On Breach Remedies: Contracting with Bilateral Selfish Investment and Two-sided Private Information*

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Abstract

In this paper, a setting of bilateral selfish reliance investments and post contractual two-sided asymmetric information is explored. Since the pioneering work of Rogerson (1992) and Hermalin-Katz (1993), it is by now well known thatcomprehensive contracts can implement the first best even if the parties' valuations are private information and reliance investments are of selfish types (with quasi-linear utilities). However, real world contracts seem to be rather simple - fixed-price incomplete contracts which are sometimes renegotiated later. Hence, it is of interest to analyse whether breach remedies can introduce the first best in this set-up. Paper tries to fill this gap in the literature. Some interesting results are obtained: both the parties tend to over-invest under Restitution (i.e. no-damage) which is contrary to the conventional literature on hold up, also under Reliance damage. Further analysis of the Subjective Valuation and the Objective Valuation (Expected Expectation Damage) - two Court adopted methods of establishing a breach-victim's expectation interest under asymmetric information - shows that Expected Expectation damage is superior to the others but still falls short of what party-designed liquidated damage could achieve. Analysis also shows that it may be of the parties mutual interest to set a very high liquidated damage to protect their investment upfront, and Court should recognise this fact. However, first best is generally not achievable.

JEL Classification: K12, D82

Key Words: Asymmetric Information, Breach of Contract, Expected Expectation Damage, Moral Hazards, Reliance and Restitution Damage

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1. Introduction

In this paper we shall be presenting a model involving two-sided informational asymmetry and bilateral selfish investments. To introduce the analysis, suppose that two risk-neutral parties come together to exchange a specific commodity in the future. Both the parties invest in their respective valuations and costs, that enhance the social surplus when they trade. At the beginning, the parties know their respective distributions from which the values of the relevant parameters related to their valuations will be drawn. The parties individually learn the respective true valuations only after they invest; but these values are neither observable to the other party nor verifiable to the court, thus private information. The parties then will continue their venture if the market favours the commodity i.e. if they can produce it at a particular cost and exchange at a particular (predefined) price. Otherwise, dispute arises and they settle it in a court.

The present paper deals with the question of whether the first-best outcome is possible (with or without the support of legal remedies), when investments undertaken in reliance by both the parties are unobservable and the good's value and cost are also private information (*ex post*). This problem is not trivial. Two distinct cases are identified. First, when there is a "gap" between the supports of the seller's cost and the buyer's valuation. Secondly, when there is "No-gap" between the supports. In the "gap" case, trade is always feasible. When it is common knowledge between the parties that gains from trade exist, contract theory says that efficiency is attained quite trivially by a single-price mechanism: trade for sure at a price belongs to the gap. This is Incentive Compatible, since the outcome does not depend on the report. Also it is Individually Rational, since each party receives a non-negative payoff in every realisation. (See, Ausubel, Crampton & Deneckere (March, 2001)). We thus concentrate on the non-trivial case where there is "no gap" between the supports of the seller's cost and buyer's valuation. The bargaining does not conclude with probability one after any finite number of periods. One basic question is whether the private information prevents the bargainers from reaping all possible gains from trade.

Myerson & Satterthwaite (1983) find that if there is a positive probability of gains from trade, but if it is not common knowledge that gains from trade exist, then no incentive compatible, individually rational, budget balanced mechanism can be *ex post* efficient. In the Groves-Clarke mechanism (similar to Vickrey's (1961) second price auction mechanism), both the buyer and the seller have the incentive to truthfully announce their valuations to the court. Indeed, this is the only scheme where truth-telling is implementable as a dominant strategy (Green & Lafont (1979)). Despite this very attractive feature, the Groves-Clarke mechanisms are problematic because they do not provide a *balanced budget* (*BB*). The "basic" Groves mechanism generates an expected deficit. In other words, the "basic" Groves mechanism satisfies *individual rationality* (*IR*) but violates *BB*, whenever the expected gains from trade are positive. More general Groves mechanisms can try to finance the deficit by taxing the agents, but *IR* limits the magnitude of those taxes. For example, whenever the buyer's valuation (v) is higher than the seller's cost (c), the court orders a transfer to the tune of v to the seller but only collects c from the buyer, implying that it must make up the difference.[1]

Whenever there is some uncertainty about whether trade is desirable, *ex post* efficient trade is impossible. For this reason, private information is a compelling explanation for the frequent occurrence of bargaining breakdowns or costly delay. Inefficiencies are a necessary consequence of the strong incentives for misrepresentation between the bargainers, each holding certain private information.

However, it is by now well known that *ex post* efficiency can be achieved in such a problem with quasi-linear utilities, if the parties can write a comprehensive contract *ex ante*; i.e., before they privately learn their types (see D'Aspremont & Gérard-Varet (1979), and Arrow (1979)). It has been shown by Konakayama, Mitsui & Watanabe (1986), Rogerson (1992), and Hermalin & Katz (1993) that comprehensive contracts can implement the first best even if the parties' valuations are private information and reliance investments are of selfish types.

While optimal contracts that induce first best trading under bilateral asymmetry are often quite complicated, real world contracts seem to be rather simple. Most often the parties come up with fixed-price incomplete contracts which are generally renegotiated later (if not prohibited by court). Hence, it is an interesting question to ask whether in this case it is also possible to achieve the first best. Taking this route Schmitz (2002 b), using a mechanism design approach, demonstrates that voluntary bargaining over a collective decision under asymmetric information may well lead to *ex post* allocative efficiency as well as *ex ante* efficient reliance if the default decision is non-trivial (and the parties' valuations are symmetrically distributed). By a non-trivial default decision he argues that the parties merely specify an unconditional level of trade, $q^o \in [0, 1]$; i.e. the default decision is an interior choice. His work was motivated by the solutions to hold-up problems using simple contracts that just specify a threat-point for future negotiations, given that the parties are symmetrically informed (see, Aghion, Dewatripont & Rey (1990, 1994), Chung (1991), Nöldeke & Schmidt (1995, 1998), Edlin (1996), and Edlin

[1] Supra, Ausubel, Cramton and Deneckere.

& Reichelstein (1996). However, all these elements of the literature are based on the premise that renegotiation can always exploit any inefficiency remaining after a contract has been written under a complete information setting. This assumption, unfortunately, does not seem compelling in an incomplete information setting. Any efficient renegotiation process must be *interim individually rational*; that is, having observed his/her private information, each party must always expect to become at least as well off from participating in the renegotiation process as from not participating and enforcing the existing contract. Otherwise, in some instances efficient breach opportunities will be lost. Accordingly, we can directly apply the theorem of *MS* and state the impossibility of efficient renegotiation. As a consequence, *ex post* efficiency is still under question.

In the light of the discussion above, instead of renegotiation this paper considers standard breach mechanisms (that specify a fixed compensation paid by the contract breacher) following the usual *Sub-game Perfect Nash Equilibrium method.* Under asymmetric information, when valuation problems are extreme, the legal proceedings (under Common Law and Civil Law countries) may either turn to assess the expectancy of the victim of breach or allow opting for reliance damages by the victim of breach. Generally, courts adopt two methods to establish the expectation interest of the victim – an objective method and a subjective method. Objective damage measures are based on prudent or reasonable investment behavior and/or on the average type of a fictitious agent. By construction, these measures differ from subjective expectation damages that were required to compensate the promisee for her loss.We try to examine the efficacy of such practices and analyse whether these solutions to the valuation problem alleviate or exacerbate opportunistic behaviour by the parties. It begins with a standard analysis of the behavioural effects of restitution and reliance damages. It then proceeds to the application of expectation damage measures in a world where the courts are not perfectly informed about the parties' valuations of the contract.

In this paper, we find some interesting results : (a) as opposed to the conventional under-investment result under Restition (no-damage) remedy here both the parties tend to over-invest; (b) Reliance damage remedy leads to convetional over-investment; (c) review of Subjective Valuation and Objective Valuation (Expected Expectation Damage) - two Court-adopted methods of establishing the breach-victim's expectation interest under asymmetric information - draws the conclusion that the Expected Expectation damage is superior to the others but still falls short of what party-designed liquidated damage could achieve; (d) however, first best is generally not achievable. We further establish two important but competing facts. First, the parties may deliberately use a high penalty as a liquidated damage to induce efficient relation specific investment, which however may not induce *ex post* efficiency or augment social welfare. Second, the optimal rule that can be chosen *ex post* by the court under bilateral incomplete information corresponds to the 'expected expectation damage' rule that maximises the social welfare but induces inefficient incentive to invest. These results complement the existing literature on the issue of optimal breach remedies, which has been mostly concerned with the question of *ex ante* efficiency, i.e. inducing a correct level of relationship-specific investment (reliance), when information is complete (and hence renegotiation is assumed to make the *ex post* outcome always efficient). [Cf, Shavell; Rogerson; Chung; Edlin & Reichelstein; and Edlin, Spier & Whiston (1995)].

1.1. Related Literature

There are three types of literature that are closely related to the present analysis: the literature that addresses the efficiency of various contract remedies, the literature that compares the different information disclosure effects of these remedies, and finally the literature on the optimal accuracy of damages assessment.

