Chapter 2
Unilateral Self Investment, Single dimensional Informational Asymmetry, Fixed-Price Contract and the Legal Remedies

2.1 Introduction:

"[A]symmetric information has played a very limited role in the analysis of the hold-up problem". (Hart, 1995).

In the bulk of the existing incomplete-contract literature initiated by Grossman and Hart (1986) and Hart and Moore (1988), all the variables of interest such as revenue, cost and investment are supposed to be observable but not verifiable at the bargaining stage. Therefore, the ex post efficiency is automatically guaranteed and any inefficiency comes from the ex ante under-investment (Hold-ups).

In the previous chapter, we explored a similar setting where the parties undertake non-contractible reliance investments (efforts) that enhance the value of performance at the individual level. After the investments are undertaken, one of the parties receives some relevant non-verifiable information. Thus we were in a world of the moral hazard with ex post non-verifiability. But the maintained assumption, following the existing incomplete-contract literature, was that the valuations of the parties, although not verifiable, were ex post observable to each other (i.e. symmetric information between the parties), thereby enabling ex post (re)negotiation. Under the symmetric information particularly the analysis
of renegotiation is much more tractable than under the asymmetric information. Also from a purely economic point of view it is most natural to study the hold up problem in the context of symmetric information since this is most acute when a buyer observes the seller's investment and can exploit this information to extract a high price. However, such an assumption is particularly problematic considering the literatures' emphasis on human capital investment and the existence of post contractual hidden information regarding the parties' valuations. There are some contracts that are particularly affected by the imperfect and asymmetric information. The problems encountered by these contracts are commonly illustrated by the insurance contracts, although many other different types of contracts suffer from the same potential for the inefficient incentives and breach, such as the agency agreements, the employment contracts and the contracts between the suppliers and the buyers (subcontractors) for the procurement a particular commodity.

In a symmetric information framework, as in the previous chapter, the hold-up problem can disappear when one party has the full bargaining power. By contrast, this chapter shows that even when one party has full bargaining power, the hold-up problem can persist in the asymmetric information settings. This chapter studies the hold-up problem with an non-observable investment by one party and an ex post private information by the other party, which is a more realistic description of diverse situations. From the buyer's point of view, the sellers are identical at the beginning of the game but develop private types midway through. His chief concern is to give them the incentives to disclose their types later, which gives the game a flavour close to that of the ex post adverse selection.
Earlier on, it was assumed that the gains from trade are always positive, and so a simple fixed price incomplete contract (with renegotiation) could achieve the first best outcome. Here more realistically, we assume that the gains from trade are no longer positive always. Sometimes it can be negative. A possibility of the ex post contract breach arises. We show that the simple fixed price contract in this situation is no longer efficient. Legal penalties are required to protect the promisee's reliance. It is further shown that the adoption of the different legal protections again creates different levels of moral hazard on the part of the reliance investor and may also bring forth certain kinds of ex post allocative inefficiency.

In the moral hazard model the primary force that shapes the optimal contract is the trade-off between the risk sharing and the incentive provision; with the adverse selection model, the optimal contract is driven by the trade-off between the allocative efficiency and the need to extract rent from the buyer. By contrast, the agents in the current model are risk neutral towards income, so the risk sharing is not a concern; the rent extraction per se is also not a concern because the lump-sum transfers can be made at ex ante. Additionally, there are no third parties, no liability constraints, no pre-contractual private information (i.e., *ex ante adverse selection*)\(^{32}\). Instead, the present model highlights the interaction between the incentive provision and the allocative efficiency.

Such an results in some striking features of the optimal contract, which depend in a crucial way on the degree to which the seller's incentive constraint binds at the optimum.

\(^{32}\) Note that from a pure contract-theoretic point of view, the model developed herein has an advantage over the models which assume that there are rents due to pre-contractual private information or wealth constraints, because here the efficiency of the optimal contract does not depend upon the distribution of the initial bargaining powers.
First, when the incentive constraint binds to a low degree, i.e. the shadow price on the constraint is small, the trade is efficient at the two ends of the type interval. The intuition is that reducing trade for the top or the bottom type shifts a constant amount of rent from the buyer to the seller.

What kind of a contract should they write? Although this seems to be one of the most basic and natural problems a contract theorist might think of, it has not yet been properly analysed in the framework we are dealing with. The purpose of this analysis is to fill this small but surprising gap in the literature.

2.1.1 Literature on Legal Remedies:

The "hold-up literature" contends that the investments that enhance the value of the completed transaction must be sunk before the state of uncertainty is resolved. In the subsequent negotiations, therefore, a party will lose part of the returns of her relationship-specific investment; and thus the incomplete contracts lead to an under-investment in specific assets.

The literature on the legal remedies for the breach of contract, however, has predicted the reverse. This literature has studied the contractual and non-contractual solutions to this hold-up problem. The two main results on the contractual solutions to the hold-up problem have been obtained. First, a simple contract specifying a price and a quantity of the final good to be traded will, fairly generally, induce efficient investments if the investments are 'selfish' in nature – i.e., if each party's investment directly affects only his own profit (Edlin

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33 This hold-up literature spans industrial organization, labor, and comparative institutions (see, for example, Williamson, 1975, 1985; Benjamin Klein et al, 1978; Oliver D. Hart and John D. Moore, 1988; and Paul Grout, 1984). Hold-ups play a central role in recent attempts, for example, Sanford J. Grossman and Hart (1986), to broaden and deepen the investigation begun by Ronald H. Coase (1937) into the boundaries of the firm.
and Reichelstein, 1996). Second, and in contrast, no contract however complicated is of any value in reducing inefficiency if the investments are ‘cooperative’ in nature, i.e., if each party’s investment directly affects only the other party’s profit (Che-Hausch, 1999).

