Whither Contract Damages: Contracts with Bilateral Reliance, One-sided Private Information*

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Abstract

This article explores the canonical contracting problem in a general set up of bilateral "selfish" reliance with post contractual one-sided asymmetric information, helping shape optimal contracts and damage compensation. The quantity choice of traded commodity is initially binary, later extending to a continuous condition. Agent reliance may enhance individual valuation but not the contract. Information concerning either valuation or cost accrues for one of the two contracting parties, and remains private –visible only for one party and not even verifiable in court. If some dispute arises, one party may contemplate a preventive breach of contract. This article categorically shows that in an Asymmetric Information scenario, a simple incomplete contract , even under a court-imposed damage regime, often fails to provide an appropriate reliance-incentive for both parties simultaneously, while renegotiation does not help restore ex post efficiency in comparison to a symmetric information case. When the victim´s breach of contract expectation interest is difficult to determine by court, how can a direct revelation mechanism to solve moral hazard while assessing expectation damages correctly turn out to be at odds with ex post efficiency? Conclusions determine that designing a liquidated damage measure for each party is unconditionally superior to all other court-imposed damage procedures.

Key Words author: Contract Law, Contract Breach, Incomplete Contracts, Asymmetric Information, Moral Hazard, Mechanism Design.

Key Words plus: Contract Law, Damages, Asymmetric Information.

JEL Classification: D82, D86, K12.

Fecha de recepción: 16 de octubre de 2010
Fecha de aceptación: 2 de noviembre de 2010

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* Research article on Contract Theory and Economics of Contract Theory. Written by the author under the Law and Economics and Applied Econometrics research line of the Department of Economics, Delhi School of Economics, University of Delhi – India. I am thankful to Dr. Priyodorshi Banerjee, ISI-Calcutta for his valuable suggestions.

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LOS DAÑOS Y PERJUICIOS DE ORIGEN CONTRACTUAL: NUEVAS PERSPECTIVAS CON RESPECTO A CONTRATOS BILATERALES CON ASIMETRÍA DE INFORMACIÓN

RESUMEN

Este artículo explora los interrogantes económicos de la contratación al establecerse acuerdos bilaterales con información asimétrica unilateral post contractual, cuestión que ayuda a formular un modelo de contratación y de reparación de daños y perjuicios óptima. La cantidad elegida de producto a comercializar es inicialmente de tipo binario, pero después éste caso se extiende y continúa. La confianza de los agentes acentúa las valoraciones individuales, pero no fortalece necesariamente el contrato. La información relativa a valoración y costos tiende a ser compilada sólo por una de las partes contratantes, y se mantiene como información privada – sin acceso de la contra parte y sin ser verificable ni siquiera en un tribunal. En caso de un conflicto, una de las partes puede contemplar un incumplimiento anticipado del contrato. Este artículo muestra categóricamente que en un escenario de información asimétrica, un simple contrato incompleto, aún bajo un régimen de daños y perjuicios impuestos por un tribunal, no garantiza un incentivo de confianza apropiado para ambas partes simultáneamente. Asimismo, la renegociación no ayuda a restablecer la eficiencia ex post, en comparación a un caso de información simétrica. Cuando el interés de anticipo de la víctima del incumplimiento es difícil de determinar por la corte, ¿cómo puede un mecanismo de revelación directa resolver el problema de riesgo moral, evaluar los daños y perjuicios anticipados correctamente sin oponerse a la eficiencia *ex post*? Concluimos entonces que tomar una medida de liquidación diseñada para daños y perjuicios para cada una de partes es superior a todos los demás procedimientos de compensación por daños y perjuicios impuestos por un tribunal.

Palabras clave autor: Derecho de los contratos, incumplimiento del contrato, contratos incompletos, información asimétrica, riesgo moral, diseño de mecanismos.

Palabras clave descriptor: Derecho de los contratos, daños y perjuicios, información asimétrica.

Clasificación JEL: D82, D86, K12.

Les dommages et intérêts d'origine contractuelle: nouvelles perspectives quant aux contrats bilatéraux avec asymétrie d'information

Résumé

Cet article explore les questions économiques du contrat lorsque sont établis des accords bilatéraux avec une information post-contractuelle asymétrique unilatérale, question qui aide à formuler un modèle optimal de contrat et de réparation des dommages et préjudices. La quantité choisie de produit à commercialiser est initialement de type binaire, mais ensuite ce cas est étendu et continue. La confiance des agents accentue les estimations individuelles, mais ne fortifie pas nécessairement le contrat. L'information relative à l'estimation et aux coûts tend à être compilée seulement par l'une des parties contractantes, et est maintenue comme information privée - sans accès de la contre partie et sans même être vérifiable devant un tribunal. En cas de conflit, l'une des parties peut considérer un manquement anticipé du contrat. Cet article montre de manière catégorique que, dans un environnement d'information asymétrique, un simple contrat incomplet, même sous un régime de dommages et préjudices imposés par un tribunal, ne garantit pas une incitation à la confiance appropriée pour les deux parties simultanément. De même, la renégociation n'aide pas à rétablir l'efficience ex post, en comparaison à un cas d'information symétrique. Quand l'intérêt d'anticipation de la victime du manquement est difficile à établir par le tribunal, comment un mécanisme de révélation directe peut-il résoudre le problème d´aléa moral, évaluer les dommages et les préjudices anticipés correctement sans s'opposer à l'efficience ex post ?Nous concluons alors que prendre une mesure de liquidation conçue en cas de dommages et de préjudices pour chacune des parties est supérieur à toutes les autres procédures de compensation pour dommages et préjudices imposés par un tribunal.

Mots clés auteur: Droit des contrats, non-respect du contrat, contrats incomplets, information asymétrique, aléa moral, risque moral, conception de mécanismes.

Mots clés descripteur: Droit des contrats, dommages et préjudices, information asymétrique.

Classification JEL: D82, D86, K12.

1. INTRODUCTION

Earlier economic analyses of contract law have shown (e.g. Shavell, 1980, 2004) that in an environment with unilateral reliance investment and *ex post* symmetric information, there will be incentives toward excessive reliance under both the expectation measure and thereliance measure. It has also been argued that when there is no explicit damage payment, the victim of breach has an incentive to under-invest in reliance. Edlin and Reichelstein (1996, hereafter ER), however, called the over-reliance result in question. In a setting of continuous quantity choice, they show that the *expectation* or the *specific damage measures* provide efficient incentives *iff* the reliance investment is one-sided, the contract specifies some suitable intermediate quantity of trade as a performance obligation and the inefficient performance choices are costlessly renegotiated *ex post*. They find that a continuous quantity in the contract is a powerful tool to adjust incentives. But when both the parties invest, using a deterministic and linear cost function ER show that it is not possible to achieve the first best with expectation damages, (at least not for all types of payoff functions). They also observe that Specific performance remedy induces a symmetry that allows simple contracts to obtain the first best for a particular class of payoff functions.

In this paper we extend the basic unilateral investment models discussed earlier in the literature in a setting of two-sided reliance investments when one of the contracting parties later receives information about his or her utility privately,[1] (profit or cost functions that remain hidden to the other party and to courts).Investments are specific to the relationship, but not contractible, and a party's investment does not directly affect the other party's payoff, only indirectly via the optimal quantity which is higher the more the parties invest. As for the quantity choice of the specific commodity, we start with a model of binary performance choice but later extend the analysis to allow for continuous choice. It adds more realism to the analysis as many bilateral trade relationships involve trading divisible goods and agents can have general utility and cost functions. More importantly, this general treatment helps uncover the funda-

1 Ackerlof (1970) was the first to postulate the issue of asymmetric information in the contractual scenarios.

A recent article by Korobkin and Ulen (2000) excellently summarises the impact of asymmetric information on decision biases and heuristics as a basis for legal policy.

mental forces that shape optimal contracts as well as the optimal damage remedy in this canonical contracting problem with post contractual informational asymmetry.[2]

All the usual court-imposed damage measures are systematically explored. It begins with a standard analysis of the behavioural effects of restitution, reliance and expectation damages when the losses to the victim of contract breach can be thoroughly assessed by court. It then discusses the application of these damage measures in situations when courts cannot perfectly assess the victim's valuations of the contract (as it is private information).

When both the parties make (selfish) investments into the respective individual valuation function and thereby augment the social surplus, any damage measure - to be optimal - should induce efficient *ex ante* reliance investments for both the parties as well as ex post allocative efficiency. The analysis shows that when the parties write a fixed-price contract non-availability of any damage measure leads both the parties' reliance incentives to be held-up. It is also noticed that the reliance damage remedy, as usual, not only fails to restore allocative efficiency but also renders both the parties with inefficient incentives to rely: victim of breach over-invests whereas breacher under-invests.

Whether expectation damage provides efficient incentives or not, for being granted, it must be verified in front of courts. We segregate two cases – whether the victim's expectancy is *ex post* verifiable or not. When the valuation of the victim of breach is observable and verifiable to court, our analysis, in a setting of binary performance choice, shows that while allocative efficiency is achieved under expectation damage remedy, it leads both the parties to rely excessively. On the other hand, if the victim of breach has private information, then the expectation damage is difficult to assess and so the court may deny recovery to the party claiming exposure to breach. When problems of assessing the valuation are extreme, the courts may turn to alternative remedies, or the parties may attempt to solve the problem themselves through liqui-

2 How the likelihood of settlement might be affected by the presence of informational asymmetry and by various legal rules was discussed quite insightfully by Posner (1973).