Among the first type, there is a large volume of literature on the comparative advantage of various contract damages measures. For example, Birmingham (1970), Barton (1972), Goetz & Scott (1977), Shavell (1980, 1984), and Miceli (2004), among many others, have studied various damages measures for breach of contract and compared their efficiency. Edlin & Schwartz (2003) provide an excellent survey of this literature. Almost without exception these studies assume that the non-breaching party will always pursue a remedy for the contract breach regardless of her post-breach valuation. As a result, these studies ignore the endogenous option given to the non-breaching party to not litigate the case if her post-breach valuation is smaller than the contracted price. In contrast, our model incorporates the embedded option to rationally acquiesce to a breach and demonstrates that this has important efficiency implications.

The second type of literature analyses the incentives to disclose private information that the various remedies provide (see Ayres & Gertner (1989); Bebchuk & Shavell (1991); Adler (1999)). Bebchuk and Shavell exhibited that awarding expected expectation damages by the court induces better information disclosure at the contracting stage from the privately informed party and thus makes the estimation of expectation damage more accurate, leading to more efficient breach decisions. As against this, we deal with a framework where the parties to the contract have no private information at the contracting stage, thus no information disclosure incentives need to be dealt with at that stage. The advantage of expected expectation damages over actual damages in our model emerges because: first, it maximises expected social payoff; secondly, the breacher has distorted incentives to breach under actual damages as the non-breaching party may to not file a lawsuit.

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

1.2. Certain issues related to the applicability of damages

From a social point of view, private information is a barrier to mutually beneficial exchange; it is a type of transaction cost that may prevent parties from capturing a potential surplus or may lead them to enter into inefficient transactions. In the real-world, the parties' private interest in keeping information private makes the goal of full information revelation within a particular market unattainable. Rather than revealing such information, parties will - often driven by a "secrecy interest" - prefer to forgo suit in the event of breach, change their patterns of contracting and/or important aspects of the terms on which they deal, or forgo the transaction entirely. As opposed to secrecy interest there is a "compensatory interest" by the parties, which will compensate their expectation loss in the event of breach.

Thus the secrecy interest and the compensatory interest are often in direct conflict, and they cannot be reconciled simply by elevating one over the other *ex post*. When the secrecy interest is sufficiently strong, the cost of revealing the underlying private information may well exceed the aggrieved party's expected recovery from trial. As a consequence, the aggrieved party may not file suit and may therefore receive no compensation. As the breacher may be informed about the existence of the victim's secrecy interest, she may breach too often. On the other hand, if the victim of breach brings a suit and ask for expectation damage guided by compensatory interest, he will overstate his valuation, which is a pure rent-seeking motive.

Thus from a policy perspective, the challenge becomes to structure legal rules in general, and damage remedies in particular, to achieve "Second Best" outcomes in transactional contexts that will always be characterised by asymmetric information [2]. In particular, damage measures like fully compensatory expectation damages that give efficient breach or perform incentives in an ideal world, need to be replaced or supplemented by the measures that take into account the "secrecy interest" of the aggrieved party and the type of discovery that will be available.

2. The Model Setting

To formalise the model, let two risk-neutral parties – a seller and a buyer – meet at Time-1 to consider a project. A specific commodity is to be supplied by the seller under this contract, which would be further used as an intermediary input by the buyer to manufacture a final good whose uncertain demand is yet to be seen in the market. The project will certainly fail unless both the parties invest in it, though it may still fail even if both invest. If the parties do not reach an agreement and thereby do no trade, then the investments undertaken by them are wasted — that is, their investments are fully of the relation specific and selfish type. We consider a procurement contract between a seller and a buyer in a situation when after contracting neither party can find any other buyer or seller in the market for the specific commodity but some unforeseen contingencies may induce breach after an agreement has been reached. Thus it is a thin market, and investments are agent specific. The parties recognise this possibility but may have the oppotunity to to write a fixed-price contract. This price, essentially a device to divide the *ex post* surplus, depends on the relative burgaining strength of the parties. So in the contract formation stage, they bargain over an *ex ante* price and may specify a damage remedy, which the breacher agrees to pay the victim in the event of not honouring the contractual obligations. Some of our discussion of breach remedies will be couched as if the remedy selection were made by courts.

Now let us describe the *ex ante* uncertainty features of the model. The first source derives from the seller's cost of production. And the second one comes from the buyer's valuation of the contract due to future fluctuations in the market prices of the products the buyer ultimately manufactures and sells. We assume

[2] The ex-post revelation of information that is required by subjective damage measures and the rules of discovery may also reduce parties' incentives to either deliberately acquire certain types of information or to invest in the types of innovations and activities whose profitability is dependant on keeping information private. Consider a manufacturer, who invents a low cost production process for a product. If she brings a suit for damages against a supplier of a component, she will have to reveal her cost of production, which will induce her competitors to try to obtain information about her production process. Firstly, protecting this type of information from revelation in such a suit would have the beneficial effect of preserving or enhancing parties' incentive to devise such innovations. Secondly, there are many contracting contexts in which protecting private information ex-post is likely to create more efficient ex-ante incentives to gather and use information.

here that the court cannot observe both the buyer's true valuation and the exact cost of performance by the seller; however, the court is able to fashion a noisy estimate of both valuation and cost out of the information provided by the buyer and the seller during the trial (upon breach). What is clear, however, is that by the time the parties' dispute is deliberated in the courts, both the parties will have learned the new market prices. The seller will know her costs and the buyer his valuation respectively at the individual level, but neither party is able to verify these valuations at court and therefore private information of the individual parties. So in the present model there is two-dimensional *ex post* asymmetric information between the parties themselves and the court. When dispute arises this creates a problem for the courts in terms of choosing a damage measure as judges cannot credibly ascertain the expectation interest of the promisee.

The court can observe the written contract (which clearly specifies the good(s) to be delivered and the price to be paid) and can verify whether the good has been delivered and the price has been paid. Clearly, the courts can determine efficient remedies if they have sufficient information about the valuations of the parties. However, being unable to verify the buyer's value and the seller's cost in actual terms, the court is limited in its ability to remedy the dispute efficiently and thus it often employs damages incorrectly, which leads to an inefficient outcome. We focus on the ex ante design of the contract in light of new information expected in future (and thus assume no renegotiation[3]) despite the fact that the specific investments by the parties increase thier risk and pave a way for renegotiation.

[3]It is cited that most articles that used fixed-price contracts required the assumption of costless renegotiation to be able to achieve the first-best outcome, an outcome which the contingent-contract literature was able to achieve without assuming costless renegotiation. A renegotiation game is in reality never costless ex post and hard to design ex ante. It is thus questionable whether writing a fixed-term contract and designing a renegotiation game (which itself should be renegotiation proof) is indeed simpler than writing a contingent contract (Schmitz, 2001). It is therefore also questionable whether costless renegotiation is a more plausible assumption to make than the one we make here. Besides that, throughout the analysis it is our maintained assumption that the parties' valuation(s) are not observable even at the stage when parties decide to perform or breach, thus under this kind of asymmetric participation the renegotiation is probably more costly than when parties' valuations are observable. Indeed, models, which account for renegotiation typically assume that parties' valuations at the trade-or-renegotiate stage are observable. Although making renegotiation less costly, the observability assumption (which we do not make) is quite restrictive (see Chung (1992), Edlin & Reichelstein, Hart & Moore (1988), Noldeke & Schmidt, Spier and Whinston. Third, some have argued that the parties may find ways to commit not to renegotiate or at least find ways to significantly raise the costs of renegotiation. Maskin & Tirole (1999) analyse several ways the parties can commit not to renegotiate (but see Hart & Moore, 1999). Thus, our model also captures situations where the parties were able to commit to not renegotiate. As Hart & Moore (1999) noted the degree of the parties' ability to committing not to renegotiate "is something about which reasonable people can disagree." Thus, they argue, both the cases where the parties can and cannot commit not to renegotiate are worthy of study. Lastly, even if renegotiation were simple and costless, our forthcoming result shows that there is no room for it under two sided asymmetry.

2.1. Technical Assumption

It is assumed that the buyer's valuation of the good and the seller's cost of performance are dependent on respective transaction-specific reliance investments incurred by them at the individual level, as well as the respective private information they may hold *ex post*.

Thus the buyer's valuation is denoted by:

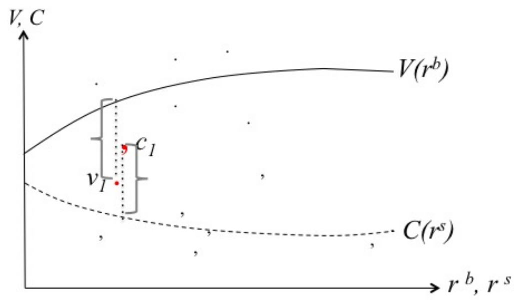
$$v = V(r^b) + \phi \text{ , so that } E(v) = V(r^b),\ V'(r^b) > 0,\ V''(r^b) < 0,\ \forall\ r^b \text{ ,}$$
$$\text{with } E(\phi) = 0 \text{ , } Var(\phi) = \sigma_\phi^2 \text{ and } r^b \in [0, r^{b\ max}].$$

And the seller's cost of performance is denoted by:

$$c = C(r^s) + \theta \text{ , so that } E(c) = C(r^s),\ C'(r^s) < 0,\ C''(r^s) > 0 \text{ ,} \forall\ r^s$$
$$\text{with } E(\theta) = 0 \text{ , } Var(\theta) = \sigma_\theta^2 \text{ and } r^s \in [0, r^{s\ max}].$$

Here θ and ϕ represent the information parameters held respectively by the seller and the buyer. Each of these information parameters is a random variable and can be thought of as the agents' type; once realised by one particular agent, it is not observed by the other agent and thus is not contractible. So a contract cannot directly depend upon it. Let $f(.)$ and $F(.)$ respectively be the probability density function and the corresponding distribution function of the seller's uncertainty component θ; whereas $g(.)$ and $G(.)$ represent the same for the buyer. We assume that $f(.)$ and $g(.)$ are continuous and positive on their respective domains and are independent [i.e. the seller's private information does not affect the buyer's valuation for the object, and *vice versa*]. The distributions $f(.)$ and $g(.)$ are common knowledge between the parties and follow monotone hazard property. See figure 1 below for a stylized representation of the agents' value and cost.