Early analyses, on the assumption that the parties could not renegotiate, revealed that the standard breach remedies lead to an inefficient trade or an inefficient investment (i.e. either the over-investment or the under-investment depending upon the situation) or both (Shavell 1980, Goetz & Scott 1977). Rogerson (1984) and Shavell (1984) expanded the analysis by allowing for the costless renegotiation. The costless renegotiation implies that the trade is always optimal (Coase 1960), so the efficiency is determined by the parties’ investment choices. Rogerson and Shavell found that the parties using a simple fixed-price contract will invest inefficiently under standard remedies. Some researchers sought to solve the inefficient investment problem by allowing for a “knife-edge” clause that assigns the entire surplus to one party and allow for a high punitive damage for the parties that deviate from the equilibrium path (Chung, 1991; MacLeod & Malcomson, 1993; Aghion et. al., 1994). The others have focused on more complete contracts, such as fill-in-the-price contracts (Konakayama, Mitsui & Watanabe 1986, Hermalin & Katz 1993) and the liquidated damage clauses (Spier & Whinston 1995) as the means of achieving efficiency under the standard remedies. These more complete contracts include de facto remedies that the court simply enforces if some contingencies arise. Through these various clauses (knife-edge, fill-in-the-price, and liquidated damages) the court’s optimal role is reduced to enforcing the terms of the contract, which leads to an unsurprising conclusion that the specific performance will produce an efficient result whereas expectation damages will not (Herma-
lin & Katz 1993). Unfortunately, the "fill-in-the-price" contracts and liquidated damage clauses can be very complex, perhaps indescribably so (see, Hart & Moore (1999); Maskin & Tirole (1999, 98)). Furthermore, the real-world contracts do not often contain damage schedules, and even when they do, the courts are typically unwilling to enforce the terms that appear excessively punitive. Returning to the simple fixed-price contracts, Edlin & Reichelstein (1996) demonstrated that the parties can write contracts that provide the incentive for efficient investment under the expectation damage and the specific performance remedies. However, Che & Chung (1999) showed that for some types of investments—the so-called cooperative investments where the investment by one party directly impacts a second party's value—the standard breach remedies again lead to an inefficient outcome. (See also Che & Hausch (2000)).

With the expectation remedy, the over-investment problem can be mitigated if the damage award is based on the investments that take into account the likelihood of efficient breach (see Goetz & Scott, 1980; Cooter, 1985; Cooter & Eisenberg, 1985). The over-investment problem from these standard remedies may also be addressed through another means. For example, recall that in addition to highlighting the over-investment problem produced by specific performance and expectation money damages, Rogerson (1984, 1992) and Shavell (1984) also demonstrated that the parties under-invest when remedies are unavailable. In particular, when the investments are non-contractable and non-redeployable (i.e., relationship-specific) the potential for hold-ups by the contractual partners encourages under-investment—a point first introduced in the more descriptive literature by Williamson (1975, 1985) and Klein, Crawford & Alchian (1978). Balancing this under-investment
from hold-ups against the over-investment generated by standard breach remedies, Edlin & Reichelstein (1996) were able to demonstrate that the parties can write simple contracts that lead to an efficient selfish one-sided investment under the expectation damage remedy and the efficient one-sided and bilateral selfish investments under the specific performance remedy\(^{34}\). Edlin & Reichelstein also argued that the Rogerson-Shavell over-investment result was an artefact of the discrete choice framework of their models (i.e., if contracts allow for the continuum of units then the under-investment or even optimal investment may occur under the standard remedies.)

\[\text{2.1.2 Our work and Relation to the existing literature}\]

Following the existing literature, we, in the present analysis, mainly deal with a particular family of contract which involves the production of goods (basically a deferred exchange). It is worth noting that the formal analysis of the performance of service is essentially the same. The model in the current analysis generalises the principal-agent model: the principal (buyer) having a hidden action (a selfish investment\(^{35}\)), the agent (seller) privately observing her cost of production, and on top of that the parties choosing the level of trade and a price. (Thus there is one-sided informational asymmetry). Throughout the chapter, we set aside questions of litigation costs but assume renegotiation not possible (un-}

\(^{34}\) When investments are purely cooperative, the parties tend to under-invest and the best initial contract is no contract at all. See, Che & Chung (1999).

\(^{35}\) Cooperative investments are particularly natural if the seller produces the good at Time 1 (efforts increase the quality of good). Such cooperative investments are important for buyer-supplier alliances in industrial purchasing. In the case of self investments, it is natural to assume that the seller produces the good at time 2, and production costs can be reduced by Time 1 investment whereas the buyer can also enhance his time2 valuation by investing in Time 1. See Che & Chung (1994) for more on deferred exchange and nature of investment.
2.1 Introduction:

In order to provide a clear view of the regulation that focuses on the efficient contract breach and the efficient investment incentives. This assumption brings our analysis close to Shavell’s than that of Edlin et. al. and Rogerson (1984).

Keeping a note on the earlier-mentioned formal differences in approach, and contradictory the views between the theoretical and the legal postulates of contracts, an attempt has been made in this analysis to integrate this legal intuition with that arriving from the hold-up theoretic literature, and extend its focus to an efficient ex ante designing of the contract in the face of ex post private information. In the one-sided asymmetry case the contract design problem (taking into consideration the existing laws) reduces to a problem of controlling the informed party’s response. This gives our analysis a unique character in the literature since most of the legal literatures, as we have explored in previous subsection e.g. Shavell, Edlin etc., generally use an informational environment where the contracting parties are ex post symmetrically informed.