In the similar line, in a paper Bebchuk (1984) have shown how the presence of an asymmetry might influence parties' litigation and settlement decisions, and how it might lead to a failure to settle. However, in this article, one party is assumed to have superior information about the other party's, and not only his own, expected payoff in case an agreement is not reached and a trial takes place; furthermore, in his model of a private law dispute, the potential plaintiff would prefer to extract from the defendant as high a settlement amount as possible. This is somewhat a different domain than our present work focuses upon.

In contrast, similar to Fudenberg and Tirole (1983), Rubinstein (1983)we assume, the private informationthat parties are assumed to have is only about their own preferences, and thus only about their own payoffs.

In a recent independent working paper, Urs Schweizer (2006) seeks to advance the analysis in the same direction. The present article abstracts the bargaining procedure from Schweizer. He focuses on a unilateral reliance, whereas we on bilateral investment.

dated damages clauses. The analysis also considers whether these solutions to the valuation problem alleviate or exacerbate opportunistic behaviour by the parties.

Thus we render a special focus on the issue of assessing expectation damages under asymmetric information. We use a particular class of revelation mechanisms of the Clarke-Groves type that would assess expectation damages correctly, further we show that this mechanism generally achieves the first best.

As it turns out, assessing expectation damages correctly comes at a price in terms of efficiency loss. It is shown that mechanisms assessing expectation damages correctly will implement performance decisions only that are constant over states. Typically, such outcomes fail to be *ex post* efficient, since asymmetric information (*ex post*) is a source of transaction costs and, hence, the Coase Theorem may fail to hold, as shown by the impossibility result of Myerson and Satterthwaite (1981). Therefore, assessing expectation damages correctly contradicts with *ex post* efficiency. In any case, renegotiations under asymmetric information, if at all possible, cannot be expected to restore *ex post* efficiency as would have been the case under symmetric information of Edlin and Reichelstein.

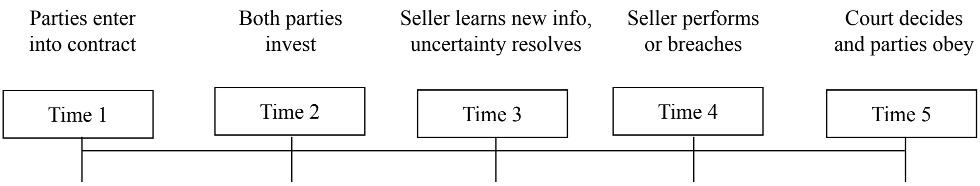
Thus, while expectation damages may work well under symmetric information, at least given a continuous performance choice, the performance of expectation damages as well as other court-imposed damages under asymmetric information falls short of what more general mechanisms and party designed liquidated damage may achieve.

2. THE MODEL: BILATERAL RELIANCE AND ONE-SIDED PRIVATE INFORMATION

2.1. GENERAL SETTING

Let us consider a particular contract with a single (male) buyer, B, who contracts to purchase *one unit of an indivisible specific* good from a single (female) seller S. Both are risk-neutral. The parties enter into a simple fixed-price contract at Time 1. At the time of contracting, the parties are in a bilateral bargaining situation. The seller will later produce the good and will deliver it to the buyer at some future date. The buyer's valuation is dependent on the level of investment he undertakes and denoted by $v = V(r^b)$of reliance investments with a maximum $\overline{V} = \max_{r^b \in R} V(r^b)$ and a minimum $\underline{V} = \min_{r^b \in R} V(r^b)$. We assume that $V(r^b)$ is monotonically increasing and strictly concave: $V'(r^b)>0$and $V''(r^b)<0$, where r^b is the investment by buyer. In a similar fashion, the seller also undertakes investment to reduce her cost of production. To accommodate this feature we need to ascribe a special structure on the seller's cost. The sole source of uncertainty in this model comes from the future fluctuation that hovers around the seller's production cost, which may be due to potential fluctuations in the market prices for the inputs. We hereby denote the seller's production cost as $c \in [\underline{c}, \bar{c}]$, with $c=C(r^s)+\theta$, where the expected value of $c$is denoted by $E(c)$and $E(c)=C(r^s)$, so that $E(\theta)=0$ when θ is a random variable which is distributed in the interval $[-a,a]$ with $a>0$, according to a cumulative distribution function denoted by $F(\theta)$ with positive continuous density function $f(\theta)>0$ with zero mean and variance σ_θ^2 . The uncertainty parameter θ is private information to the seller, which she learns after the initial contract has been signed. The distribution $F(\theta)$ is common knowledge. Moreover, we make the standard assumptions to get a "well behaved" problem, $C'(r^s)<0$, $C''(r^s)>0$. At this point we simply assume that these reliance investments are *ex ante* indescribable and thus non-contractible. In case they are verifiable *ex post* in the court, then reliance damage may be applicable.

Periodic Structure for the Contract Model



The sequence of events can be summarised is as follows:

The parties sign a contract and specify the delivery price p at Time 1 → Both the buyer and the seller make reliance investment at Time 2 → The seller observes her cost of production c at Time 3 as uncertainty resolves → The seller decides whether to perform the contract or repudiate at Time 4 → If the seller breaches, the buyer files a lawsuit at no cost in between Time 4 & 5 → The court awards damages of D, which may be a function of investments and p at Time 5.

2.2. THE ANALYSIS: FIRST BEST

The first best is achieved if the *ex-ante* investment decision and the *ex post* trade decision are efficiently made. The *ex post* efficient trade decision is to exchange the specific good whenever the seller's Time-4 costs are less than the buyer's valuation, while *ex ante* efficient level of investment maximises the total expected surplus including both the buyer's and the seller's investment costs, given the *ex post* efficient trade decision.

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

Thus, $Prob[performance] = Pr[c \leq V(r^b)] = Pr[C(r^s) + \theta \leq V(r^b)]$ (1)
$= Pr[\theta \leq V(r^b) - C(r^s)] = F[V(r^b) - C(r^s)],$

and $Prob[breach] = 1 - Prob[performance] = 1 - F[V(r^b) - C(r^s)].$ (2)

Thus the Expected Joint Payoff would be –

$$EPJ = F[V(r^b) - C(r^s)].[\{V(r^b) - r^b - p\} + \{p - E(c \mid c \leq V(r^b)) - r^s\}] + \{1 - F[V(r^b) - C(r^s)]\}.\{0 + 0 - r^b - r^s\}$$
$$= F[V(r^b) - C(r^s)].\{V(r^b) - E(c|C(r^s) + \theta \leq V(r^b))\} - r^b - r^s. \quad (3)$$

To check the investment incentives for the contracting parties, we need to differentiate[3] the above expression. To complete our analysis we need the following technical assumptions –

1. $F[V(0)].V'(0) > 1.$
2. $\frac{\partial}{\partial r^b}\{F[V(r^b)].V'(r^b)\} < 0.$
3. The distribution $F(.)$ follows Monotone hazard rate.

Explanation: Our third assumption states that both $((1-F(x))/f(x)$ and $f(x)/F(x)$ are decreasing in x. This is a standard and fairly mild assumption often used in the literature. The first assumption implies that necessarily $V(0) \geq \underline{c}$, i.e. the contract breach and the eventual separation between the trading parties are never efficient when $c = \underline{c}$. This is sufficient for the efficient level of investment to be strictly positive. (From $V'(r^b) \to 0$ for $r^b \to \infty$, it follows that the efficient investment level would be finite).

And the second assumption guarantees a unique solution $\{r^{b*}, r^{s*}\}$ (a Kaldor-Hicks efficient level of reliance vector that maximises this joint value) for the following f.o.c.s: for the buyer,

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

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

and for the seller,

3 For the purpose of differentiation we have used the following formula of fundamental theorem of integration: $\frac{d}{dt}\int_{q(t)}^{h(t)} f(x)dx = f(h(t)).h'(t) - f(q(t)).q'(t)$

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

$$\Rightarrow -C'(r^{s*})=\frac{1}{F[V(r^b*)-C(r^s*)]}>1, \quad [\because C'(r^s)<0,\ C''(r^s)>0]. \qquad (5)$$

The term $F[V(.)-C(.)]$ in the first order equilibrium condition reflects the probability that the specific investment actually pays off and the efficient level of investment is an increasing function of this probability.

3. Court-imposed Remedies for Breach of Contract

Given the conditions for socially optimal breach and investments, we now turn to assess the impact of available remedies. We start with Reliance and Restitution damages.

3.1. Reliance and Restitution Damage Measures

Since we consider here a case of unilateral breach by the seller, let us denote the reliance damage to the buyer by $D_r=\beta.\ r^b$, where $\beta\in[0,1]$ is that part of the entire reliance undertaken by the buyer which is *ex post* verifiable into the court, (but put off the debate on verifiability of reliance for the time being). Notice here, we have identified a relation between the reliance damage and restitution damage measures through the variation in the value of β; when $\beta=1$, full reliance cost is recoverable; and when $\beta=0$, no damage is recovered which is synonymous with restitution damage.