Figure 1: A stylized representation of the agents'value and cost



The buyer's expected valuation $E(v) = V(r^b)$ is continuosly increasing in r^b uptill $r^{b\ max}$; whereas the seller's expected cost $E(c) = C(r^s)$ is decreasing in r^s. There is a starting gap between the expected value and cost of the agents which diverges further as the parties invest more. However, there is "no-gap" between the supports of the seller's cost and the buyer's valuation; in some contingencies depending upon the particular realisation of θ and ϕ (like the one shown) $c > v$.

In the face of two-sided *ex post* private information, *ex ante* trading opportunity between the parties arises whenever $E(v) \geq E(c)$ i.e. whenever the buyer's expected valuation is larger than the seller's expected cost in Time 1, they may find the contracting worthwhile. Without any loss of generality, we assume here that the buyer holds the entire bargaining power and thereby he set a very low price P in such a way (so close to $E(c)$, with very little surplus from the contract) that only the seller faces the option to breach unilaterally. Note here, in this particular kind of set up, that either party can contemplate on breaching the contract whenever the cost of performance is higher than the value. But we shall restrict our analysis to unilateral breach by the seller; this does not affect any other aspect. The analysis of breach by the buyer is just similar to that of the seller.

Proposition 1. ***: (The First Best)***

The optimum level of reliance investments under two-sided informational asymmetry must be lower not only when compared to the social optimum under complete information but also less than the optimum levels of reliance under one-sided informational asymmetry.

Proof. We provide the proof in three simple steps as below:

STEP-1: The first best is achieved if the *ex ante* investment decision and the *ex post* trade decision are efficiently made. Therefore, following the convention, before the realisation of c and v, the probability of efficient performance under two-sided informational asymmetry is:

$$\begin{aligned}
\Pr[\text{efficient performance}] &= \Pr[c \leq v] = \Pr[C(r^s) + \theta \leq V(r^b) + \phi] \\
&= \Pr[\theta - \phi \leq V(r^b) - C(r^s)] = \Pr[\xi \leq V(r^b) - C(r^s)] \\
&= H[V(r^b) - C(r^s)], \qquad (1)
\end{aligned}$$

$$\text{where } \xi = (\theta - \phi) \backsim h(0, \sigma_\theta^2 + \sigma_\phi^2), \because \theta \text{ and } \phi \text{ are independent.}$$

And, $$\Pr[\text{efficient breach}] = 1 - H[V(r^b) - C(r^s)] \qquad (2)$$

This completes the analysis of the efficient breach decision. Given the efficient breach decision, the other issue is to determine the efficient amount of reliance. Given the efficient probability of breach, the socially efficient reliance investment by the buyer is that which maximises the joint expected value of the contract. The expected joint value is defined as:

$$EPJ = [1 - H[V(r^b) - C(r^s)]].(0 - r^b - r^s) + H[V(r^b) - C(r^s)].\{[E(v) - r^b - P] + [P - r^s - E(c|c \leq v]\}$$

$$= H[V(r^b) - C(r^s)].[V(r^b) - \{E(C(r^s) + \theta|C(r^s) + \theta \leq V(r^b) + \phi\}] - r^b - r^s \quad (3)$$

For the Kaldor-Hicks efficient level of investments that maximise this joint value, we deduce the first order conditions as follows:

For the buyer,

$$EPJ'(r^b) = h(.).V'(r^b).V(r^b) - h(.).V'(r^b).V(r^b) + H(.).V'(r^b) - 1 = 0$$

Thus at the efficient level of investment for the buyer, we have:

$$V'(r^{b**}) = \frac{1}{H[V(r^{b**}) - C(r^{s**})]} > 1, \text{ [since } H(.) < 1] \quad (4)$$

Now for the seller,

$$EPJ'(r^s) = h(.).[-C'(r^s)].V(r^b) - h(.).[-C'(r^s)].V(r^b) + H(.).C'(r^s) - 1 = 0$$

$$\Rightarrow \quad H[V(r^b) - C(r^s)].C'(r^s) = -1.$$

Therefore, at the efficient level of investment for the seller, we have:

$$-C'(r^{s**}) = \frac{1}{H[V(r^{b**}) - C(r^{s**})]} > 1, \text{[since } H(.) < 1] \quad (5)$$

This means that the amount of investment under dual sided uncertainty must be less than the amount without uncertainty since $C'(r^s) < 0, C''(r^s) > 0$.

For the purposes of comparison, let us now derive the efficient levels of investment respectively under one-sided private information and complete information.

STEP-2: Without any loss of generality, now consider that only one of the two parties holds e*x post* private information. Let the seller hold the private information θ, so that her cost is $c = C(r^s) + \theta$; and the buyer's valuation be $v = V(r^b)$ as he does not have any information.

Thus in an *ex post* sense (ignoring the "sunk costs" of investments), contract breach is efficient iff: $v < c$; otherwise performance is efficient.

$$\begin{aligned} \text{Thus,} \quad \Pr[\text{performance}] &= Pr[c \leq V(r^b)] = Pr[C(r^s) + \theta \leq V(r^b)] \\ &= Pr[\theta \leq V(r^b) - C(r^s)] = F[V(r^b) - C(r^s)] \end{aligned}$$

Thus Expected Joint Payoff would be –

$$
\begin{aligned}
EPJ &= F(.).[\{V(r^b) - r^b - p\} + \{p - E(c|c \leq V(r^b)) - r^s\} \\
&\quad +\{1 - F(.)\}.\{0 + 0 - r^b - r^s\} \\
&= F[V(r^b) - C(r^s)].\{V(r^b) - E(c|C(r^s) + \theta \leq V(r^b))\} - r^b - r^s
\end{aligned}
$$

To check the investment incentives for the contracting parties, we differentiate the above expression and obtain the following expressions.

For the buyer,

$EPJ'(r^b) = f(.).V'(r^b).V(r^b) + F(.).V'(r^b) - f(.).V'(r^b).V(r^b) - 1 = 0$

$$\Rightarrow \quad V'(r^{b*}) = \frac{1}{F[V(r^{b*}) - C(r^{s*})]} > 1, \ [\because V'(r^b) > 0, V''(r^b) < 0] \tag{6}$$

For the seller,

$EPJ'(r^s) = f(.).(-C'(r^s)).V(r^b) - f(.).(-C'(r^s)).V(r^b) + F(.).(-C'(r^s)) - 1 = 0$

$$\Rightarrow \quad -C'(r^{s*}) = \frac{1}{F[V(r^{b*}) - C(r^{s*})]} > 1, \ [\because C'(r^s) < 0, C''(r^s) > 0] \tag{7}$$

STEP-3: Now coming to a set-up without any uncertainty (or private information), the efficient amounts of reliance investment simply solves the following: the buyer solves $\max_{r^b} V(r^b) - r^b$; let $r^b = r^b_c$ that satisfy the following F.O.C:

$$V'(r^b_c) = 1 \tag{8}$$

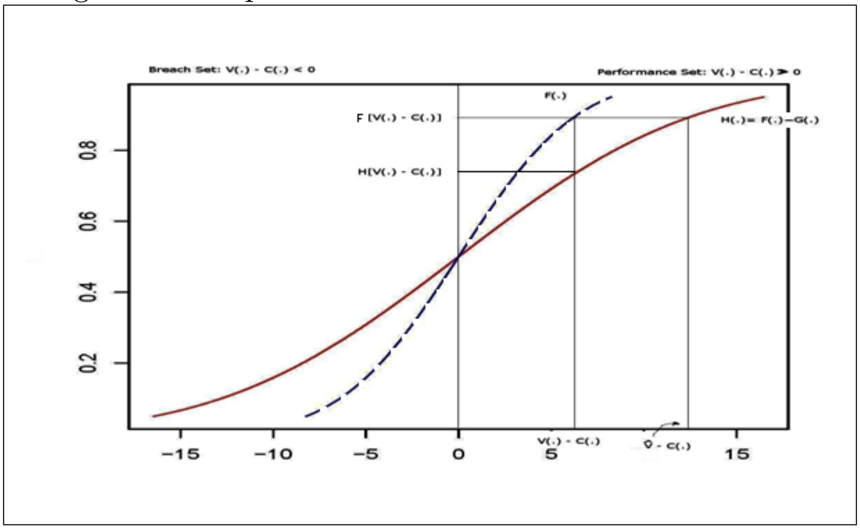
and the seller solves $\max_{r^s} C(r^s) - r^s$; let $r^s = r^s_c$ that satisfy the F.O.C:

$$V'(r^s_c) = 1 \tag{9}$$

So at this point we are in a position to weigh the levels of reliances for different dimensions of asymmetry. Since $V'(r^{b*}) > 1 = V'(r^b_c)$, this means that, since $V'(r^b) > 0$ and $V''(r^b) < 0$, the amount of reliance investment under one sided uncertainty must be less than the amount without uncertainty. We can construct a similar argument for the seller's investment.