Existing literature on the solutions to the hold-up problem adopts two distinct methods. Some papers consider a revelation mechanism (e.g. Rogerson) in which the parties’ messages to some central agent determine the ex post outcome. The other method considers a fixed-price contract (which may be renegotiated) (e.g. Shavell, Miceli, Edlin). We followed both the methods to examine the trade-off between the allocative efficiency and the incentive provision in more general terms rather than focussing exclusively on the investment incentives.

We study various damage measures for the breach of contract and compare their efficiency, similar to Shavell (1980, 1984), and Miceli (2004). We also explore how damage
measures serve as an implicit substitute for the completely specified contracts and reliance actions. The general result we obtain here – no court-imposed damage remedy upholds the first best – is not any the more novel than that obtained in the works of Shavell and Miceli.

But our work establishes the importance of liquidated damage remedy in an asymmetric information framework, as it not only achieves the first best but maximises the social welfare as well. The magnitude of the stipulated damage actually reflects the *perfect expectation damage* (See, Shavell 1980) and does not contravene with the theory often presented by the legal scholars that posits that the legal remedies for breach of contract should serve only to compensate and never to punish (See, Farnsworth (1982)). The economic analysis of the liquidated damage clauses has been mostly limited to the case of symmetrically informed parties. Stole (1991) and Schwartz (1990) are the pioneering works in the field of liquidated damages when the asymmetries in information are present, although they did not consider the reliances. The liquidated damage clause plays a triple role: (i) providing incentives for the efficient breach, (ii) efficiently screening among the different types of buyers and sellers, and (iii) providing incentives for the efficient investment. Specifically, in this analysis, we demonstrate that when one party holds the ex post private information, the contractually stipulated damages may be used to categorise the types of informed party at the post-contractual execution stage. As such, the loss from suboptimal or excessive breach may be offset by the informational gains. [A direct revelation mechanism]. In fact, in the typical buyer-seller contract where only one party has the private information, the total breach cost would always equal to the buyer's optimal valuation; therefore the stipulated damages will almost always fall short of actual losses from the breach (ex post).
2.2 The Model: We draw a normative conclusion that the courts should drop their scepticism about the mutually agreed terms within a contract in the form of a liquidated damage. Moreover, the courts would do better if they routinely ask the parties to write contracts with stipulated damages in the circumstances with asymmetric information.

2.2 The Model: Unilateral reliance (buyer) and One-sided private information (seller)

2.2.1 The General Setting

Consider a particular setting with a single (male) buyer, B, who contracts to purchase one unit of an \textit{indivisible} specific good\textsuperscript{36} from a single (female) seller S. Both are risk-neutral. The parties enter into a simple \textit{fixed-price} contract at Time 1. Without any loss of generality, and for simplicity, we assume that the buyer has the entire bargaining power so that the seller’s surplus from the contract is assumed to be zero. This entails that the buyer makes a take-it-or-leave-it offer with the price \( p \). Thus either one unit of the said good is traded, or zero; so that the parties are left with only one default option – no trade. The contract argues that the seller will produce the good and deliver it to the buyer at Time 4, in exchange for the price \( p \). Further, we assume that the price of the good is a constant and agreed upon at Time 1 but payable only upon the delivery of the good\textsuperscript{37}.

\textsuperscript{36} Indivisibility is just a standard assumption in contract literature (for example, Besanko and Spulber (1992)). It simplifies our analysis by suppressing the issue of quantity choice, helps highlight the issues of breach, a particular concern to us since the court does not treat this as a divisible contract (as was the case for Edlin & Reichelstein).

\textsuperscript{37} Ideally, the parties would like to specify a price schedule, i.e. a different price for every possible cost \( c \) that might occur. But we assume that the parties cannot write such contracts here, as it is prohibitively costly for them to do so. Price is determined on the basis of ex-ante bargaining power of the parties.
2.2 The Model:

The sequence of events is summarised in the following Time line:

<table>
<thead>
<tr>
<th>Time 1</th>
<th>Time 2</th>
<th>Time 3</th>
<th>Time 4</th>
<th>Time 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parties enter into contract with ( p )</td>
<td>Buyer invests ( r )</td>
<td>Seller privately learns cost</td>
<td>Seller performs or breaches</td>
<td>If approached, Court decides and parties obey</td>
</tr>
</tbody>
</table>

At Time 1, the buyer is uninformed about the seller's cost, whereas the seller herself is not sure about it. The seller's production cost, \( c \), is a random variable\(^{38}\) in accordance with a strictly positive probability density function \( f(c) > 0 \); the corresponding cumulative distribution function denoted by \( F(c) \) from the interval \([c, \bar{c}]\) where \( \bar{c} > c > 0 \). The expected value of \( c \) is denoted by \( E(c) \). We assume that this cost is realised and privately observed by the seller at Time 3.

At Time 2, the buyer can make a reliance investment costing \( r > 0 \), which directly affects the buyer's valuation of the good, denoted by \( V(r) \); this is non-stochastic [and thereby invertible], and ex post observable to both the parties and also verifiable to court. This value accrues to the buyer \textit{iff} the good is actually delivered. We assume that \( r \) is non-contractible ex ante (because they are prohibitively costly to describe ex ante), but ex post verifiable. We make the standard assumptions to get a "well behaved" problem: \( V(r) \) is monotonically increasing and strictly concave in \( r \) i.e. \( V'(r) > 0 \) and \( V''(r) < 0 \) where the prime denotes the derivatives. Moreover, to avoid the corner solutions, we assume that the \textit{Inada Conditions} \( V'(0) > 1 \) and \( V'(r) \to 0 \) for \( r \to \infty \) are satisfied.

\(^{38}\) It could be discrete or continuous. Analysis could proceed on either premise but here we concentrate on a continuous case.
General Assumptions:

1. Throughout the analysis we shall consider only the interior solutions (we will assume that the second-order conditions for the optimisation are satisfied).