Now the seller's payoff when the contract is honoured is: $P-c$; and when she breaches her wealth: $-D_r$ S o the seller chooses to perform when: $P-c\geq -D_r$ i.e. $P+\beta.r^b\geq c$, otherwise breaches. Thus the seller breaches too frequently relative to the first best level.Therefore, $Pr[performance]=Pr[c<P+\beta.r^b] = F[P+\beta.r^b - C(r^s)]$

Now the buyer's expected payoff would be –

$$F[P+\beta.r^b - C(r^s)].[V(r^b)-r^b-P]+\{1 - F[P+\beta.r^b - C(r^s)]\}.\{\beta.r^b - r^b\} \qquad (6)$$

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

$$EPB'(r^b)= f(.).\beta.[V(r^b) - P - \beta.r^b]+F(.).V'(r^b)-(1-\beta)-F(.).\beta = 0 \qquad (7)$$
$$\Rightarrow V'(r^b) = (1-\beta)/F(.)+\beta - \beta.\ [V(r^b)-P-\beta.\ r^b].f(.)/F(.), \text{if } 0<\beta<1$$
$$= 1 - [V(r^b)-P-r^b].\ f[P+r^b - C(r^b)] / F[P+r^b - C(r^s)], \text{ if } \beta=1$$
$$= 1 / F[P+C(r^s)], \text{ if } \beta=0, \text{ [equivalent to Restitution damage]}$$

Similarly, the seller's expected payoff would be –

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

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

$$EPS'(r^s) = F(.).[-C'(r^s)] - 1 = 0$$
$$\Rightarrow -C'(r^s) = 1/F[P + \beta.r^b - C(r^s)], \text{ if } 0<\beta<1$$
$$= [P + \beta.r^b - C(r^s)], \quad \text{if } \beta=1$$
$$= 1/F[P - C(r^s)], \quad \text{if } \beta=0, \text{[equivalent to Restitution damage]}$$

We now compare the reliance levels by the buyer and the seller under the two different remedies with those chosen in the first best setting −

3.1.1. RESTITUTION MEASURE (WHEN β=0)

Note that, since $V(r) > p$, we must have $F[P - C(r^s)] < F[V(r^b) - C(r^s)]$, and so:

For the buyer, $$V'(r^b{}_S) = \frac{1}{F[P - C(r^s{}_S)]} > \frac{1}{F[V(r^b*) - C(r^s*)]} \qquad (9)$$

⇒The buyer under invests in reliance compared to the first best.

And for the seller, $$-C'(r^s{}_S) = \frac{1}{F[P - C(r^s{}_S)]} > \frac{1}{F[V(r^b*) - C(r^s*)]} \qquad (10)$$

⇒The seller also makes less investment with respect to the first best.

Comparing (4) with (9) and (5) with (10), we can establish the following proposition:

Proposition 1: *In a fixed-price contract under a regime of no contractual damage liability, each party chooses a level of reliance investment that is less than first best level, given the other party's investment.*

Remarks:

1. *Divergence between Private and Social Gain*: The distorted investment result arises from the divergence between a party's private gain and the social benefit from reliance. From the social point of view, the buyer should raise r^b so long as the benefit, i.e. increased surplus, exceeds the marginal cost of 1. From the buyer's private point of view, however, it pays to raise r^b as long as his private benefit, in terms of the fraction of the surplus he can extract, exceeds his marginal cost of 1. Since the buyer in this case has to internalise the social cost of breaching and he expects to be "*held up*", he does not capture the full benefit of his reliance, but only a fraction of it, he is led to strike a suboptimal balance.

2. The seller would also undertake less investment compared to the first best. This is because − first, in case of breach she does not need to make any monitory payment; and secondly, as she breaches to too frequently given a contractually specified low

price, her motivation to investment in reducing the cost does not get the required encouragement.

3. During the bargaining of contractual price, in case the seller is capable of raising it, then the reliance investments by both parties would increase accordingly.
4. The under-investment problem basically stems from *ex post*allocative inefficiency, which in turn depends on the initial contractual price.

3.1.2. Reliance Measure (when β=1)

For the buyer,

$$V'(r^b)= 1 - [V(r^b)-P -\beta.\ r^b{}_R]\ .\ \frac{f[P+r^b{}_R - C(r^s{}_R)]}{F[P+r^b{}_R - C(r^s{}_R)]} \leq 1 < \frac{1}{F[V(r^b*) - C(r^s*)]} \qquad (11)$$

⇒Thus the buyer would over-invest compared to first best.

$$\text{And for the seller, } -C'(r^s) = \frac{1}{F[P+r^b{}_R - C(r^s{}_R)]} > \frac{1}{F[V(r^b*) - C(r^s*)]} \qquad (12)$$

⇒The seller still be investing less relative to the first best level; but the amount is higher when compared to a no-damage situation, since we have
$F[P - C(r^s)] < F[P+r^b - C(r^s)]$.

We summarise the above results in the form of following proposition –

Proposition 2: *With a fixed-price contract under a regime of reliance damage liability, the uninformed victim* (*here the buyer*) *will over-invest in reliance* (*given the level of reliance by the other party*)*, whereas the other party i.e. the informed breacher would under-invest in reliance always irrespective of the level of reliance by the buyer.*

Remarks: Intuition − Under reliance damages, the victim (buyer) can shift the cost of reliance to the other party only in the event of contract-breach, as in this contingency the seller (breacher) has to pay r^b. At the same time, the benefit to him from increasing his investment is greater than merely the incremental value created; the benefit also includes the increased likelihood that the contract will be performed rather than breached. This induces the seller to raise her level of investment, so as to reduce the likelihood of suffering the cost of increased damages. With higher level of precautions, the buyer would be more likely to receive $V(r^b)$, rather than just r^b, and we know that $V(r^b)>r^b$. The seller under-invests in reliance because she has to protect against only part of the loss that may occur. Although the total loss from breach is $V(r^b)$, the seller would sustain only a fraction of it, i.e. r^b. Note that both the parties tend to rely more, the higher the initial contracted price.

3.2. EXPECTATION DAMAGE

Expectation damages are measured *ex post* to make the injured party exactly as well off as if the contract were fully performed. Thus the damage stands at: $D_e = V(r^b) - p$. Therefore, the seller would perform only when $p - C \geq -D_e$ i.e. $C \leq V(r^b)$, otherwise she breaches the contract.Now, $Prob[performance] = F[V(r^b) - C(r^s)]$.

Thus the buyer's expected payoff becomes −

$$EPB_e = F[V(r^b) - C(r^s)].[V(r^b) - r^b - p] + [1 - F(.)].[D_e - r^b] = V(r^b) - r^b - p,$$

Therefore the F.O.C. gives us, $V'(r_E^b) = 1$. (13)

⇒the buyer makes over-investment in reliance.

Similarly, the seller's expected payoff becomes −

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

The F.O.C. implies that –

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

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

$$\Rightarrow -C'(r_E^s) = \frac{1}{F[V(r_E^b) - C(r_E^s)]} < \frac{1}{F[V(r^b*) - C(r^s*)]} = -C'\left(r^s*\right)$$

⇒The seller makes over-investment in reliance.

Remarks:

1. *Intuition* for the promisee's (buyer) over-investment: Suppose that the buyer can make an investment that will increase value only if the parties trade. If trade turns out to be inefficient i.e. the seller's cost exceeds the buyer's value, the investments will have been wasted. The buyer, in choosing an investment level, thus should consider the return onreliance in states of the world in which they trade − positive, and the return on reliance in states of the world in which the parties do not trade − zero. Contract law awards buyer the difference between his valuation (given his reliance) and the price when the parties do not trade; the buyer thus is fully insured against lost valuations regardless of the investment level he chose. The buyer thus invests too much.

2. Intuition behind the promisor's (seller) over-investment in reliance: Under the expectation measure, the buyer chooses an excessive level of reliance, and the seller has to fully internalise the buyer's actual loss from breach. This makes the breach contingency more costly for the seller than it would have been under optimal reliance. Hence, the seller increases her investments, to reduce the likelihood of sustaining this enhanced cost.

3. It can be easily shown that when one of the two contracting parties, possessing *ex post* private information, simultaneously controls reliance decision and the breach decision, then the first best solution can be achieved under expectation damage with a fixed-price contract in a unilateral investment framework, provided trade is a binary choice i.e. $\{0,1\}$.

We can establish following important claim from the above discussions –

***Claim 1**: In case of one-sided asymmetry under a fixed price incomplete contract with a binary trading choice:* (*a*) *one-sided investment: if only the breaching party* (*who has ex post private information*) *invests then the expectation damage remedy would induce efficient reliance investment,* (*b*) *bilateral investment: the expectation damage remedy would induce both the parties to over invest. Efficient breach is always achieved.*

4. Further on Private Information, Expectation Damage and Investment Incentives: A Mechanism Design Approach

So far we have been considering a case of where the informed party chooses to breach the contract; so that assessing the expectation interest of the victim by court was possible. In this subsection we rather permit the breach by either of the two parties irrespective of whether it holds private information or not. When the non-breaching party holds the private information, the verification of expectation damage is difficult. In this situation, he may be denied the recovery of expectation damage as the courts may be unable gauge it correctly. This has a direct implication for the incentives to the parties under expectation damage.

4.1. The general setting[4]

As before, a buyer (B) and a seller (S), both risk-neutral, after signing a contract choose to make reliance investments $r^b, r^s \in R^+=[0,\infty)$ before nature reveals the value of parameter θ from an interval $\Theta=[\theta_L,\theta_H]$ where $\theta_H>\theta_L\geq 0$; where θ is a random

4 This is an adaptation of UrsSchweizer's model (2006) to accommodate bilateral reliance.

variable and its realisation is observed only by one party and is thereby not contractible. The other party has a prior probability distribution over θ. After θ is realised, the performance decision $q \in Q$ is made. In the present setting, Q is assumed to be a subset of the positive real line of an interval $Q=[q_L, q_H]$.[5] Notice here, so far we have been using a binary choice model in the same ethos as Shavell (1980) whereas Edlin and Reichelstein (1996) deal with continuous performance choice. [At relevant places comments on binary setting are made.]