Comparing the expressions (6) with (4) and (7) with (5), we infer that under two-sided uncertainty the efficient levels of investments by the parties would be even less vis-à-vis under one-sided uncertainty [since $H(x) < F(x)$ for all $x[:= V(r^b) - C(r^s)] > 0$ except at the extreme, see figure 2 below]. The reason is that uncertainties at double margin (about the buyer's valuation as well as the seller's cost) coupled with the possibility of breach undermines the value of reliance for the parties when compared to the one-sided uncertainty case . ■

Figure 2: Comparison of Distribution functions H and F



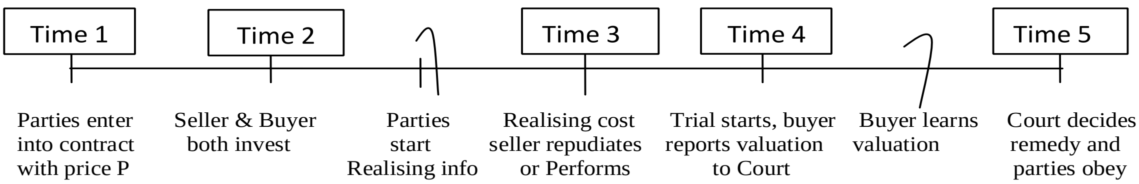
Note: The blue curve (the broken line) [i.e. *F(.)*] is the normal distribution with variance 25, and the red curve (the thick continuous line) [i.e. H(.)] is the normal distribution function with variance 100 and mean in both case being zero. On the left of the horizontal mark 0, according to our assumption no contract is feasible since the argument takes negative value i.e. $V(.)$ - $C(.)$ $<$ 0. Thus the relevant zone is the RHS; and in this zone $F(.) > H(.)$.

3. Court imposed Damages

3.1. The setting

To formalise the model, the buyer offers the seller in Time 1 a take-it-or-leave-it contract (with price P) for exchanging one unit of an indivisible specific good. The price will be paid when the seller performs. Once the contract is signed, it becomes binding and no further alteration is allowed.

Figure 3: Periodic Structure for the Contracting Model:



At Time 2, both the parties invest in their respective cost and valuation. At the end of this phase, all uncertainties relating to cost and valuation start getting resolved in the sense that all new information – unknown at the time of contracting

– is now revealed. At Time 3, once the seller realises her exact cost of performance, she decides whether to perform the contract or to repudiate. It is useful to highlight the situation here, when the seller contemplating breach does not know the actual loss it will cause to the buyer – a paradigmatic case of asymmetric information. Thus in deciding whether or not to breach, the promisor will attempt to estimate the expected value of the damages she will be ordered to pay if a suit is brought (a suit may not be even brought [4]). So she decides on the basis of two factors – first, the pre-decided price P and secondly, the forthcoming default legal damages regime a court will adopt and apply at Time 5 if the seller does not deliver at Time 3 and a lawsuit is filed by the buyer at Time 4 [5].

In case the seller chooses to repudiate (i.e. she delays her delivery), then the buyer reasonably suspects that the seller will not perform at Time 4, as was promised. The buyer's suspicions could be based on a message that he received from the seller (such as a letter saying he would not perform in time) or due to some exogenous information that has arrived (for example, the seller has filed for bankruptcy). The buyer files a suit. At Time 4, trial starts, since the goods have no readily available market price, the court hears evidence about the damages that the breach of the promise to deliver has caused to the buyer and consequently determines the amount of damages the seller needs to pay the buyer. We further assume that at Time 5 when the court makes its decisions, both the seller's cost of performance and the buyer's valuation are not observable to the other party and not verifiable to the court [6].

This creates a moral hazard problem as well as gives vent for oppotunistic behaviour by the parties. We demonstrate the impact of restitution and reliance damages first. Then we move to the case of expectation damage. When it comes to the court to fix the buyer's expectation damages, the competence and the rationality of the court becomes quite important. At Time 4 when the buyer presents evidence to the court about his valuation, contract incompleteness coupled with asymmetry of information in between the parties and the court may accrue to some room for the buyer to customise the evidence. We shall consider three distinct cases as to the court's behaviour in this scenario.

[4] Think of a situation,when the value to the buyer is less than the agreed price.

[5] Also they may take into account the price and incentives to breach reflect the anticipated ex post costs of verifying a buyer's valuation, as well as whether the English rule of loser pays or the American rule of shared costs applies.

[6] This is a substantial departure from notions immanent in the existing models in the literature that deals with incomplete contracts. At Time 1, the parties only observe each other's distributions and their estimates, and do not even know their individual (ex post) valuations. Thus in this sense, they are symmetrically uninformed ex ante. This is the only similarity with other models in the literature. Hidden action exists in the form of self investments by each party. At Time 3 asymmetry of information is introduced. A party learns her individual valuation but still cannot observe (and definitely cannot verify) other's valuation, and the court knows nothing but the estimates.

3.2. Restitution Damages

Restitution damages are defined as the amount of money which restores the buyer to the position he was in before the breach was made. This means that if the buyer prepays the price P before delivery of the good, restitution damages will be $D_s = P$. On the other hand, if, as we are assuming here, there is no prepayment of the price, $D_s = 0$. In this case, restitution damages are the same as no damages. The seller performs if: $P - c \geq 0$, or if, $c \leq P$; otherwise she chooses to breach.

Since $P \in \{[\underline{V},\bar{V}] \cap [\underline{c},\bar{c}]\}$ also $\underline{c} \leq \underline{V} \leq \bar{c} \leq \bar{V}$, we cannot say conclusively that the seller breaches too often when compared to the first best level of efficient breach, as was the case in earlier models in the literature [see, Shavell, supra]. In fact, since the buyer's valuation is private information (moreover the seller cannot observe it) in some contingencies such as $v \leq P$, the seller cannot breach. Thus the breach-set is actually smaller.

$$\begin{aligned} \text{Therefore, } \Pr[\text{performance}] &= \Pr[c \leq P] = \Pr[C(r^s) + \theta \leq P] \\ &= \Pr[\theta \leq P - C(r^s)] = F[P - C(r^s)] \end{aligned}$$

Now the buyer's expected payoff would be –

$$EPB = F[P - C(r^s)].[V(r^b) - r^b - P] + \{1 - F[P - C(r^s)]\}.\{0 - r^b\}.$$

The first order condition for the buyer's payoff maximisation can be derived as –

$$EPB'(r^b) = F[P - C(r^s)].V'(r^b) - 1 = 0$$

$$\Rightarrow \qquad V'(r^b_S) = \frac{1}{F[P - C(r^s_S)]} \lesseqgtr \frac{1}{H[V(r^{b**}) - C(r^{s**})]}$$

$\Rightarrow$ The buyer makes over-investment if $F[P - C(r^s_S)] > H[V(r^{b**}) - C(r^{s**})]$, and if $F[P - C(r^s_S)] < H[V(r^{b**}) - C(r^{s**})]$ then he would under-invest.

$\Rightarrow$ Investment incentive to the buyer cannot be determined conclusively. Most likely, he over-invests. Investment incentive is highly sensitive to the initial choice of contracted price P; it is also highly dependent on the seller's investment structure and particular shape of the two distribution functions $F(.)$ and $H(.)$. If P is chosen sufficiently low then efficient investment or even under-investment is possible. [See figure 2.]

Similarly, the seller's expected payoff would be –

$$EPS = F[P - C(r^s)].[P - r^s - E(c|c \leq P)] + \{1 - F[P - C(r^s)]\}.(0 - r^s)$$

The first order condition for the seller's payoff maximisation can be derived as –

$$EPS'(r^s) = F[P - C(r^s)].[-C'(r^s)] - 1 = 0$$

$$\Rightarrow \qquad -C'(r^s_S) = \frac{1}{F[P - C(r^s_S)]} \lesseqgtr \frac{1}{H[V(r^{b**}) - C(r^{s**})]},$$

$\Rightarrow$ Most likely, the seller would also over-invest in reliance. See the argument provided in the buyer's case.

Remarks:

These over-investment results are in stark contrast to the under-investment results obtained under single dimensional asymmetry.

Intuition – Since the buyer's valuation is private information, he in some contingencies receives some free performance (though this is inefficient from the economic point of view as $v \leq c$) by the seller. Thus he still gets some private return on the specific investment, even when the separation of the parties is efficient and the investment has no social return. This is the 'insurance motive'. Since the buyer does not need to fully internalise all social cost of breach, his incentive to invest is not held-up here (when compared to a model with one-sided private information of the seller, see equations (6) and (7)). Besides, if the contracted price is not so high, the seller anticipating this phenomenon increases her investment to the point she has to perform under restitution damage. A precautionary motive operates for the seller.