2. We assume that the optimal solution is unique.

The analysis:

We structure the model in such a way with a fixed price that only the seller contemplates breaching unilaterally. The price of the good, $p$, is so chosen in the model that we must always have $V(r) - r > p$ or $V(r) > p + r$ or $V(0) > p$; i.e. a fixed price with no possibility of default by the buyer, whereas $c \leq p \leq \bar{c}$ for the seller\footnote{Note here that $c \leq V \leq \bar{V}$}. In this kind of set-up, the buyer will never refuse the performance by the seller since: first, all the uncertainty is on the seller's side of the model, and secondly, he cannot observe the seller's cost ex post. If the trade turns out to be inefficient – the seller's production cost would exceed the buyer's value – and the seller fails to perform the contract and does not deliver the good, the investment would have been wasted and thereby the value accrues to the buyer is zero. It is assumed that the parties cannot make any changes to the contract after Time 1 even in the face of ex post discordance. We focus on the ex ante design of the contract in the light of new information expected in future (and therefore assume no renegotiation\footnote{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, through out 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}}.
2.2 The Model:

despite the fact that the specific investment involved on the part of the buyer increases his risk and paves a way for the renegotiation.

2.2.2 The First Best (Efficient Breach and Efficient Investment):

The modern theory of "efficient breach"\footnote{For more details see Posner (1986).} proposes that if the promisor's profits from the breach exceed the loss to the promisee, the breach is to be permitted or even encouraged on the ground that it leads to the maximisation of resources. Under this theory of the efficient breach, the breacher is given an option not to perform his contract so long as she is prepared to pay the plaintiff (the aggrieved party) his expectation damages, that is, a sum of money necessary to make the plaintiff indifferent between the performance of the contract and the damages so paid. The implication of the theory of efficient breach is such that the breaching party will exercise this option if and only if the gains from breach are greater than the money so paid over. The pristine form of the theory implies that the plaintiff is left as well off from the breach as before, while the defendant is made better off. If so, the expectation damages, if truly implemented, satisfies not only the Kaldor-Hicks standard of hypothetical compensation but the more restrictive Pareto standards of efficiency as well:

\footnotetext[41]{For more details see Posner (1986).}
not only is there a net social gain for the contracting parties, but no one is left worse off after the breach than before. Consequently, under the either view of efficiency, the optimal level of damages is that which compensates the plaintiff only for this loss, and no more.

In economic analysis, the breach of contract is efficient when the two pre-conditions are met viz. when the breaching promisor internalises the costs of her decision by compensating the promisee for the losses caused by the breach and when the agents (or agent) undertake(s) the efficient transaction-specific reliance investment. Keeping these two principles in mind, here we try to find out the efficient reliance decision for the buyer (for simplicity, we assume only one agent is making the reliance investment) and the efficient performance decision by the seller. In some cases, it will be Kaldor-Hicks efficient for the seller to decide not to perform the contract. Hypothetically, if the seller’s cost eventually turns out to be relatively high, then this cost could exceed the benefits that might accrue to the buyer from the performance, and so the aggregate welfare would be lower (if not negative) if the performance actually took place.

Clearly, after the seller realises a cost $c$ (i.e. in ex post sense), the breach of contract will only be efficient iff: $V(r) < c$; otherwise the performance will be ex post efficient. In the case of the equality between the two, the total surplus for the transaction is zero; but the contract is still worth honouring as both the parties would be recovering their respective expenses. The set of all possible realisations of $c$ such that $c > V(r)$ is called the breach set.
Therefore, the probability of efficient performance is:

\[ \text{Pr}[c \leq V(r)] = \int_c^{V(r)} dF(c) = F[V(r)] \]

And the probability of an efficient breach is:

\[ \text{Pr}[V(r) < c] = \int_{V(r)}^{\bar{c}} dF(c) = 1 - F[V(r)] \]

Next we turn to reliance decision as the analysis of breach decision is completed here.

**Lemma 2.1:** The first best amount of reliance investment under the one-sided uncertainty (in no-gap situation\(^{42}\)) must be less compared to that of by the parties without any uncertainty.

**Proof:** Given the efficient breach decision, the other issue in front of us is to determine the efficient amount of reliance. Given the probability of efficient breach, the socially efficient reliance investment by the buyer is that which maximises the joint expected value of the contract. Now, the expected joint value is defined as follows:

\[
EPJ = \int_{V(r)}^{\bar{c}} dF(c).(0 - r) + \int_{V(r)}^{\bar{c}} dF(c).\{[V(r) - r - p] + [p - E(c)c \leq V(r)]\}
\]

i.e.

\[ EPJ = F[V(r)].[V(r) - E(c)c \leq V(r)] - r \quad (2.1) \]

To check the investment incentives for the contracting parties, we differentiate the above expression and obtain the following\(^{43}\) –

\[ EPJ'(r) = f(V(r)).V'(r).V(r) - F[V(r)].V'(r) - f(V(r)).V'(r).V(r) - 1 \]

\(^{42}\) By a 'gap situation', we mean that there is a gap between the supports of the seller's cost and the buyer's valuation, whereas there could be "no-gap" as well between the two. In the gap case when it is a common knowledge between the parties that the gains from trade exist always.