Say, *ex post* trading surplus amounts to −

$$G^b(r^b,r^s,\theta,q)=V(r^b,\theta,q) - C(q,r^s), \text{ if B holds private information,}$$

and $G^s(r^b,r^s,\theta,q)=V(r^b,q) - C(q,\theta,r^s)$, if S holds private information;

where $V(r^b,.)$ denotes the buyer's valuation function and $C(r^s,.)$ the seller's cost function. In either case, at the investment stage, the effect of reliance investments on social surplus is uncertain due to the presence of uncertainty factor θ. These two cases are to be treated separately. Keeping with flow of current analysis here we shall take up the case when only the seller holds the private information but either party can unilaterally choose to breach. The buyer's private information case can be dealt in a similar way. We require the following assumptions for optimal and interior solutions.

Assumptions

a) $V(.)$ is increasing and strictly concave in q; i.e. if $q<q'$ then $V(.,q)<V(.,q')$.

b) $C(.)$ is increasing and strictly convex in q; i.e. if $q<q'$ then $C(.,q)<C(.,q')$.

c) If $\theta<\theta'$, then $V(.,\theta')>V(.,\theta)$, $\forall r^b,q$.

d) If $\theta<\theta'$, then $C(.,\theta')<C(.,\theta), \forall r^s,q$.

Explanation: Assumption (a) requires that the buyer's payoff net of investment costs to be strict monotonically increasing and concave as a function of performance choice. Assumption (b) requires that seller's payoff net of investment costs to be monotonically increasing (and concave). Assumption (c) guarantees that buyer's payoff increases with respect to increase in θ i.e. private information. Similarly, assumption (d) requires that as private information factor rises for the seller, her cost decreases.

5 Alternatively it may be just binary $Q=\{q_L, q_H\}$, equivalently {0,1} i.e. (q_L =0) stands for not perform and (q_H =1) means perform. In the case of continuous performance choice, q can be thought of as the quantity or quality of a divisible good to be exchanged.

4.2. THE FIRST BEST

We construct the first best solution through backwards induction, as a reference point. The *ex post* socially best response performance choice exists and which is $q^{+}(r^b,r^s,\theta)\in\arg\max_{q\in Q} G^s(r^b,r^s,\theta,q)$ that maximises social surplus at the performance stage (*ex post*) when reliance investment and the move of nature are given. Note that this performance choice is unique[6] for each type. Correspondingly, we define the social surplus net of investment costs as: $W(r^b,r^s,\theta,q^{+})=V(r^b,q^{+})-C(r^s,\theta,q^{+})-r^b-r^s$, [S holds private info].

Thus the efficient level of reliance are then defined as –

for the buyer, $r^{b*}\in \arg\max_{r^b\in R} E_\theta[W(r^b,r^s,\theta,q^{+}(r^b,r^s,\theta))]$,

and for the seller, $r^{s*}\in \arg\max_{r^s\in R} E_\theta[W(r^b,r^s,\theta,q^{+}(r^b,r^s,\theta))]$,

that maximise the *ex-ante* expected social surplus. Now folding back these efficient reliance choices into the socially best performance decision, we therefore define the efficient performance choice as $q^{*}(\theta)=q^{+}(r^{b*},r^{s*},\theta)$, i.e. this is the socially best response to efficient reliance investments. Then the following conditions must hold −

$$r^{b*}\in \arg\max_{r^b\in R} E_\theta[W(r^b,r^s,\theta,q^{*}(\theta))] \tag{15}$$

and $$r^{s*}\in \arg\max_{r^s\in R} E_\theta[W(r^b,r^s,\theta,q^{*}(\theta))]. \tag{16}$$

Before proceeding further we establish three important auxiliary results for later reference. We use a tool known as "monotone comparative statics", which investigates the optimum points of a system with respect to changes in the parameters in a monotonic way (i.e., the solution is always either non-increasing or non-decreasing in parameter).

The key to ensure monotone comparative statics is the following:[7]

6 Uniqueness of efficient trades simplifies the exposition, but all results can be restated for multiple efficient trades. Indeed, note that Lemma 2 (see infra) holds with multiple maximisers, for any selection of maximisers. One way to ensure single-valuedness is by assuming that $W(r^b,r^s,\theta,q)$ is strictly concave in q, which is actually done here.

7 Note here that we use a discrete type just for analytical convenience.

Assumptions:

e) For the function $W(.)$, if $\theta<\theta'$, then $\{W(r^b,r^s,\theta',q)-W(r^b,r^s,\theta,q)\}$ is strictly monotonically increasing as a function of $q\in Q$. [**SCP**]

f) For the function $W(r^b,r^s,\theta,q)$, $\forall\ q''>q'$ such that $q'',q'\in Q$, the difference $\{W(.,\theta,q'')-W(.,\theta,q')\}$ is strictly increasing in $\theta\in\Theta$. [**ID**]

g) If $q<q'$ then the difference $\{W(r^b,r^s,\theta,q')-W(r^b,r^s,\theta,q)\}$ is monotonically increasing as a function of r^j, $\forall\ j=b,s$.

Explanation:The condition (e) is well-known 'single-crossing property'[8] in mechanism design. Similarly, (g) means that, net of investment costs, the marginal social product is an increasing function of investments. This means that investments are specific. And finally, assumption (f) is known as 'Increasing Difference'[9]. It turns out that the analysis of contracting is dramatically simplified when the Agent's types can be ordered so that higher types choose a higher consumption.

We now establish following three important lemmata for future reference.

Lemma 1.: *If $W(r^b,r^s,\theta,q)$ is continuously differentiable and satisfies SCP, and Q is an interval, then $W(r^b,r^s,\theta,q)$ satisfies ID.*

Proof. For $\theta''>\theta'$, $[\forall\ \theta'',\theta'\in\Theta]$we have,

$$W(r^b,r^s,\theta'',q'')-W(r^b,r^s,\theta'',q') = \int_{q'}^{q''} W_q\ (r^b,r^s,\theta'',q)dq$$

$$> \int_{q'}^{q''} W_q\ (r^b,r^s,\theta',q)dq = W(r^b,r^s,\theta',q'')-W(r^b,r^s,\theta',q'). \tag{17}$$

Note that if the Agent's value function $V(.,\theta,q)$ satisfies ID, then the indifference curves for two different types of the Agent, θ' and $\theta''>\theta'$, cannot intersect more than once. Indeed, if they intersected at two points (q',t'), (q'',t'') with $q''>q'$, this would mean that the benefit of increasing q from q' to q'' exactly equals $\{t'-t''\}$ for both types θ' and θ'', which contradicts ID. This observation justifies the name of "single-crossing property".

A key result in monotone comparative statics says that when the objective function satisfies ID, maximisers are non-decreasing in the parameter value θ. Moreover, if

8 In a differentiable setting, this would hold if the second derivative $W_{\theta q}>0$ is positive. The Single-Crossing Property was first suggested by Spence (1972) and Mirrlees (1971). Our definition is a simplified version for preferences that are quasi-linear in transfers t. Our SCP was introduced by Edlin-Shannon [1998] under the name "increasing marginal returns".

9 This property is more precisely called strictly increasing difference, see Topkis (1998).

SCP holds and maximisers are interior, they are strictly increasing in the parameter. Formally.

Lemma 2.:*Under the single-crossing property, the socially best response performance choice is in the interior of Q and is a monotonically increasing function of private information held by the contracting parties; i.e. ex post efficient performance choice will typically be state-contingent and interior.*

In other words:
Let $\theta' > \theta$, $q^+(r^b,r^s,\theta') \in argmax_{q\in Q} W(r^b,r^s,\theta',q)$ *and* $q^+(r^b,r^s,\theta) \in argmax_{q\in Q} W(r^b,r^s,\theta,q)$.
Thus, (a) if $W(.,\theta,q)$ *satisfies ID, then* $q^+(r^b,r^s,\theta') \geq q^+(r^b,r^s,\theta)$.
(b) if, moreover, $W(.,\theta,q)$ *satisfies SCP, and either* $q^+(r^b,r^s,\theta)$ *or* $q^+(r^b,r^s,\theta')$ *is in interior of Q [i.e.* $q_L(r^b,r^s,\theta) \leq q^+(r^b,r^s,\theta) \leq q_H(r^b,r^s,\theta)$*], then* $q^+(r^b,r^s,\theta') > q^+(r^b,r^s,\theta)$*; where* q_L *and* q_H *are respectively some low level and high level of quantities.*

Proof: We prove the lemma in two steps. In the first step we show that the *ex post* performance choice is state contingent; and our second step proves that the socially best response quantity choice is an interior solution for a given realisation of information parameter. For notational simplicitywe suppress the reliance arguments.

STEP-1: Following revealed preference, by construction we have −

$$W(.,\theta,q^+(.,\theta)) \geq W(.,\theta,q^+(.,\theta')) \text{ and, } \quad W(.,\theta',q^+(.,\theta')) \geq W(.,\theta',q^+(.,\theta)).$$

Adding up vertically and rearranging the terms we have −

$$W(.,\theta',q^+(.,\theta')) - W(.,\theta',q^+(.,\theta)) \geq W(.,\theta,q^+(.,\theta')) - W(.,\theta,q^+(.,\theta)).$$

Notice here that this is the same condition as our ID. By ID, this inequality is only possible when $q^+(r^b,r^s,\theta') > q^+(r^b,r^s,\theta)$. Hence proved.

