that breach under atypical circumstances is also in their interest, readers who did not follow the details of the analysis should reconsider the example in footnote 4.

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