\(^{43}\) For differentiation we have used the following formula of fundamental theorem of integration:

\[ \frac{d}{dt} \int_{g(t)}^{h(t)} f(x)dx = f(h(t)).h'(t) - f(g(t)).g'(t) \]
In order to allow for the hold-up and to facilitate a comparison of the equilibrium investment levels under uncertainty and (a benchmark) no uncertainty situations, we assume that the level of efficient investment is positive and unique. To complete our analysis we need the following additional assumptions –

**Technical assumptions:**

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

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

And the second assumption guarantees a unique solution $r^*$ (a Kaldor-Hicks efficient level of investment $r$ that maximises this joint value) for the following first order condition to the equation (2.1) –

$$F[V(r^*)].[V'(r^*)] = 1 \quad (2.2)$$

Therefore at the efficient level of investment, we have:

$$V'(r^*) = \frac{1}{F[V(r^*)]} > 1, \text{ since } \int_{\zeta}^{\infty} f(c) F(c) < \int_{\zeta}^{\infty} dF(c) \quad (2.3)$$

Now for the comparison purpose, let us construct the efficient amount of investment without the uncertainty. Without any uncertainty (thereby, no breach possibility), the efficient
amount of reliance investment simply solves the following problem:

$$\max_r V(r) - r$$ \hspace{2cm} (2.4)

We solve for \( r = r_c \) that satisfies the first order condition as follows:

$$V'(r_c) = 1$$ \hspace{2cm} (2.5)

where \( r_c \) is investment level under no uncertainty.

The term \( F[V(r)] \) 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; but since \( V'(r^*) > 1 = V'(r_c) \), this means that, as \( V''(r) < 0 \), the amount of investment under one-sided uncertainty must be less than the amount without uncertainty. The reason is that the uncertainty about the seller's cost and the possibility of breach together confirms that in some states of the world it is no longer efficient to make a reliance investment of that magnitude when there's no uncertainty. This means that, on average, the amount of reliance investment must be lower under uncertainty than under perfect certainty.

\[\square\]

2.3 Court-imposed Remedies for Breach of Contract:

Compensation is the governing principle in contract law remedies. This principle shapes the key doctrines that specify the consequences of breach. Typically in the incomplete contract framework, the damage measures are expected to fulfil three aspects viz. first, it should serve as an implicit substitute for more complete contract; secondly, it should induce the efficient reliance or effort and lastly, it should induce the optimal risk-bearing.
[See, Posner (1972a) and Shavell (1980b)]. Notice, as both the agents are risk neutral, therefore risk-bearing is not a concern here.

A contract may include a breach mechanism that the seller can enforce should she want to walk out of the relationship after observing the value of the breach option. This mechanism can in principle be a sophisticated one (a revelation mechanism for instance), but typically we observe some fixed number, an amount that the breaching party can pay the injured party to let herself free of the relationship. Let us refer to this type of simple breach mechanism as a standard damage measure that specifies a number \( D \) where \( D \in R^+ \).

Sometimes the breach mechanisms are not privately stipulated, but court-imposed. There are four commonly observed types of the court-imposed standard damage measures. First, the expectation damage levies a compensation on the breaching party that makes the non-breaching party as well off as he would have been if the relationship had been completed. Second, the specific performance forces the relationship to be completed (unless the agents mutually agree/renegotiate to terminate it before completion). Thus, the specific performance amounts to a prohibitively large value for \( D \). Third, the restitution damages are defined as the amount of money which restores the buyer to the position he was in before the breach was made. Fourth, the reliance damage gives the non-breacher the amount he has spent on reliance, thereby putting him back to his position prior to the relationship. This applies to the case in which the relationship surplus depends on some ex ante investment. If for instance the non-breacher incurs an investment cost of \( r \), then reliance damage amounts to \( D = r \). However, sometimes, the reliance damage may not be implementable in case \( r \) is not verifiable (i.e. if the value enhancing investments by the agents are truly
hidden actions). When the breach is occurring, the relationship surplus which is a function of the investment, will not have materialised either, so there will be nothing from which the court can infer \( r \).

Thus Law of Contract has more than one rule towards resolving the disputes. Now, in case of dispute let us consider one by one what different standard damage measures can achieve in terms of inducing the socially optimal breach decision and the socially optimal level of reliance investment instead of renegotiation. Clearly, there exists no single value \( D \) that would universally implement the efficient breach rule.

### 2.3.1 Restitution Damages (No explicit damage liability)

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 the 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, so \( D_s = 0 \). 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 breaches. Again, since \( V(r) > p \) in any contract, we must have that the seller breaches too often when compared to the first best level of efficient breach.

The probability of performance is now: 
\[
\int_{c}^{p} dF(c) = F(p)
\]

Given this, the buyer's expected payoff from the contract is:
\[
EP^b_s = F(p).[V(r) - p - r] + [1 - F(p)].(0 - r)
\]
\[
= F(p).[V(r) - p] - r . 
\]
(2.6)

The first order condition is: 
\[
F(p).V'(r_s) = 1 
\]
(2.7)
Note that, since \( V(r^*) > p \), we must have \( \int_{c}^{p} \, dF(c) < \int_{c}^{V(r^*)} \, dF(c) \), and so:

\[
V'(r_0) = \frac{1}{F(p)} > \frac{1}{F[V(r^*)]} = V'(r^*). \tag{2.8}
\]

Remarks:

1. *This suggests that with no explicit damages, the buyer under-invests in reliance i.e. he is effectively being held-up by the seller.*

2. *Intuition: Although the buyer fully internalises any social cost of breach, the seller breaches too often, and thereby the buyer is induced to under-invest.*

3. In the absence of any contractual liability, i.e., under a regime in which a party cannot get any recovery for its reliance expenditures if the contract is not performed, the party that relies will bear the full cost of reliance, but this party will not capture the full benefit of reliance, since the other party will be able to capture some fraction of the increase in surplus owing to reliance investment. This is the hold-up problem.

4. Note that the seller's private information may play a significant role in the investment incentives to the parties through her price setting power. The buyer's investments do increase with the price-setting power of the seller. The reason being as the price increases, the possibility of breach decrease, so the buyer's incentive to invest gets a boost.