In a similar vein, we can further prove that −

$$W(.,\theta',q^+(.,\theta')) > W(.,\theta,q^+(.,\theta')), \text{ and, } \quad W(.,\theta,q^+(.,\theta)) < W(.,\theta',q^+(.,\theta)).$$

⇒*Ex post* efficient performance choice is positively dependent on the private information.

STEP-2: For some performance decision $q_H(r^b,r^s,\theta) > q^+(r^b,r^s,\theta)$, by assumption (e), we have – $W(.,\theta',q^+(.,\theta)) - W(.,\theta,q^+(.,\theta)) \leq W(.,\theta',q_H(.,\theta)) - W(.,\theta,q_H(.,\theta))$
and, hence, $W(.,\theta,q_H(.,\theta)) < W(.,\theta,q^+(.,\theta)) - \{W(.,\theta',q^+(.,\theta)) - W(.,\theta',q_H(.,\theta))\}$

$$\leq W(.,\theta,q^+(.,\theta)).$$

⇒ For a particular realisation of θ, there is no performance decision in the range above $q^+(r^b,r^s,\theta)$ that maximises $W(r^b,r^s,\theta,q)$. In a similar fashion, we can also prove that for any performance choice in the range below $q^+(r^b,r^s,\theta)$ [i.e. say, $q_L(r^b,r^s,\theta)< q^+(r^b,r^s,\theta)$] the welfare $W(r^b,r^s,\theta,q)$ won't be maximised, and, hence, one part of Lemma 2 is established.

Alternatively, suppose for definiteness that $q^+(.,\theta)$ is in the interior of Q. Then the following first order condition must hold: $W_q(.,\theta,q^+(.,\theta))=0$.

But then by SCP we have: $W_q(.,\theta',q^+(.,\theta))>W_q(.,\theta,q^+(.,\theta))=0$, and therefore $q^+(.,\theta)$ cannot be optimal for parameter value θ', a small increase in q would increase $W(.)$. Since by assumption (a), $q^+(.,\theta')\geq q^+(.,\theta)$, we must have$q^+(.,\theta')>q^+(.,\theta)$.

Note: In a differentiable setting where the socially best response is an interior solution, the socially best response quantity (performance) choice will be strictly monotonically increasing as a function of private information. In particular, *ex post* efficient performance choice will typically be state-contingent.

Lemma 3.:*There exist some constant contractual performance decisions* [*other than* $q^+(.)$] *such that the ex-ante optimal reliance investments turn out to be lower or higher, when compared to first best efficient level of investments.*

Alternatively, *suppose assumption (g) is met, then there's an optimal level of reliance for each quantity choice.*

Alternatively, *suppose assumption (g) is met. Then, for all i=L,H and j=b,s; there exists a choice of reliance,* $r_i^j \in \arg\max_{r_i^j \in R} E_\theta[W(r^b,r^s,\theta,q_i)]$ *such that* $r_L^j \leq r^{j*} \leq r_H^j$ *corresponding to* $q_L \leq q^+ \leq q_H$

Proof. Given r^{b*} and any contractual performance choice q_L (where $q_L< q^*$), for any investment by the seller $r^s>r^{s*}$, following the assumption (f) we have that

$$W(r^{b*},r^{s*},\theta,q^*(\theta)) - W(r^{b*},r^{s*},\theta,q_L)\leq W(r^{b*},r^s,\theta,q^*(\theta)) - W(r^{b*},r^s,\theta,q_L)$$

Now taking expectation on both sides and changing sides we get that −

$$\begin{aligned} E_\theta[W(r^{b*},r^s,\theta,q_L)] &\leq E_\theta[W(r^{b*},r^{s*},\theta,q_L)]-E_\theta\{W(r^{b*},r^{s*},\theta,q^*(\theta)) - W(r^{b*},r^s,\theta,q^*(\theta))\} \\ &\leq E_\theta[W(r^{b*},r^{s*},\theta,q_L)] \end{aligned}$$

must hold. Thus, $E_\theta[W(r^{b*},r^s,\theta,q_L)]$ attains a maximum in the range $r^s\leq r^{s*}$ and the first claim of lemma is established. The second claimof lemma can be established in the similar way.

Observe, if the difference in assumption (b) is strictly monotonically increasing in r^j also if the efficient performance is inner choice (i.e. $q^*(\theta)\in[q_L,q_H]$) with positive probability then the claims of Lemma 3 would hold for any $r_i^j \in \arg\max_{r_i^j\in R} E_\theta[W(r^b,r^s,\theta,q_i)]$.

Note here, in a differentiable setting with continuous performance choice, it follows from Lemma 3 that an intermediate performance decision $q^{oo}\in Q$ [i.e. $q_L<q^{oo}<q_H$] exists sothat $r_i^{j*}\in \arg\max_{r_i^j\in R} E_\theta[W(r^b,r^s,\theta,q^{00})]$, $\forall$j holds good. Moreover, it follows from the assumed structure of social surplus that –

$$\arg\max_{r^b\in R}\ E_\theta[W(r^b,r^s,\theta,q^{oo})]=\arg\max_{r^b\in R}\ [V(r^b,q^{oo})-r^b],\text{(for buyer)}$$

and $\arg\max_{r^s\in R} E_\theta[W(r^b,r^s,\theta,q^{oo})]=\arg\max_{r^s\in R}\ \{E_\theta[C(r^s,\theta,q^{oo})]-r^s\}$ (seller)

must hold if it is the seller who obtains private information.

4.3. Mechanisms under the shadow of expectation damages

When one of the two parties' valuations is private information, it may be particularly difficult for the courts to award the correct amount of damages in case the party with private information turns out to be the victim of contract breach. The parties, when confronted with such problems of hidden information, may take resort to the sophisticated revelation mechanisms. The general setting as introduced earlier allows us to implement the first best solution with a mechanism of the Clarke-Groves type. The transfer payments under a revelation mechanism, that implement the efficient *ex post* breach and the efficient *ex ante* reliance investments by the parties, however turn out to be notably different from that of correct *ex post* expectation damages.

Thus we would rather inspect the provisions that would allow awarding the correct expectation damages even under asymmetric information. In other words, we shall investigate the class of mechanisms that reflect expectation damages along the equilibrium path correctly. Following Shavell (1980) and Edlin and Reichelstein (1996), the initial contract $[q^o,T^o]$ categorically specifies the parties contractual obligations – the seller's choice of performance is fixed at $q^o\in Q$, and upon this performance the buyer must pay T^o to the seller. The two cases will be distinguished according to which party obtains private information and which party considers breaching the contract.

4.3.1. Case SB:Seller obtains private information but buyer considers breach

Suppose, just before the seller starts production, the buyer notifies the seller to accept delivery of some quantity $q\leq q^o$ only. So he breaches for the remaining quantity and therefore owes a compensation to the seller according to expectation damage. But, in principle, the seller must grant a reduction of payments in the amount of his cost savings $[C(r^s,\theta,q^o) - C(r^s,\theta,q)]$. Due to hidden information, however, courts may no longer be able to administer such a price reduction correctly.

Had it been properly administered, suppose a situation when information is symmetric between the parties, then the seller's payoff would have been −

$$\Psi(r^b,r^s,\theta,q) = T^o - C(r^s,\theta,q) - r^s - [C(r^s,\theta,q^o) - C(r^s,\theta,q)] = T^o - C(r^s,\theta,q^o) - r^s.$$

Thus the seller in the face of anticipatory breach by the buyer is as well off as the contract is honoured when compensated through actual expectation damage. In that case, the seller's final payoff strictly depends on the initial contractual quantity choice which is q^o.

The seller would thus choose her investment according to −

$$r_E^s \in \arg\max_{r^s \in R} E_\theta[\Psi(r^b,r^s,\theta,q^o)] \neq \arg\max_{r^s \in R} E_\theta[W(r^b,r^s,\theta,q^+(r^b,r^s,\theta))] = r^{s*}.$$

And hence she would have an incentive to rely higher or lower than the socially best level which crucially depends upon the initially contracted higher or lower performance choice q^o. In this case, the first best solution can be implemented by just requiring the parties to specify a suitable initial contractual quantity choice $q^o = q^{oo}$(in the light of Lemma 3) and the buyer to mitigate damages as per actual expectancy of the seller resulting from breach.

If the buyer announces anticipatory breach $q \leq q^o$, upon receiving the benefit of reduction in payment to the tune of $[C(r^s,\theta,q^o) - C(r^s,\theta,q)]$, his payoff is−

$$\begin{aligned}\Phi(r^b,r^s,\theta,q) &= V(r^b,q) - T^o - r^b + [C(r^s,\theta,q^o) - C(r^s,\theta,q)]\\ &= [V(r^b,q) - C(r^s,\theta,q) - r^b - r^s] - [T^o - C(r^s,\theta,q^o) - r^s]\\ &= W(r^b,r^s,\theta,q) + [C(r^s,q^o) + r^s - T^o]\end{aligned}$$

andwhich, till the first term, depends on actual performance and equal to social surplus.

Hence, the buyer's performance choice in equilibrium solves –

$$q^+(r^b,r^s,\theta) \in \arg\max_{q \in Q} \Phi(r^b,r^s,\theta,q) = \arg\max_{q \in Q} W(r^b,r^s,\theta,q)$$

and coincides with the socially best response i.e. $q^+(r^b,r^s,\theta)$. Anticipating such a quantity choice at the investment stage, the buyer would have the incentive for efficient reliance, as−

$r^{b*} \in \arg\max_{r^b \in R} E_\theta[\Phi(r^b, \boldsymbol{r}^{s*}, \theta, q^+(r^b, r^s, \theta))] = \arg\max_{r^b \in R} E_\theta[W(r^b, \boldsymbol{r}^{s*}, \theta, q^+(r^b, r^s, \theta))]$,

provided the seller invests efficiently.