3.3. Reliance Damages

Reliance damages are defined as the amount of money that puts the buyer in the same position as he would be if the contract was not signed. The buyer's position if the contract was never signed is zero, while his position in the event of breach is $\{-r^b\}$. Reliance damages are computed as the difference between these two, i.e. $D_r = r^b$.

Now the seller's payoff when the contract is honoured is: $\{P - c\}$; and when she breaches her wealth is: $\{-D_r\}$. Thus the seller chooses to perform when: $P - c \geq -D_r$ i.e. $P + r^b \geq c$, otherwise she breaches.

Therefore, $\Pr[\text{performance}] = \Pr[c < P + r^b] = \Pr[C(r^s) + \theta \leq P + r^b]$
$= \Pr[\theta \leq P + r^b - C(r^s)] = F[P + r^b - C(r^s)]$

Now the buyer's expected payoff would be –

$$EPB = F(.).[V(r^b) - r^b - P] + \{1 - F(.)\}.\{r^b - r^b\}$$

The first order condition for the buyer's payoff maximisation can be derived as –

$$EPB'(r^b) = f(.).[V(r^b) - P - r^b] + F(.).V'(r^b) - 1 = 0$$

Thus at the efficient level of reliance by the buyer, we get the following –

$$\begin{aligned} V'(r^b_R) &= 1 - [V(r^b_R) - P - r^b_R].\frac{f[P + r^b_R - C(r^s_R)]}{F[P + r^b_R - C(r^s_R)]} \\ &\leq 1 < \frac{1}{H[V(r^{b**}) - C(r^{s**})]} \end{aligned} \tag{10}$$

$\Rightarrow$ Thus the buyer will over-invest compared to the first best.

Similarly, the seller's expected payoff would be –

$$EPS = F(.).[P - r^s - E(c|c \leq P + r^b)] + \{1 - F(.)\}.[-r^b - r^s]$$

The first order condition for the seller's payoff maximisation can be derived as –

$$EPS'(r^s) = F(.).[-C'(r^s)] - 1 = 0$$

i.e.
$$-C'(r^b_R) = \frac{1}{F[P + r^b_R - C(r^s_R)]} < \frac{1}{H[V(r^{b**}) - C(r^{s**})]} \tag{11}$$

$\Rightarrow$ The seller will also be investing more relative to the first best.

Remarks:

The buyer is as usual investing excessively under reliance damage because of the separation prevention motive. But over-investment by the seller here stands in surprising contrast to the case of single dimensional asymmetry. This again happens because of the precautionary motive adopted by the seller, similar to the case of restitution damage.

Notice here that the seller's equilibrium investment incentive condition (11) in this case is essentially the same as the condition in the one-sided asymmetry case. So naturally the question arises here, how do we get this over-investment result? The reason is that the first best levels are different for different dimensions of asymmetry. The first best optimum level of reliance under two-sided private information is lower than that under one-sided private information. [See Proposition1]. Thus when the reliance damage is the concerned remedy, even if the seller undertakes the same amount of investment in both cases, her investment stands higher under two-sided asymmetry whereas it falls below under one-sided asymmetry (compared to the respective first best levels).

3.4. Analysis of Expectation Damage

Whenever it is efficient for the seller, she pays the court-imposed expectation damages in Time 3 and exit the contract. So, the seller's gain on performance is $(P-c)$ and on failure to honour the contract is $(-D_E)$, where D_E is the expectation damage measure. Therefore, the seller will perform whenever: $P - c > -D_E$, otherwise she will breach.

In the face of breach, the buyer will most likely misguide the court about his actual valuation of performance of the contract so that his *ex post* payoff increases. At this juncture, it is worth commenting on how his expected payoff may vary depending upon how the court reacts to his claim on valuation. There could be different level of strictness (competence) attached to different courts. There are three possible cases – (a) the court is naive and simply believes in the evidence produced by the promisee regarding his (inflated) valuation and grants expectation on the basis of that; (b) the court is very strict and refutes the evidence and only accepts the *ex ante* expected level of the promisee's valuation; and (c) the court at its discretion chooses a value in between the expected valuation and the evidential (inflated) valuation by the promisee.

We have sought to focus on these cases because of the interest in contributing to the legal debates on expectation liability for reliance. When expectation interest is not properly verifiable in the court either because of uncertainty in valuations or because of hidden information or both, the liability for such reliance is highly debated in the literature. The legal debate is thus relevant to those cases in which liability could in principle be imposed by the courts, and the question is whether it should be imposed and to what extent. Let us now try to show, one by one, what happens in the aforementioned three different situations.

Case-1: The court is naive

In this case, the court adopts "*subjective measures*" of damage that either require the revelation or permit the discovery of firm-specific information. The court accepts the evidence put before it by the promisee (buyer) and grants him to recover a D_E , the expectation damage measure based on the buyer's reported valuation, $\hat{V}$, to the court. Thus $D_E = \hat{V} - P$. Therefore, the seller will breach whenever $c > \hat{V}$, and will perform otherwise. Thus we calculate the probabilities of performance and breach –

$$\begin{aligned}\Pr(\text{performance}) &= \Pr[c \le \hat{V}] = \Pr[C(r^s) + \theta \le \hat{V}] \\ &= \Pr[\theta \le \hat{V} - C(r^s)] = F[\hat{V} - C(r^s)]\end{aligned}$$

Therefore, the buyer's expected payoff would be –

$$\begin{aligned} EPB_E &= F[\hat{V} - C(r^s)].[E(v) - P - r^b] + [1 - F(\hat{V} - C(r^s))].[D_E - r^b] \\ &= F[\hat{V} - C(r^s)].[V(r^b) - P - r^b] + [1 - F(\hat{V} - C(r^s))].[\hat{V} - P - r^b] \\ &= F[\hat{V} - C(r^s)].V(r^b) + \hat{V} - F[\hat{V} - C(r^s)].\hat{V} - P - r^b \end{aligned} \tag{12}$$

Similarly, the seller's expected payoff is –

$$\begin{aligned} EPS_E &= F[\hat{V} - C(r^s)].[P - r^s - E(c|c \leq \hat{V})] + [1 - F[\hat{V} - C(r^s)]].[-D_E - r^s] \\ &= P - r^s - F[.].E[C(r^s) + \theta | C(r^s) + \theta \leq \hat{V}] - \hat{V} + \{1 - F[.]\}.\hat{V} \end{aligned} \tag{13}$$

Now to check the investment incentives for the parties, we derive following lemma –

Lemma 2. *To check whether the buyer and the seller make efficient investment or not, we now one by one maximise the buyer's expected pay off in equation (12) with respect to* r^b *and the seller's expected pay off in equation (13) with respect to* r^s *–*

$$\begin{aligned} & EPB'_E(r^b) = F[\hat{V} - C(r^s)].V'(r^b) - 1 = 0 \\ \Rightarrow \quad & F[\hat{V} - C(r^s)].V'(r^b) = 1 \end{aligned}$$

$$\text{Therefore,} \qquad V'(r^b_E) = \frac{1}{F[\hat{V} - C(r^s_E)]} \lesseqgtr \frac{1}{H[V(r^{b**}) - C(r^{s**})]} = V'(r^{b**}) \tag{14}$$

Thus from the previous expression we cannot conclusively comment upon whether the buyer would make over-investment or efficient investment in reliance compared to the first best level in this case; we need further evidence on $\hat{V}$ to be able to compare the values of $F(.)$ and $H(.)$ in the expression (14).

The seller's expected payoff maximisation gives us the following –

$$\begin{aligned} & EPS'_E(r^s) = -1 - f[\hat{V} - C(r^s)].[-C'(r^s)].\hat{V} \\ & \qquad -F[\hat{V} - C(r^s)].C'(r^s) + f[\hat{V} - C(r^s)].[-C'(r^s)] = 0 \\ \Rightarrow \quad & F[\hat{V} - C(r^s)].C'(r^s) = -1 \end{aligned}$$

$$\text{Therefore,} \quad -C'(r^s_E) = \frac{1}{F[\hat{V} - C(r^s_E)]} \lesseqgtr \frac{1}{H[V(r^{b**}) - C(r^{s**})]} = -C'(r^{s**}) \tag{15}$$

Again we cannot say anything conclusive about over/under/efficient level of investment by the seller compared to first best. Comment no.7 following the lemma below will conclusively state the equilibrium outcome. ■

Now, when the buyer tries to maximise his expected payoff by choosing $\hat{V}$, we get the following condition –

$$f[\hat{V} - C(r^s)].1.V(r^b) + 1 - f[\hat{V} - C(r^s)].\hat{V} - F[\hat{V} - C(r^s)].1 = 0 \qquad (16)$$

We derive the following lemma –

Lemma 3.

$$\hat{V}^E = E(v) + \frac{1 - F[\hat{V} - C(r^s_E)]}{f[\hat{V} - C(r^s_E)]}, \qquad \textit{where } E(v) = V(r^b) \qquad (17)$$

$$P^E = E(c|c \leq \hat{V}^E) + \{1 - F[\hat{V}^E - C(r^s_E)]\}.\hat{V}^E,$$
$$D_E = F[\hat{V}^E - C(r^s_E)].\hat{V}^E - E(c|c \leq \hat{V}^E).$$