5. In the models with symmetric information, the hold-up problem leads to under-investment by the player without any bargaining power. In our model, with asymmetric information, it leads to the misallocation of resources and the possible under-investment by the uninformed player (who would extract the whole surplus in a symmetric information environment, hence would always invest efficiently).
2.3.2 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 \(-r\). Reliance damages are computed as the difference between these two: \(D_r = r\). Let us consider the seller's choice problem first. Once again, she performs only when:

\[
p - c \geq -D_r \quad \text{or when:} \quad p - c \geq -r \quad \text{or when:} \quad c \leq p + r. \tag{2.9}
\]

Reliance damages under-compensate the buyer in the event of a breach, and therefore charges the seller a "price" of breaching that is too low.

The probability of performance is:

\[
Pr[c \leq p + r] = F(p + r). \tag{2.10}
\]

Let us now consider the buyer's choice problem. Given the probability of breach by the seller, and the reliance damages \(D_r\), the expected payoff to the buyer is:

\[
EP^b_R = F(p + r).[V(r) - r - p] + [1 - F(p + r)].(D_r - r)
= F(p + r).[V(r) - r - p]. \tag{2.11}
\]

The first order condition is:

\[
f(p + r).1.[V(r) - r - p] + F(p + r).[V'(r) - 1] = 0
\]

or,

\[
V'(r_R) = 1 - \frac{f(p + r_R)}{F(p + r_R)} [V(r_R) - r_R - p] \leq 1. \tag{2.12}
\]

Therefore, the buyer over relies \(r_R > r^*\) under reliance damage remedy.

Remarks:

1. *Intuition:*
a) As \( r \) is returned to the buyer in the event of a breach, the buyer ignores the loss of \( r \) in the event of non-performance. This effectively insures him against the risk that the investment may appear (socially) unprofitable after all.

b) Under the reliance measure of damages, there is excessive reliance from another motive besides the general reason just mentioned above. The fact that damages in this case are less than the expectation interest, the buyer will be made worse off if there is a breach. Hence, the buyer will want to reduce the likelihood of breach, and this in turn he can accomplish by increasing the reliance – for the higher is the reliance, the more the seller will have to pay in damages if she breaches, and thus the less often will she commit breach. This motive will be referred to as the breach prevention motive (Chung (1995)). For this reason, it will be shown that the level of reliance undertaken under the reliance measure of damages tends to be even more excessive than the reliance under the expectation measure.

2. One point worth noting at this stage: if we drop the assumption of verifiable reliance then the court would certainly refuse to implement this measure since it cannot observe the amount of reliance and thus cannot quantify it.

2.3.3 Expectation Damages:

Expectation damages are defined as the amount of money that the victim of the breach must receive in order to put them in the same position as if the contract had been performed. In the event that the contract is performed, the buyer’s payoff is: \([V(r) - p - r]\). And if the contract is not performed, the buyer’s position is: \([0 - r]\)
Thus, the expectation damage is simply the difference between these two amounts:

\[ d_e = \{V(r) - p - r\} - [0 - r] = V(r) - p. \] (2.13)

Let us solve the seller’s decision problem first. Once \( c \) is realised, the seller will perform, as long as he gains from doing so (i.e. if gain from performance exceeds the damages to be paid in the event of breach). This means that performance will occur iff:

\[ p - c \geq -d_e \quad \text{or} \quad p - c \geq -[V(r) - p] \quad \text{or} \quad V(r) \geq c. \] (2.14)

Thus expectation damage measure leads to performance iff the gross value of performance exceeds the production cost. This is exactly the same condition that induces efficient performance. Therefore, expectation damages induce the seller to breach when only it is socially optimal to do so (ex post).

The probability of performance is now:

\[ \int_{c}^{V(r)} dF(c) = F[V(r)]. \]

Now consider the ex ante decision problem of the buyer regarding the choice of level of investment \( r \). Given that the seller breaches only when it is efficient to do so, the buyer’s expected payoff is:

\[ EP_e^b = F[V(r)][V(r) - p - r] + [1 - F[V(r)]](d_e - r) \]
\[ = V(r) - p - r > 0, \quad \text{[replacing } d_e]. \] (2.15)

And the seller’s expected payoff would be:

\[ EP_e^s = F[V(r)].[p - E(c|c \leq V(r)) - [1 - F[V(r)]]d_e \]
\[ = p - F[V(r)].E(c|c \leq V(r)) + [1 - F[V(r)]]V(r). \] (2.16)
The buyer chooses \( r \) to maximise his payoff in equation (2.15). Let us denote the reliance investment under expectation damages by \( r_e \). The first order condition is:

\[
V'(r_e) = 1,
\]

which maintains that \( r \) will be adjusted to a level such that the marginal return equals the marginal cost. This means that \( r_e > r^* \) thus the buyer once again over-invests in reliance compared to the first best level.

**Remarks:**

1. The remedy of expectation damages induces the seller to make efficient breach decisions, but induces the buyer to make inefficient investment decisions.

2. *Intuition:* Expectation damages fully insure the buyer against any possible breach, which creates an incentive to over-invest, relative to the efficient level of investment under one-sided uncertainty (as we have derived in equation 2.3).

**2.3.4 Comparison of Court-imposed damages:**

**Social welfare and damages:** Which of the damage measures mentioned above can optimise the social gain from trading? To find an answer to the question, we assume a unilateral breach by the seller. Suppose \( D \) be any damage (where \( D \in \mathbb{R}^+ \)) that the seller has to pay if she breaches the contract.

Thus the seller breaches and frees herself of the contract by paying damage \( D \) iff \( p - c < -D \) i.e. \( c > p + D \); otherwise, she would perform.