Note here, the expectation damages remedy entails asymmetric treatment of the contract breacher and the victim of breach, and creates a tension between providing efficient incentives for both of them simultaneously. Because damages give the injured party exactly his expectancy, only he is overcompensated for hisreliance; the breacher winds up with the residual, and so receives exactly the social return to her investment at the margin.

The analysis above works efficiently in a symmetric/complete information framework, but ceases to work in the presence of asymmetric information as the state contingent actual compensation is not possible. The buyer's choice of quantity will not be state contingent rather arbitrarily dependent on how court settles the expectancy of seller. So anticipating his *ex post* (inefficient) quantity choice (corresponding to the court's arbitrary compensation choice) he will undertake a level of investment which will be anything but efficient. However, the preceding analysis uncovers an insight that helps us to design a mechanism using a message game between the parties which ensures efficiency.

• ***The Revelation Principle***

To be able to deal with hidden information, we suppose that the informed party (here seller) would communicate a message m out of a set of alternative messages M once her private information $\theta \in \Theta$ is realised, but before the performance choice $q \in Q$ by the buyer is conveyed. The message is expected to affect the net payment (transfer), which the buyer owes to the seller and, which may further depend on the seller's actual reliance investments as well as on the buyer's performance decision.

Definition 1*: A transfer is a function* $T(.)$ *which specifies the payments that the buyer has to make in order to receive different amounts* $q \in Q$ *of the good.*

Depending upon the verifiability of the reliance actions, the transfer schedule can be denoted either by $T(r^b, r^s, m, q)$ if reliance investments are observed by the parties and verifiable in front of court (i.e. information structure is Partial Private Information, hereafter PPI) or by $T(m,q)$ if investments are hidden action (environment is CPI). The incentives provided by each of the aforementioned transfer schedules can be calculated by backwards induction. We consider the PPI environment case first.

PPI Environment (θ is private information but investments are observable): At the performance stage (*ex post*), when the actual reliance investments and the message are known, the buyer will choose his performance decision according to −

$$q_B(r^b,r^s,m) \in \arg\max_{q\in Q} \{V(r^b,q) - T(r^b,r^s,m,q)\}.$$

Anticipating the buyer's performance choice (for a particular message sent by her), the seller upon realising her private information θ would then send a message −

$$m_S(r^b,r^s,\theta) \in \arg\max_{m\in M} \{T(r^b,r^s,m,q_B(r^b,r^s,m)) - C(r^s,\theta,q_B(r^b,r^s,m))\},$$

that maximises her payoff. Now, folding back this m_S into the earlier expression of q_B, we denote the resultant equilibrium performance choice by the buyer, along the equilibrium path, as a function of reliance investments of both parties and the private information of the seller, $\eta(r^b,r^s,\theta)=q_B(r^b,r^s,m_S(r^b,r^s,\theta))$, and thereby the corresponding net transfer will amount to $\tau(r^b,r^s,\theta)=T(r^b,r^s,m_S(r^b,r^s,\theta),\eta(r^b,r^s,\theta))$, such that the informed party seller's payoff will be: $I(r^b,r^s,\theta)=\tau(r^b,r^s,\theta) - r^s - C(r^s,\theta,\eta(r^b,r^s,\theta))$. This state-contingent payoff (and the underlying transfer schedule) is said to reflect expectation damages correctly if : $I(r^b,r^s,\theta)=T^o - r^s - C(r^b,\theta,\eta(r^b,r^s,\theta))$, $\forall\theta$ holds. In fact, the seller would then be awarded with correct expectation damages, at least along the equilibrium path.

Reflecting the correct expectation damages comes at a cost, as our next proposition shows. While it may still be feasible to provide efficient reliance incentives, in the light of Lemma 3, the solution will typically fail to be *ex post* efficient.

Definition 2*: Any mechanism to be efficient must satisfy that -(a)the participation constraints[IR]; and (b) the incentive constraints [IC] are met.*

The process: Suppose the transfer schedule $T(r^b,r^s,m,q)$ gives rise, in equilibrium, to the performance choice $\eta(r^b,r^s,\theta)$ and the transfer payment $\tau(r^b,r^s,\theta)$. Notice that disallowing a certain performance q is equivalent to setting $T(r^b,r^s,m,q)=+\infty$, and since the agent always has an option to reject the tariff, without loss of generality we constrain the Principal to offer $T(r^b,r^s,m,q=0)=0$, and assume that the Agent always accepts. Thus, the contractual form of tariff is quite general, and as we will later see we lose nothing by restricting attention to this form of a contract. Thus $\forall\theta,\theta'\in\Theta$ following two inequalities must hold –

[IR]: $\tau(r^b,r^s,\theta)-r^s-C(r^s,\theta,\eta(r^b,r^s,\theta))\geq C(r^s,\theta,q=0)$,

and [IC]: $\tau(r^b,r^s,\theta) - r^s - C(r^s,\theta,\eta(r^b,r^s,\theta))\geq\tau(r^b,r^s,\theta') - r^s - C(r^s,\theta,\eta(r^b,r^s,\theta'))$

i.e. $\tau(r^b,r^s,\theta')-\tau(r^b,r^s,\theta)\geq C(r^s,\theta,\eta(r^b,r^s,\theta))-C(r^s,\theta,\eta(r^b,r^s,\theta'))$.[10]

10 Note: (IR) stands for the familiar *Individual Rationality (or Participation) constraints*. The (IR) inequality reflects the fact that the agent of type θ has the option of choosing performance $\eta(r^b,r^s,\theta)=0$, i.e., rejects the tariff, but prefers to choose $\eta(r^b,r^s,\theta)$ which is meant for his type. The (IC) stands for *incentive-compatibility* or *self selection or truth telling*. The inequalities (IC) tells that the agent of type θ has the option of choosing $\eta(r^b,r^s,\theta')$, which is the equilibrium consumption of type θ', but prefers to choose $\eta(r^b,r^s,\theta)$.

Now consider a different mechanism in which the principal asks the agent to make an announcement θ' and then supplies the agent with the quantity $\eta(r^b,r^s,\theta')$ in exchange for the payment $t(.,\theta')$. Since the inequalities (IC) are satisfied, each agent will prefer to announce his true type $\theta'=\theta$, rather than lying. Since the (IR)inequality is satisfied, each type of agent will accept this mechanism.

Before proceeding further, using definition 2, we derive the following lemma:

Lemma 4: *IfSCP is met for $W(.,q,\theta)$ then by construction the negative of seller's cost i.e. $[-C(.,q,\theta)]$ also satisfies SCP. Then, for all $\theta,\theta'\in\Theta$, the seller's IC requires that −*

$$C(r^s,\theta,\eta(r^b,r^s,\theta))-C(r^s,\theta',\eta(r^b,r^s,\theta))\leq I(r^b,r^s,\theta')-I(r^b,r^s,\theta)$$
$$\leq C(r^s,\theta,\eta(r^b,r^s,\theta'))-C(r^s,\theta',\eta(r^b,r^s,\theta')).$$

Moreover, if $\theta<\theta'$ then $\eta(r^b,r^s,\theta)\leq\eta(r^b,r^s,\theta')$ i.e. the equilibrium performance choice is a monotonically increasing function of private information.

Proof: Since the message sent by the informed party maximises his payoff, then it follows that for a given level of reliance investments and a θ we have −

$$I(r^b,r^s,\theta) = T(r^b,r^s,m_S(r^b,r^s,\theta),q_B(r^b,r^s,m_S(r^b,r^s,\theta)))-C(r^s,\theta,q_B(r^b,r^s,m_S(r^b,r^s,\theta)))-r^s$$

$$= \tau(r^b,r^s,\theta)-C(r^s,\theta,\eta(r^b,r^s,\theta))-r^s$$

$$\geq T(r^b,m_S(r^b,r^s,\theta,q_B(r^b,r^s,m)))-C(r^s,\theta,q_B(r^b,r^s,m))-r^s \quad (21)$$

must hold for any other message $m\neq m_S(.)$; $\forall\ m,\in$. In particular, this must be true for the message $m=m_S(r^b,r^s,\theta')$ that the seller would have sent in equilibrium after having obtained private information θ'. It follows that −

$$I(r^b,r^s,\theta) \geq T(r^b,r^s,m_S(r^b,r^s,\theta'),q_B(r^b,r^s,m_S(r^b,r^s,\theta')))-C(r^s,\theta,q_B(r^b,r^s,m_S(r^b,r^s,\theta'))-r^s$$
$$= \tau(r^b,r^s,\theta')-C(r^s,\theta,\eta(r^b,r^s,\theta'))-r^s$$

from which the second inequality of the lemma follows easily.

The first inequality follows from a similar argument for the situation where the true information is θ' but the informed party has revealed θ instead. Moreover, the monotonicity of performance choice as a function of private information follows from the single-crossing property (assumption (e)) and the two inequalities that have just been established.