Proof: $\hat{V}^E$ is directly derived from equation (16). This $\hat{V}^E$, as we shall call, is agent's "virtual valuation under expectation damage" [7]. The other conditions are calculated by substituting F.O.C. values in the relevant places. ■

Observations:

1. Observe that F.O.C. implies that $\hat{V}^E \geq E(v)$.
2. From equation (13), we can see that the buyer tend to inflate his valuation by the amount $\left\{\frac{1-F[\hat{V}-C(r^s_E)]}{f[\hat{V}-C(r^s_E)]}\right\}$. This evidence confirms our suspicion that the buyer would try to fetch more than his expected valuation during the litigation by misguiding the court.
3. As the buyer's $E(v)$ increases, the buyer's reported value $\hat{V}^E$ also increases, but the exaggeration factor (i.e. $\frac{1-F[\hat{V}-C(r^s_E)]}{f[\hat{V}-C(r^s_E)]}$) decreases. This can be directly derived from the monotone hazard property we ascribed to $f(.)$.
4. Observe that the buyer faces an ambivalence in terms of (mis)reporting his anticipated value to the court: if the buyer inflates his valuation and the seller's cost is even higher (with the probability, $[1 - F(\hat{V} - C(r^s))]$), then the seller will breach and the buyer wins higher damages. However, a higher reported valuation, and hence a higher damage payment, will discourage the seller from breaching, in which case the buyer only gets $E(v)$ instead of a higher $\hat{V}$. He will balance these two countervailing incentives when choosing his evidence.
5. Note that in this case we assumed that the buyer's uncertainty has not realised fully when the breach occurs and so he has reported an anticipated valuation. However, even if his valuation is fully realised, it is his dominant strategy under trial to report such a valuation so long as his actual valuation $v < \hat{V}^E$. Also

[7] The 'virtual valuation/ cost' (see, Myerson, 1981) appears in many related models where agents have private information about their willingness-to-pay. See Bulow and Roberts (1989) for an interesting economic interpretation of 'virtual valuations' and 'virtual costs'.

to be noted here is that in case the buyer's actual valuation $v > \hat{V}^E$, then he may even ask for a 'specific performance' remedy in the court.

6. Note here that the seller breaches whenever $c > \hat{V}^E$ $(\neq v)$. Therefore, importantly, there is inefficient breach from the *ex ante* and *ex post* perspectives. Clearly, there is under-breach if $v < \hat{V}^E$ and there is over-breach whenever $v > \hat{V}^E$.

7. Therefore in the light of the previous point, we can now conclusively say that in the expressions (14) and (15) only strict inequality hold good [since $F(.) > H(.)$, refer to figure 2], and thus both the buyer and the seller will over-invest in reliance compared to the individual first best levels under this case.

Intuition: When a naive court accepts the buyer's reported value in establishing the expectation compensation, knowing this the buyer then does not stretch his reliance too much; rather he tries to customise his report to maximise his gain. We mean to say that while the insurance motive is still present in the mind of the buyer, the separation prevention motive is absent here (as against Case-II, see the intuition of remark no.3 following the lemma below [*Lemma 4*]).

Remarks:

Note that, in a special case when $F[\hat{V} - C(r^s)] = H[V(r^b) - C(r^s)]$, then both the buyer and the seller would undertake efficient levels of investment as under the first best. This is striking and has an important bearing on court-decisions to uphold efficiency (at least in terms of efficient reliance when *ex post* efficient breach is very unlikely). In case the parties foresee this particular possibility, they may at the time of contracting (under the provision of liquidated damage) fix a high-penalty [according to $F(.) = H(.)$] as a default option in case of dispute, which will effectively ensure the efficient reliance for both the parties. Also note that this penalty may often be higher than the *actual expectation damage* (in case verified, it could be lower as well; but certainly higher than the *Expected expectation damage* [vide equation (17)] at the time of dispute settlement depending upon the realisation of the buyer's valuation. Note that this finding stands in stark contrast to the result by Stole (1991), which suggeststhat liquidated damages could not be higher than the buyer's expected valuation. In fact, his analysis was motivated by the social welfare maximisation whereas our result arises from the parties' interest to induce the efficient reliance when the efficient breach is difficult to detect. But it is noted in the literature that the courts routinely refute these stipulated penalties in case of disputes and only allow non-penalty liquidated damages.

What is surprising here is the following: When the promisee's expectation interest is difficult to monetise and the contract is silent regarding remedies, the court at its will may threaten the promisor with a large penalty (actually this is the specific performance remedy) in order to induce the promisor either to perform or to make a supra-compensatory payment to the promisee. However, when the promisee's expectation is difficult to monetise, the parties themselves cannot threaten the promisor with a large penalty in order to induce the promisor either to perform or to make a supra-compensatory payment to the promisee. Why can the courts do what the parties cannot? Without questioning the welfare impacts of the penalties, from the logical point of view we advocate that the court (which itself suffers from lack of competence in the face of parties' private information) should drop its bias towards this issue and allow the parties to set the contractual terms freely (under mutual assent).

Case-2: The court is strict

When the court is strict, it adopts measures that neither require the aggrieved party to reveal, nor permit the breaching party to discover, firm-specific information. It completely overlooks all the evidences produced by the promisee regarding his *ex post* valuation and only accepts $E(v)$, which is observable and easier to calculate and may be due to the seller's refutal. This is thus an "objective damage" measure . We call this as "Expected Expectation Damage". Thereby, the court sets expectation damage $D_e = E(v) - P$ and allows the breach-victim to recover this amount when trade is inefficient. Thus, the seller performs *iff*: $P - c \geq -D_e = -\{E(v) - P\}$ or if, $c \leq E(v)$; otherwise she breaches. Therefore,

$$\begin{aligned} \Pr[\text{Performance}] &= \Pr[c \leq E(v)] = \Pr[C(r^s) + \theta \leq E(v)] \\ &= \Pr[\theta \leq E(v) - C(r^s)] = F[V(r^b) - C(r^s)] \end{aligned} \tag{18}$$

Now the expected payoff for the buyer would be –

$$\begin{aligned} EPB_e &= F[V(r^b) - C(r^s)].\{E(v) - P - r^b\} + \{1 - F[V(r^b) - C(r^s)]\}.\{D_e - r^b\} \\ &= V(r^b) - P - r^b \end{aligned} \tag{19}$$

And the expected payoff for the seller would be –

$$\begin{aligned} EPS_e &= F[V(r^b) - C(r^s)].\{P - r^s - E(c|c \leq E(v))\} \\ &\quad + \{1 - F[V(r^b) - C(r^s)]\}.\{-D_e - r^b\} \\ &= P - r^s - F[V(r^b) - C(r^s)].E(C(r^s) + \theta | C(r^s) + \theta \leq V(r^b)) \\ &\quad - V(r^b) + F[V(r^b) - C(r^s)].V(r^b) \end{aligned} \tag{20}$$

Lemma 4. ***:*** *(Investment Incentives)*

To check whether the buyer and the seller make efficient investment or not, we maximise the buyer's expected payoff in equation (19) with respect to r^b and the seller's expected payoff in equation (20) with respect to r^s –

$$EPB_e'(r^b) = 0 \Rightarrow V'(r_e^b) = 1 < \frac{1}{H[V(r^{b**}) - C(r^{s**})]} = V'(r^{b**}) \tag{21}$$

⇒The buyer severely over-invests in reliance compared to the first best level.

Again, $$EPS_e'(r^s) = -1 - f[V(r^b) - C(r^s)].[-C'(r^s)].V(r^b)$$
$$-F[V(r^b) - C(r^s)].C'(r^s) + f[V(r^b) - C(r^s)].[-C'(r^s)].V(r^b) = 0$$

$$\Rightarrow \quad -C'(r_e^s) = \frac{1}{F[V(r_e^b) - C(r_e^s)]} < \frac{1}{H[V(r^{b**}) - C(r^{s**})]} \tag{22}$$

⇒The seller also over-invests in reliance compared to the first best level. ■

Remarks:

1. Note here, the level of reliance investments both by the buyer and the seller in this case is equivalent to that in the model where there is only one-sided uncertainty pertinent to the seller's cost of performance. This result is not very surprising as the breach decision is unilateral in both the cases and is exercised by the seller.

2. Note that the breach condition here is not exactly the same for efficient breach; we observe that the seller breaches whenever $c > E(v)$. This is inefficient in some states of the world when $E(v) > v$. Therefore, importantly, there is over-breach from the *ex ante* perspective. Also worth noting, from the *ex post* perspective, there is under-breach whenever $E(v) > v$ and there is over-breach if $E(v) < v$.

3. Comparing the expressions (21) with (14), we can conclude that the investment incentives to the buyer under case-II are far higher than under case-I. The reason is twofold: first, an insurance motive (which is common argument for expectation damages), secondly, here the separation prevention motive also works (in contrast to the view of Sloof et. al. 2006 where they say that this motive only works under reliance damage measure) as the buyer's expected valuation is directly dependent on his investment choice (by construction, in our model). Since in this case the buyer is better off when the parties trade than when they efficiently separate, he may therefore have an incentive to invest at least so much such that the valuation within the relationship reaches the highest possible valuation.