Now, \( \Pr[\text{efficient performance}] = \Pr[c \leq p + D] = F(p + D) \),
and, \[ \Pr[\text{efficient breach}] = \Pr[c > p + D] = 1 - F(p + D). \]

Thus, given any \( D \), Expected Joint Value of Contract can be calculated as follows -

\[
\begin{align*}
EPJ &= [1 - F(p + D)] \cdot [(D - r) + (-D)] \\
&\quad + F(p + D) \cdot \{[V(r) - p - r] + \{p - E[c|c \leq p + D]\}\} \\
&= F(p + D) \cdot [V(r) - E[c|c \leq p + D]] - r 
\end{align*}
\]

We want to maximise this payoff with respect to a \( D \) bounded in the region \([0, p - c]\). The upper bound arises from the fact that if \( D \) takes this value (which is the maximum possible ex post gain for the seller from trading), then this damage would never be paid by the seller and she would rather choose to perform always in the face of this damage amount. This could be treated as the specific performance remedy.

**Proposition 2.1:** Define: \( D^* = \text{arg max} \ EPJ(D) \); thus \( D^* = \min[V(r) - p, p - c] \).

**Proof:** The First Order Condition gives us –

\[
EPJ'(D) = f(p + D)1.V(r) - f(p + D)1.(p + D) \\
= \{(V(r) - (p + D)).f(p + D)\}.
\]

And the second order condition gives us –

\[
\]

Therefore, given \( f(.) > 0 \), by setting \( D^* = \{V(r) - p\} \) gives us the unique global maximum since –

\[
EP'[V(r) - p] = 0 \\
\text{and,} \quad EP''[V(r) - p] = -f(V(r)) < 0
\]
Of course, this requires \( V(r) - p \leq 0 \). But this contradicts our assumption, thus we have
\[ D^* = \{ V(r) - p \} , \] and if not then we get \( D^* = \{ p - \zeta \} \), depending upon the claim. 

From the above expression, it is seen that the joint payoffs are highest when \( D^* = \{ V(r) - p \} \) or, \( \{ p - \zeta \} \). The first term, \( \{ V(r) - p \} \), corresponds to the expectation damages breach remedy under which the breach decision is always efficient. And the second term, \( \{ p - \zeta \} \), refers to the case synonymous with Specific Performance, this measure although capable of maximising joint surplus but force the seller to perform irrespective of her cost of performance since if she contemplates breach she has to bear the maximum possible damage payment. The price \( p \) is used as a separate instrument to distribute the gains from trade in such a way that both the parties are willing to enter into the relationship.

We now rank these breach remedies in terms of efficiency, for a given price \( p < V(r) - r \). As noted above, the expectation damages rule \( D = V(r) - p \) is the first choice; the damage measures that are less than the expectation measure may lead to a breach even though the value of performance exceeds the production cost. We elaborate this further. Since the price \( p \) is paid at the time the contract is performed according to our model setting, the restitution damage is thus synonymous with the case of no damage i.e. \( D = 0 \). This breach remedy is (weakly) dominated by the reliance damages \( D = r \). However, since \( p + r < V(r) \), reliance damage does not attain first best at all. Under both the reliance and the restitution damages inefficiencies arise because the seller breaches too often. In the case of the specific performance remedy, the breach of contract is not at all possible. The inefficiency then results from excessive performance although expected net social surplus equals \( \{ V(r) - r - c \} \). Whether the specific performance is more or less efficient than the
reliance damages depends on how the problem of excessive performance compares to the problem of inappropriate breach. In general, this can go either way (See, Shavell [1984]). Finally, in case the investment is not ex post verifiable, then the reliance damage would not be implemented at all.

Overall, the equilibrium prediction is that from the viewpoint of the mutually optimal contracting\textsuperscript{44} in case the parties look to opt for a damage measure while writing the contract (ex ante) or while settling the dispute in the court (ex post), the rule would be the expectation damage rather than any other court-specified breach remedy in place. Exactly how the joint surplus is divided (i.e. how large price $p$ is) depends on the bargaining power of both the parties at the contracting stage.

We thus summarise the ongoing discussion in the form of a following claim –

**Claim 2.1:** In a fixed price contract that has unilateral self-investment (by the non-breaching party) and single-dimensional ex post asymmetry(uncertainty) pertinent to breacher, none of the court-imposed damage remedies result in an efficient outcome; for only the expectation measure provides optimal incentives to perform, yet it does not provide proper incentives to rely.

\textsuperscript{44} A mutually optimal completely specified contract is that there will be performance in precisely the contingencies that would have been set out (by the first best and bereft of any price). Moreover, the size of the pie to be shared by the parties is maximized under the mutually optimal completely specified contract.
2.4 Restoring Efficiency in the contracts:

Empirical research has shown that the expectation and the other damage measures often lead to improper reliance. This complicates the determination of the mutually desirable damage measure. Therefore, the best measure should represent an implicit compromise between providing the proper incentives to rely and the proper incentives to perform. To elaborate this issue we now focus on other measures that can be available to the parties; namely the liquidated damage which is a more sophisticated version of expectation damages.