Proposition 4: *Suppose assumptions* (*a*),(*b*) *and* (*e*) *are met. If the transfer schedule $T(r^b,r^s,m,q)$ reflects correct expectation damages along the equilibrium path then* *the seller will meet her obligation, i.e.* $\eta(r^b,r^s,\theta)\equiv q^o$ *even if it were efficient to breach. Moreover, the buyer has the incentive for reliance investments:* $r^b\in \arg\max_{r^b\in R}$ $[V(r^b,q^o) - T^o - r^b]$, *and the seller has the incentive for reliance investments:* $r^s\in \arg\max_{r^s\in R} E_\theta[T^o - C(r^s,\theta,q^o) - r^s]$, *which are efficient under a contract stipulating* $q^o=q^{oo}$(*if* q^{oo} *exists*).

Proof : Let $\theta^o=sup\{\theta\in \Theta:\eta(r^b,r^s,\theta)\leq q^o\}$ under which the performance choice does not exceed the quantity specified in the contract. It then follows from the monotonicity established in Lemma 3 that, for any $\theta<\theta^o$, we have $\eta(r^b,r^s,\theta)\leq q^o$.

Moreover, if $\theta'<\theta''<\theta^o$, then we have −

$$C(r^s,\theta',\eta(r^b,r^s,\theta')) - C(r^s,\theta'',\eta(r^b,r^s,\theta'))\leq C(r^s,\theta',q^o) - C(r^s,\theta'',q^o)$$
$$\leq C(r^s,\theta',\eta(r^b,r^s,\theta'')) - C(r^s,\theta'',\eta(r^b,r^s,\theta''));$$

because, in this range of information parameters, the seller's payoff is the same as if the buyer had met his obligation. It then follows from SCP that $\eta(r^b,r^s,\theta')\leq q^o\leq\eta(r^b,r^s,\theta'')$ must hold for any two information parameters $\theta'<\theta''<\theta^o$.

For any $\theta<\theta^o$, consider two information parameters $\theta'<\theta<\theta''<\theta^o$ from this range and apply the findings from above pairwise. In particular, $\eta(r^b,r^s,\theta')\leq q^o\leq\eta(r^b,r^s,\theta)$ and $\eta(r^b,r^s,\theta)\leq q^o\leq\eta(r^b,r^s,\theta'')$ must both hold, from which it follows that $\eta(r^b,r^s,\theta)=q^o$ must be constant over the range (θ_L,θ^o).

Next, consider information parameters from the range $\theta^o<\theta<\theta_H$. For such parameters, $q^o<\eta(r^b,r^s,\theta)$ must hold as follows from the monotonicity of the equilibrium performance choice. Further, in this range, the net payoff of the seller would be amounting to: $I(r^b,r^s,\theta)=T^o - C(r^s,\theta,\eta(r^b,r^s,\theta)) - r^s$,

which, combined with the IC from Lemma 3, is leading to −

$$C(r^s,\theta',\eta(r^b,r^s,\theta')) - C(r^s,\theta'',\eta(r^b,r^s,\theta'))\leq C(r^s,\theta',\eta(r^b,r^s,\theta'')) - C(r^s,\theta'',\eta(r^b,r^s,\theta'))$$
$$\leq C(r^s,\theta',\eta(r^b,r^s,\theta'')) - C(r^s,\theta'',\eta(r^b,r^s,\theta')),$$

for any two information parameters in the range $\theta^o<\theta'<\theta''<\theta_H$ and, hence, to –

$$C(r^s,\theta'',\eta(r^b,r^s,\theta'))\geq C(r^s,\theta',\eta(r^b,r^s,\theta''))\text{and}\quad C(r^s,\theta',\eta(r^b,r^s,\theta''))\geq C(r^s,\theta',\eta(r^b,r^s,\theta')).$$

It then follows from the monotonicity of utility as a function of performance choice (assumption (d)), that equilibrium performance choice $\eta(r^b,r^s,\theta')=\eta(r^b,r^s,\theta'')=q'$ will be constant in this range as well.

Consider, finally, an information parameter $\theta<\theta^o<\theta'$ from each range. It then follows from the monotonicity of performance choice that: $\eta(r^b,r^s,\theta)=q^o\leq \eta(r^b,r^s,\theta')=q'$; and from the incentive constraints we have that −

$$I(r^b,r^s,\theta') - I(r^b,r^s,\theta) = C(r^s,\theta,q') - C(r^s,\theta',q^o)$$

$$\leq C(r^s,\theta,\eta(r^b,r^s,\theta')) - C(r^s,\theta',\eta(r^b,r^s,\theta')) = C(r^s,\theta,q') - C(r^s,\theta',q^0); \quad (22)$$

and, hence, $C(r^s,\theta,q')\geq C(r^s,\theta,q^o)$ must hold. By using the monotonicity of utility as a function of performance choice, it follows that $q^o=q'$ must hold. Proposition 4 is proved.

Recall from the previous section that, under suitable differentiability, q^{oo} will exist if performance choice is continuous. If, however, performance choice is binary then under-investment and overinvestment would result from a contract specifying $q^o=q_L$ and $q^o=q_H$, respectively, as follows from Lemma 3.

CPI Environment: Even if investments are hidden action,the next proposition shows a transfer schedule $T^*(m,q)$ exists that leads to the first best solution. But, by the Proposition 4, the efficient transfer schedule $T^*(m,q)$ cannot reflect expectation damages correctly.

Proposition 5:*A message space M and a transfer schedule $T^*(m,q)$ exist that lead, in equilibrium, to the first best solution.*

The proof of Proposition 5 is quite intuitive and thus omitted. The efficient price schedule will be based on the direct, incentive-compatible mechanism.

Remarks: To conclude this subsection, let us briefly compare the present findings that were derived under asymmetric information with those that would hold if the information parameter could be verified and, hence, correct damages according to the equation(19) could be administered by courts. Suppose that the assumptions (a) and (e) are met. If the contract specifies high performance $q^o=q_H$ then the seller has the incentive to take the socially best response as his performance choice and *ex post* efficiency would be ensured; yet, both facing excessive incentives for reliance investments as follows from the Lemma 3 and the equation (18).

If, at the other extreme, the contract specifies low performance $q^o=q_L$ then the buyer would stick to the contract. If such an outcome is anticipated under complete information, the parties would be able to renegotiate to a performance choice that is *ex post* efficient. Since the buyer would obtain only a fraction of, say, half of the renegotiation surplus, his incentives for reliance would be suboptimal. In a similar vein, as the seller anticipates *ex post* efficient performance through renegotiation thus her investment would be optimal.

In Shavell's setting of binary performance choice, only the high performance contract is available (the low performance contract would be equivalent to no contract) and would provide the buyer with excessive incentives for reliance investments. In the Edlin and Reichelstein setting of continuous performance choice, however, there exist intermediate levels of performance choice that would provide efficient reliance incentives. In this sense, Shavell's overreliance result is due to binary performance choice and not to a basic defect of expectation damages.In the case SB, assessing exact expectation damage is not only difficult but comes at price in terms of efficiency loss.

4.3.2. *CASE SS: SELLER OBTAINS PRIVATE INFORMATION ALSO CONSIDERS BREACH*

This case is similar to the model we have been originally dealing with in a binary performance choice framework. After having obtained her private information, the seller may announce that she is only going to deliver a quantity $q \leq q^o$. Since, at the time of performance, the seller chooses to deliver $q \leq q^o$ and breaches for rest of the quantity then following expectation damage rule she owes damages $D(r^b,q)=max[V(r^b,q^o) - V(r^b,q);0]$ to the buyer. This compensation then makes the buyer at least as well off as if seller had met her obligation. More precisely, if $V(r^b,q^o) - V(r^b,q) \geq 0$ then he would be exactly as well off, well in line with expectation damage remedy; whereas otherwise, in case $V(r^b,q^o) - V(r^b,q)<0$ he even enjoys a windfall gain from seller's neglecting her obligation. Common legal practice allows the buyer to keep such windfall gains for free. Since buyer does not obtain private information, such damages can be verified in front of courts provided that reliance investments are observable.

The seller's payoff amounts to: $\Psi(r^b,r^s,\theta,q)=T^o - C(r^s,\theta,q) - r^s - max[V(r^b,q^o) - V(r^b,q),0]$.

Thus the seller chooses the performance according to: $q_S(r^b,r^s,\theta) \in \arg\max_{q \in Q} \Psi(r^b,r^s,\theta,q)$.

We now segregate the two possible cases according to the values that damage remedy can take and treat them separately for purposive analytical results and definite conclusion.

First: ***If*** $D(r^b,q) \neq 0$: If the contract specifies a delivery choice q^o such that windfall gains to the buyer will never arise then the seller's payoff –

$\Psi(r^b,r^s,\theta,q)=[V(r^b,q)-C(r^s,\theta,q)-r^s -r^b]+[T^o -V(r^b,q^o)+r^b]= W(r^b,r^s,\theta,q)+[T^o -V(r^b,q^o)+r^b]$

which is, upto the first term, dependent on actual performance choice and equal to the social surplus.; and, hence, the seller takes performance decision as follows –

$$q_s(r^b,r^s,\theta)\in \arg\max_{q\in Q} \Psi(r^b,r^s,\theta,q)=\arg\max_{q\in Q} W(r^b,r^s,\theta,q)$$

andthat coincides with the socially best response performance choice i.e. $q^+(r^b,r^s,\theta)$.

If the seller announces breach $q\leq q^o$, upon receiving the expectation damage the buyer's payoff would be:

$$\Phi(r^b,r^s,\theta,q) = V(r^b,q) - T^o - r^b+[V(r^b,q^o) - V(r^b,q)]$$

$$= [V(r^b,q^o) - C(r^s,\theta,q^o) - r^b - r^s] - [T^o - C(r^s,q^o) - r^s]= W(r^b,r^s,\theta,q^o)+[C(r^s,q^o)+r^s - T^o]$$

and is, upto the first term independent of actual performance, equal to social surplus corresponding to the initial contractual quantity choice q^o and that does not depend on *ex post* actual state contingent performance choice by the seller.