4. Now for the seller, comparing the expressions (22) with (15), we can infer that the investment incentives to the seller under case II are somewhat higher than under case-I. The reason being – when the buyer invests far in excess due to the separation prevention motive and forces the seller to perform, the seller, in order to cope with this extra burden of performance, also has to be induced to undertake excess investment that will further reduce her cost of performance. This is just the precautionary/ insurance motive.

In case the court imposes a measure of damages that is equal to the breacher's estimate of the aggrieved party's loss (and does not condition it on the aggrieved party's subjective loss), then the seller's breach-or-perform decisions under this "flat" measure of damages would be the same as they would be if the law provided for the recovery of fully compensatory expectation damages. As has been recognised in the tort literature, accuracy in the assessment of damages is socially beneficial only if it can improve incentives *ex ante* – that is, only if the party contemplating an action has access to the more accurate information at a reasonable cost at the time he is deciding how to act.

Case-3: The court's nature and behaviour are uncertain

Different courts will have different levels of naivety. To capture this point, we assume that courts will determine the expectation damages in such a way that they will lie somewhere in between thresholds of the aforementioned two cases. Thus, the court is assumed to hear the buyer's report and, knowing that the buyer has an incentive to mis-report the loss, the judge will also use his/her discretion to make some (downward) adjustments. Specifically, we assume that the damages will be a linear combination of the buyer's report ($\hat{V}$) and the buyer's (observed / expressed) expected value $E(v)$, i.e., the new measure of damage will be

$$\begin{aligned} d_n &= \gamma.D_e + (1-\gamma).D_E \\ &= \gamma.[E(v) - P] + (1-\gamma).[\hat{V} - P] = \hat{V} - P + \gamma.[E(v) - \hat{V}], \end{aligned}$$

where $0 \leq \gamma \leq 1$ is a parameter representing the court's level of "strictness". We assume that the buyer does not know in advance the level of strictness of the court, and therefore cannot adapt its report to the specific court in which the trial takes place. Instead, we assume that the buyer can observe only $E[\gamma]$, the average level of strictness of the court, when it decides whether and by how much to inflate her loss. At Time 4, based on the evidence that the buyer presented to the court, the court decides the amount of expectation damages that the breach caused. Then, after the trial, but before Time 5, the buyer learns her realized valuation.

We suppress the calculations at this stage since they will proceed in the same way as in case-I and the results would be pretty much similar. The only difference that arises here that the buyer would be less aggressive in exaggerating his reported value.

A case of buyer's *ex post* verifiable valuation to court

It was assumed that the seller's costs and the buyer's valuation are private information and non-observable to the other party throughout the entire transaction. Now for expository purposes we can argue that the buyer's damages are verifiable *ex post* (only) in court through discovery, and not while the seller is making a decision on performance or breach. We assume that there are no costs associated with the verification of the buyer's *ex post* valuation (or there could be some reasonable cost for verification; under common laws this cost is borne by the seller whereas under US laws this cost goes to the buyer). As the buyer's valuation is verifiable by the court, the court is capable of awarding actual damages. But there is a catch; the buyer in this case would only file a lawsuit when his *ex post* actual valuation is larger than the contracted price; otherwise the buyer might end up paying damages. Thus, the seller does not, in fact, face the entire distribution of the buyer's valuations under actual damages remedy. Instead, he faces a truncated distribution which has a higher mean than the *ex ante* expectation damages he would pay under the fixed *ex ante* expectation damages remedy. As a result, the seller breaches too little. Therefore, joint welfare in an actual damages award regime is reduced relative to a fixed expected expectation damages regime. We suppress the analysis of incentive to investment as it is more or less expected to be inefficient.

4. Social Welfare and the Damage Measures

Let us now try to find the optimal value of D, that is, the value of D that maximises the total *ex post* surplus. In this regard, we assume a unilateral breach by the seller so that the seller will pay the amount D and free herself of the contract *iff*: $P - c < -D$ or, $P + D < c$.

$$\begin{aligned} \text{Therefore,} \quad \Pr[\mathit{Performance}] &= \Pr[P + D \geq c] = \Pr[\theta \leq P + D - C(r^s)] \\ &= F[P + D - C(r^s)] \end{aligned}$$

Given any damage D, let the expected total surplus $EPJ(D)$ be a function of D –

$$\begin{aligned} EPJ(D) &= F[P + D - C(r^s)].\{E(v) - P - r^b] + [P - r^s - E(c|c \leq P + D)]\} \\ &\quad +\{1 - F[P + D - C(r^s)]\}.\{[D - r^b] + [-D - r^s]\} \\ &= F[P + D - C(r^s)].\{E(v) - E[C(r^s) + \theta|C(r^s) + \theta \leq P + D]\} \\ &\quad -r^b - r^s \end{aligned}$$

We want to maximise this with respect to D bounded in the region $[0; P - \underline{c}]$. The upper bound comes from the fact that if D is too high it would never be paid by the breacher or else too high a D would be treated as specific performance.

Let us define: $D^* = \arg\max EP(D)$. The solution to the previous equation gives us a situation that entails the optimal mechanism is the expectation damage.

Proposition 5. $D^* = \min[E(v) - P,\ P - \underline{c}]$.

Proof: the First Order Condition for $EPJ(D)$ maximisation gives us –

$$\begin{aligned} EPJ'(D) &= f[P + D - C(r^s)].1.V(r^b) - f[P + D - C(r^s)].1.\{P + D\} \\ &= f[P + D - C(r^s)].\{V(r^b) - P - D\} \end{aligned}$$

And the second order condition gives us –

$$EPJ''(D) = f'[P + D - C(r^s)].1.\{V(r^b) - P - D\} - f[P + D - C(r^s)].1$$

Therefore, setting $D^* = V(r^b) - P$ gives us the unique global maximum since

$$EPJ'[V(r^b) - P] = 0$$

$$\text{and} \qquad EPJ''[V(r^b) - P] = -f[V(r^b) - P] < 0$$

Note here that by setting $f[P - C(r^s) + D^*] = 0$ instead, we cannot get another solution since $f(.)$ is strictly positive. Also worth noting is that $P + D - C(r^s) > 0$ by assumption (we assumed unilateral breach by the seller), thus, $D^* = E(v) - P$ or, $P - \underline{c}$, depending upon the parameters in the claim. ■

Thus we summarise our observations from the three cases in the form of the following claim –

Claim 1: *Under a fixed price incomplete contract that has bilateral investments and two-dimensional asymmetry, any variant of Expectation Damage remedy results neither in ex ante efficient relation-specific investment nor in ex post inefficient breach; although* <u>Expected</u> <u>Expectation</u> <u>Damage</u> *(case-II) optimises expected social welfare and* <u>High</u> <u>Expectation</u> *Damage (case-I) may induce efficient reliance.*

5. Party designed Liquidated damages

In the light of the preceding analysis, the parties can agree to keep a provision for a breach of contract by including a liquidated damage clause in their contract agreement. There could be three different contracting scenarios to provide a diverse range of environments for analysis. First, the buyer may propose the contract to the seller, and the seller may accept or reject it. Second, the seller may propose the contract, and the buyer may accept or reject it. Finally, an uninformed broker may design a contract that maximizes the joint surplus from trade between the parties. We take the usual route here: as is familiar in the contract theory literature, the buyer designs the contract. We now study the impact of this remedy.

The sequence of events:

The parties at Time 1 sign a contract and specify the fixed delivery price p and the liquidated damage payment, D_L $\rightarrow$ in the interim of Time 1 and Time 2, both the buyer and the seller make reliance investments of r^b, $r^s > 0$, given p and D_L $\rightarrow$ at Time 2, the seller observes his cost of production $\rightarrow$ given p and D_L, the seller decides whether to perform the contract or breach the contract $\rightarrow$ If the seller breaches, the buyer files a suit and the court awards him with the liquidated damages D_L at Time 3.

The seller's breach decision is subjected to cost, p, and D_L. The seller will perform, only when:

$$p - c \geq -D_L \qquad \text{or if :} \qquad c \leq p + D_L \ .$$

For further reference, it is useful to define T as the sum of the price and the liquidated damage clause: $T \equiv p + D_L$ .We will refer to T as the promisor's "*total breach cost*" when leaving the existing contract consisting of his opportunity costs p and the damage D_L.

Thus, the probability of efficient performance by the seller is:

$$\Pr[C(r^s)+\theta \leq p+D_L] = \Pr[\theta \leq p+D_L-C(r^s)] = F[p+D_L-C(r^s)]$$

.

Given the probability of performance, the buyer's expected payoff is:

$$EP_L^b = F[p+D_L-C(r^s)].[V(r^b)-p]+\{1-F[p+D_L-C(r^s)]\}.D_L-r^b$$

And the seller's expected payoff is:

$$\begin{aligned} EP_L^s &= F[p+D_L-C(r^s)][p-E(c|c \leq p+D_L)] \\ &\quad +\{1-F[p+D_L-C(r^s)]\}.(-D_L)-r^s \\ &= F[.].(p+D_L)-F[.].E(c|c\leq p+D_L)-D_L-r^s \end{aligned}$$

Therefore, $\quad EP_L^b + EP_L^s = F(.)\{V(r^b) - E(c|c \leq p+D_L)\} - r^b - r^s$

We obtain the following lemma –

Lemma 6. *:* For any given $T \equiv p + D_L$ and p > 0, the buyer can always be made strictly better off by increasing D_L and decreasing p by the same amount, thereby keeping T constant.

Proof: Simply note that the buyer's payoff:

$$EP_L^b = F[p + D_L - C(r^s)].[V(r^b) - p] + \{1 - F[p + D_L - C(r^s)]\}.D_L - r^b$$

can also be written as -

$$EP_L^b = F[T - C(r^s)].V(r^b) + D_L - F[T - C(r^s)]\}.T - r^b,$$

which is strictly increasing in D_L . The lemma implies that, for T given, buyer prefers to offer a price p as low as possible to the seller. Although p and D_L are prefect substitutes from the standpoint of contract performance, the buyer prefers to obtain a higher damage payment D_L rather than paying a higher price p . Clearly, there is a limit in lowering p due to the non-negativity constraint and the seller's participation requirement. ■

Since the buyer determines p and D_L to maximize his expected payoff, under asymmetric information, the principal cannot observe the agent's effort. Thus the buyer's program is then to offer the seller a contract (p, D_L) that will maximize his expected payoff subject to the incentive constraint (IC) and a participation constraint (IR) of the seller, so that the agent receives a nonnegative utility. We assume that the buyer has all the bargaining power in contracting; i.e., he makes a take-it-or-leave-it offer to the seller. The seller can accept or reject the contract. If the seller rejects, the outcome is $(q, p) = (0, 0)$. This is the seller's reservation bundle. The seller's reservation utility is therefore c= 0 as there is no market alternative.

Thus we have the following optimisation problem –

$$\begin{array}{llll} \max_{p,D_L,r^b,r^s} EP_L^b(p, D_L, r^b) & & & \\ \text{s.t.} & \text{(i)} & EP_L^s \geq 0 & \text{[IR]} \\ & \text{(ii)} & \max_{r^s} EP_L^s & \text{[IC]} \end{array}$$

<u>Aside</u>, the seller's maximisation problem gives us the following F.O.C –

$$f(.).[-C'(r^s).(p + D_L) - f(.).[-C'(r^s).(p + D_L) + F(.).[-C'(r^s)] = 1$$

$$\Rightarrow \qquad F(.).C'(r^s) = -1$$

Replacing this into the buyer's maximisation problem, we rewrite the buyer's problem as follows –

$$\begin{array}{llll} \max_{p,D_L,r^b,r^s} EP_L^b(p, D_L, r^b) & & & \\ \text{s.t} & \text{(i)} & EP_L^s \geq 0 & \text{[IR]} \\ & \text{(ii)} & F(.).C'(r^s) = -1 & \text{[IC]} \end{array}$$

The buyer, by assumption, has the entire bargaining power and thus extracts the entire *ex ante* surplus; which entails that the participation constraint is binding in the light of Lemma 6.

We derive the following lemmata –

Lemma 7.

$$p^* + D_L^* = V(r^{b*}) \tag{23}$$

$$D_L^* = F(V(r^{b*}))\{V(r^{b*}) - E(c|c \leq V(r^{b*}))\} - r^{s*}$$

$$p^* = [1 - F(V(r^{b*})]V(r^{b*}) + F(V(r^{b*})).E(c|c \leq V(r^{b*})) + r^{s*}$$

$$EP_L^b = D_L^* - r^{b*}$$

$$EP_L^s = 0.$$

Lemma 8. *Both the seller (promisor)and the buyer (promisee) make efficient investment vis-a-vis the socially desired level of investments under liquidated damage remedy when* <u>*one sided private information*</u> *(pertinent to the promisor) is present. But those* <u>*investment levels are higher*</u> *when there is* <u>*two-sided information asymmetry.*</u>

Proof of Lemmata 7 & 8: We provide a joint proof of the lemmata as they are interlinked with each other.

Substituting IR into the objective function we get –

$$F(.)V(r^b) - F(.)E[C(r^s) + \theta | C(r^s) + \theta \leq p + D_L] - r^b - r^s.$$

Now replacing IC into the previous expression, we get –

$$\frac{1}{C'(r^s)}.V(r^b) - .E[C(r^s) + \theta | C(r^s) + \theta \leq p + D_L] - r^b - r^s.$$

Maximising the above expression w.r.to r^b and r^s gives us the following –

$$\frac{1}{C'(r^s)}.V'(r^b) = -1 \qquad \text{or,} \qquad V'(r^{b*}) = -C'(r^{s*}) \tag{24}$$

$\Rightarrow$ Marginal returns from reliance investments by the parties are equal.

And $\quad f(.).[-C'(r^s)].V(r^b) - f(.).[-C'(r^s)].(p + D_L) - F(.).[-C'(r^s)] - 1 = 0$

$$\Rightarrow \quad f(.).C'(r^s).[V(r^b) - (p + D_L)] = 0, \quad [\text{since from (IC), } F(.).C'(r^s) = -1]$$

$$\Rightarrow \qquad V(r^{b*}) = (p^* + D_L^*) \qquad [\text{since } f(p + D_L) \neq 0] \tag{25}$$

$\Rightarrow$ The optimum total breach cost is equal to the optimum valuation of contract by the buyer.

$$\Rightarrow \qquad r^{b*} = V^{-1}(p^* + D_L^*)$$

Putting $p^*$and D_L^* into the seller's payoff function, we get her equilibrium payoff –

$$\begin{aligned} EP_L^{s*} &= F(p^* + D_L^*)[p^* - E(c|c \leq V(r^b))] + [1 - F(p^* + D_L^*)](-D_L^*) - r^s \\ &= F(V(r^b)).[p^* - E(c|c \leq V(r^b))] + [1 - F(V(r^b))].(p^* - V(r^b)) - r^s, \\ &= p^* - F(V(r^b)).E(c|c \leq V(r^b)) - [1 - F(V(r^b))]V(r^b) - r^s \end{aligned} \qquad (26)$$

When we set $EP_L^{s*} = 0$,then

$$p^* = [1 - F(V(r^b)].V(r^b) + F(V(r^b)).E(c|c \leq V(r^b)) + r^s$$

Thus, $\qquad D_L^* = F(V(r^b).\{V(r^b) - E(\text{c|c}\leq V(r^b))\} - r^s$

Therefore, the buyer's equilibrium payoff:

$$\begin{aligned} EP_L^{b*} &= F(p^* + D_L^*)[V(r^b) - p^*] + [1 - F(p^* + D_L^*)]D_L^* - r^b \\ &= F(p^* + D_L^*)[p^* + D_L^* - p^*] + [1 - F(p^* + D_L^*)]D_L^* - r^b \\ &= D_L^* - r^b \qquad \blacksquare \end{aligned} \qquad (27)$$

Observations and Remarks:

1. Note that under liquidated damage $p + D_L = V(r^b) = E(v)$. This is just the same condition that induces efficient breach under expectation damage in the one-sided uncertainty model.

2. Also note that under liquidated measure $p + D_L = V(r^b) = E(v)$ means that this damage is equal to the expected expectation damage (case-II) when the court is strict.

3. Under liquidated damage measure, we observe that the reliance levels undertaken by the two parties are as follows: for the buyer, $V'(r^b) = 1/F(p + D_L)$.

And for the seller, $C'(r^s) = -1/F(p + D_L)$.

Thus levels of investment undertaken by the said parties are still inefficient compared to the first best level (the buyer over-invests and the seller under-invests), but the buyer invests less and the seller invests less and that is exactly equal to the level in case II.

4. Note from the *ex ante* perspective that there is efficient breach but *ex post* there could be inefficient breach whenever $c > E(v)$. To put it starkly, inefficiency arises in both the cases when $v > c > E(v)$ and when $v < c < E(v)$.

From our analysis it is quite evident that in the presence of *ex post* dual sided asymmetry when parties employ a fixed price contract none of the expectation measures awarded by the court nor even party-designed liquidated damage can achieve the first best. However, among all the considered measures the liquidated damage measure performs better than the court imposed ones.

6. Conclusion:

The earlier literature on the analysis of contract remedies for breach does not account for the nonbreaching party's option to not sue for damages upon breach. They typically start the efficiency analysis of various contract remedies assuming, as given, that there will be litigation for breach of the contract. However, we have identified that the victim of breach might choose not to sue for remedy if the expected payoff from the lawsuit is negative, given the contractual terms and her private information about her loss from breach. Our analysis has shown that this option of acquiescing to a breach as well as the non-observability of the parties' valuations and reliances together have important implications for incentives to both breach and reliance and the efficiencies of various contract remedies. Specifically, we have also pointed out that when actual expectation damages of the victim (although not directly observable to the breacher, but) can be verified later (at a cost) in the court, it will induce under-breach from the *ex ante* perspective. Lastly, we have also investigated the court's optimal choice of damages under the case of non-verifiable damages, where the parties engage in a strategic signaling game trying to present evidence strategically to influence the court's damages award. And our results have two-fold implications: first, when the parties do not specify any particular damage measure in their initial contract, the courts should adopt the *expected expectation damage* as this will augment the social surplus and to some extent curb the strategic behaviour of the parties, although this does not lead to efficient investments by the parties; secondly, in case the parties come up with some mutually agreed upon liquidated damage provision in their contract, the court should implement the same unequivocally, as the parties might be designing this damage provision either from the perspective of maximising the joint payoff or from the perspective of implementing efficient levels of bilateral reliance investments.

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