Anticipating such a payoff, at the investment stage the buyer would have the incentive for reliance, as:

$$r_E^b \in \arg\max_{r^b\in R} E_\theta[\Phi(r^b,r^s,\theta,q^o)]=\arg\max_{r^b\in R} E_\theta[W(r^b,r^s,\theta,q^o)]$$

$$\neq \arg\max_{r^b\in R} E_\theta[W(r^b,r^s,\theta,q^+(r^b,r^s,\theta))]=r^{b*}$$

would hold. As a consequence, the buyer would have the incentive to choose a level of reliance which is higher than the socially optimal level (unless and until, the initial contractual quantity $q^o=q^{oo}$ in the light of Lemma 3; in that case there would be efficient investment by the buyer).Given the buyer's investment choice r_E^b, anticipating this the seller would thus choose her investment level according to:

$$r_E^s \in \arg\max_{r^s\in R} E_\theta[\Psi(r_E^b ,r^s,\theta,q^+(r^b,r^s,\theta))]= \arg\max_{r^s\in R} E_\theta[W(r_E^b ,r^s,\theta,q^+(r^b,r^s,\theta))]$$

$$\neq \arg\max_{r^s\in R} E_\theta[W(r^b,r^s,\theta,q^+(r^b,r^s,\theta))]=r^{s*}.$$

And hence she would have an incentive to rely higher than the socially best level which crucially depends upon the buyer's reliance choice, as the seller has to fully internalise the cost of breach under expectation damage remedy.

In this case, the first best solution can be implemented by just requiring the parties to specify a suitable initial contractual quantity choice $q^o = q^{oo}$ (in the light of lemma 3) and the seller to mitigate damages as per actual expectancy of the buyer resulting from breach.

Second*: If D*(*r^b*,*q*)=0: Then the seller's payoff would be −

$$\Psi(r^b,r^s,\theta,q) = T^o - C(r^s,\theta,q) - r^s = [V(r^b,q) - C(r^s,\theta,q) - r^b - r^s] + [T^o - V(r^b,q) - r^b]$$

$$= W(r^b,r^s,\theta,q) + [T^o - V(r^b,q) - r^b].$$

And hence she will breach whenever her *ex post* cost (net of investment) is higher than the contractual price. Now the buyer's payoff in this case is −

$$\Phi(r^b,r^s,\theta,q) = V(r^b,q) - T^o - r^b = [V(r^b,q) - C(r^s,\theta,q) - r^b - r^s] - [T^o - C(r^s,\theta,q) - r^s]$$

$$= W(r^b,r^s,\theta,q) + [C(r^s,\theta,q) + r^s - T^o].$$

Note that since both the parties' payoffs, upto the first term in their respective expressions above, are dependent on the *ex post* actual performance choice; thus it can easily be shown that both of them (automatically) undertake socially efficient investments.

Such practice gives rise to a direct and efficient mechanism, which is incentive compatible and works even if investments are hidden action. Under this mechanism, the informed party (seller) is directly asked to reveal his private information. This direct mechanism is of the Clarke-Groves type. We shall indirectly prove this mechanism in the next subsection (5) of liquidated damage analysis in a more concrete setup.

5. Party Designed Liquidated Damage

The buyer and the seller in this case can 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 a contract to the seller, and the seller may accept or reject it. Second, the seller proposesa contract, and the buyer accepts or rejects it. Finally, an uninformed broker may design a contract that maximises the joint surplus from trade between the parties. Taking the usual route in the contract theory literature, of uninformed party − here 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 → 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 → at Time 2, the seller observes his cost of production → given p and D_L, the seller decides whether to perform the contract or breach the contract → 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 her realised cost, and contractually agreed p and D_L. The seller will perform only when: $p - c \geq -D_L$ or if: $c \leq p+D_L$.

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 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 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:

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

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

We obtain the following lemma −

Lemma 5: *For any given $T \equiv p+D_L$, $p>0$, 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 expected payoff 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.

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 and her reservation utility thus be$c=0$ as there is no market alternative.Since the buyer determines p and D_L to maximise his expected payoff.[11]

Thus we have the following optimisation problem −

$$\max_{p,D_L,r^b,r^s} EP_L^b(p,D_L,r^b)$$

subjectto (i) $EP_L^s \geq 0$ [IR] and (ii) $\max_{r^s} EP_L^s$ [IC]

Aside, the seller's maximisation problem gives us the following the F.O.C. −

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

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

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

$$\max_{p,D_L,r^b,r^s} EP_L^b(p,D_L,r^b)$$

subject to (i) $EP_L^s \geq 0$ [IR]

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

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

We derive the following lemmata−
Lemma 6:

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

$$D_L^*=F[(V(r^{b*})-C(r^{s*})].\{V(r^{b*}) - E(c \mid c \leq V(r^{b*}))\} - r^{s*}$$

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

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

$$EP_L^s=0 \ .$$

11 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 maximise his expected payoff subject to the IC and an IR of the seller, so that the seller gets a nonnegative utility.

Lemma 7:*Both the partiesundertake socially desired level efficient investment under liquidated damage remedy when one-sidedprivate information is present.*

Proof of Lemmata 6 & 7: 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 rewrite it as−

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

Maximising the expression just above w.r. to r^b gives us the following −

$$-[1/C'(r^s)].V'(r^b) = -1 \text{or,} \quad V'(r^{b*}) = C'(r^{s*})$$

⇒The marginal returns from reliance investments by the parties are equal.

Now maximising the expression (27) w.r. to r^sgives us –

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

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

$$\Rightarrow \quad V(r^{b*}) = (p^* + D_L^*), \quad [\text{since } f(p+D_L - C(r^s)) \neq 0]$$

⇒ The optimum total breach cost is equal to the optimum valuation of the buyer.

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

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

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

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

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

Thus, $\quad D_L^* = F(V(r^{b*}) - C(r^{s*})).\{V(r^{b*}) - E(c \mid c \leq V(r^{b*}))\} - r^{s*}$

Therefore, the buyer's equilibrium payoff:

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

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

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

Note: So long as the buyer's valuation is observable, the breach cost $T=v$ is the unique optimum. The corresponding contract price offered by buyer is p, which just satisfies the seller's reservation price. Similarly, if the seller has all of the bargaining power, she will maximise profits subject to the buyer's acceptance of terms (i.e., $EP_L^b \geq 0$), which is identical to the buyer's program above, and so we again find $T=v$. However, the price-paid by the buyer to the seller under this scheme is $p=v$, which extracts all of buyer's rent.

Finally, if a broker proposes a contract to the parties, the broker will maximise the expected gains from trade by choosing T to maximise the collective surplus $EP_L^J(v,T,c)$. Again the solution is to set $T=v$. The broker then chooses a price to allocate the gains from trade with p lying in the interval $[v,E(c)]$. It is not surprising that the optimal full-information contract specifies $T=v$ for each contracting environment, since this condition guarantees that breach occurs if and only if it is efficient.

6. CONCLUSION

Legal proceedings both in Common Law and Civil Law countriesin an asymmetric information environment seem to be relying on two remedies. First, take resort to objectifying damage measures. Secondly,some legal systems allow the promisee to opt for recovery of reliance expenditures instead of expectation damages. The option was introduced to accommodate the promisees that have difficulties to verify their true expectation damages in front of courts. Both are defective. In the first case, neither it assesses expectation damages correctly nor does it provide incentives for efficient breach. In the case of reliance damages, the outcome, again, cannot be state-contingent and, hence, the *ex post* efficiency will not be achieved.

We find that in case of bilateral-investments both the Reliance and the Restitution Remedies lead to inefficient outcomes (both in breach and in reliance) for fixed-price incomplete contracts. With no damage measure, in case the promisee undertakes reliance she would over-rely in specific assets, whereas the promisor would under-rely. When the remedy choice is reliance damage, the general result we find across the board is that it leads the promisee to over-rely and the promisor to rely less compared to their respective efficient reliance levels. Both of these remedies result in frequent breach by the promisor; since reliance damages also lead to an effective transfer schedule $T(r^b,q)$ that does not depend on nature's move, *ex post* efficiency would not be restored.

Finally, when expectation damage can be assessed by court properly and awarded, first, it ensures efficient performance; secondly it induces efficient reliance for the breaching promisor (if at all she invests) but leads the promisee to over-rely. This result holds good irrespective of the situation whether selfish reliance is undertaken unilaterally or bilaterally. In case of a reliance setting with hidden information, our analysis has categorically established that a trade-off exists between providing efficient incentives and assessing expectation damages correctly. Provisions that would allow assessing expectation damages correctly prevent efficient breach of contract whereas revelation mechanisms leading to the first best solution would fail to assess damages correctly.

To sum up, pragmatic solutions of awarding damages under asymmetric information seem defective on two accounts. First, they fail to assess expectation damages correctly. If granted such damages, the promisee need not be equally well off as if the promisor had met his obligation. Second, the outcome will be constant over states and, as such, will typically fail to be *ex post* efficient.

In the words of Korobkin and Ulen (2000), "*Legal rules create incentives or disincentives for actors subject to the legal system to act. Thoughtful legal policy must recognise these incentive effects and be responsive to them*". Since the revelation mechanisms are available that would generate the first best solution, at least for the present setting, such legal practice are not justified from the economic perspective rather adoption of liquidated damage remedies should be encouraged.

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