2.4.1 Liquidated Damage (*Party-designed Damage)*:

Oftentimes the contracting parties ex ante agree upon how much compensation will have to be paid should one of them breach the contract. These stipulated damages are called the 'liquidated damages' when they are ex ante reasonable estimations of the true losses. They are called 'under-liquidated damages' when they are meant to be under-compensatory and 'penalty clauses' when they are deliberately over-compensatory in order to create an additional sanction or penalty. *Penalty clauses* are forbidden in *Common law* in accordance with the 'penalty doctrine'. Liquidated and under-liquidated damages however are allowed. Liquidated damages are always privately stipulated and have to be incorporated explicitly into the initial contract. Given the previous results, let us now try to use our simple model to analyse the efficiency of liquidated damage measure in the same set up. The only change in the model is that the contract, initially agreed at Time 1, stipulates a price $p$, as well as a damage $D_L$, payable by the seller if there is a breach.
The seller's breach decision is subjected to $c$, $p$, and $D_L$. The seller will perform iff-

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

(2.18)

We call $(p + D_L) = T$ as 'Breach Cost'. Thus, the probability of performance and breach respectively are: $F(p + D_L)$ and $[1 - F(p + D_L)]$. The buyer's expected payoff is:

$$EP_L^b = F(p + D_L).[V(r) - p] + [1 - F(p + D_L)].D_L - r$$

(2.19)

And the seller's expected payoff is:

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

$$= F(p + D_L).(p + D_L) - D_L - F(p + D_L).E(c|c \leq p + D_L)$$

(2.20)

Therefore, the joint expected payoff under liquidated damage is:

$$EP_L^j = F(p + D_L).V(r) - r - F(p + D_L)E(c|c \leq p + D_L).$$

The seller's (agent) individual rationality constraint or participation constraint (which ensures that the agent prefers to accept the contract and participate into it, rather than refuting) requires the buyer to offer a contract $(p, D_L)$ that will maximise the buyer's payoff while ensuring the seller's payoff being non-negative:

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

subject to $EP_L^s \geq 0 \quad [IR]$ (2.21)

It is easy to see that (IR) must bind at a solution – if it did not, the principal can raise profits by raising $D_L$ while still satisfying (IR). To show that, suppose $(p, D_L)$ is the optimal contract that satisfies IR, now consider an alternative contract $(p' = p - \varepsilon, D_L' = D_L + \varepsilon)$,
\[ \varepsilon > 0 \text{ and very small. Since } p' + D'_L = p + D_L = T, \text{ we show that the buyer's payoff goes up, while the seller's payoff has gone down.} \]

Simply note that
\[ EP^b_L = F[p + D_L].[V(r) - p] + \{1 - F[p + D_L]\}.D_L - r, \]
can also be written as
\[ EP^b_L = F[T].V(r) + D_L - F[T].T - r, \]
which is strictly increasing in \( D_L \).

And the seller's expected payoff:
\[ EP^s_L = F(T).T - D_1 - F(T).E(c|c \leq T), \]
is strictly decreasing in \( D_L \). Thus, since \( \varepsilon \) is arbitrary and small, IR must bind.

Now, by substituting (IR) into the objective function, and discarding the inequality, we see that the buyer (principal) solves

\[
\max_{p+D_L, r} [F(p + D_L).V(r) - r - F(p + D_L).E(c|c \leq p + D_L)] \tag{2.22}
\]

This is exactly the total expected surplus maximisation problem; hence the resulting payoffs are also socially optimal. Intuitively, since the participation constraint binds regardless of the agent's type, the principal extracts the entire surplus above the agent's reservation utility, and therefore has the incentive to maximise it. This situation is known as the first degree price discrimination.

Without any loss of generality, here we can assume that the buyer has the entire bargaining power and therefore can extract the entire ex ante surplus; which entails that the participation constraint is binding. The buyer can choose \((p, D_L)\) to maximise the joint payoff, and then manipulate the price of the contract and guarantees the seller's expected payoff to be zero. [Note that the seller may obtain some ex post positive surplus due to her informational rent, as she holds private information about her production cost.]
Thus our equilibrium conditions for the expression (2.22) are derived as follows –

\[ f(p + D_L). [V(r) - (p + D_L)] = 0, \]  \hspace{1cm} (2.23)

and

\[ F(p + D_L). V(r) - 1 = 0. \]  \hspace{1cm} (2.24)

We derive the following Lemmata –

**Lemma 2.2:**

\[ p^* + D^*_L = V(r^*), \]  \hspace{1cm} (2.25)

\[ D^*_L = F[V(r^*)]. V(r^*) - F(V(r^*)). E[c|c \leq V(r^*)], \]

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

\[ EP^*_L = D^*_L - r^*, \]

\[ EP^*_L = 0. \]

**Proof:** \( p^* \) and \( D^*_L \) are directly derived from equation (2.23) since \( f(p + D_L) \neq 0 \). \( EP^*_L = 0 \) has been already established. Using \( EP^*_L = 0 \) and \( p^* + D^*_L = V(r^*) \) gives us the second condition. Therefore, buyer’s equilibrium payoff:

\[ EP^*_L = F(p^* + D^*_L)[V(r^*) - p^*] + [1 - F(p^* + D^*_L)]. D^*_L - r^* \]

\[ = D^*_L - r^* \]

**Lemma 2.3:** The buyer, uninformed contract proposer, under liquidated damage measure takes on the socially desired efficient level of investment, when there is one-sided private information held by the seller.

**Proof:** Using and previous lemma and equation (2.24), we derive the condition for the present lemma: \( F(p^* + D^*_L) V'(r^*) = 1 \).

\[ \blacksquare \]
2.4 Restoring Efficiency in the contracts:  

*Intuition:* This result has a fair economic intuition. When negotiating over $p$ and $D_L$, both the buyer and the seller take into account future choices of $r$ and the breach decision. Let us consider the choice of $p$ and $D_L$ at the starting of the contracting process. Suppose that the buyer and the seller negotiate over these two variables, but do so in a way that maximises the joint surplus of the contract and subject to the constraint that the buyer will later choose reliance investment according to equation (2.25), when the probability of breach by the seller, $p$ and $D_L$ are given. Since, by construction, $D_L$ maximises the joint surplus of the parties and takes the future choice of $r$ by the buyer into account, therefore when the buyer comes to choose $r$, he will not over-invest rather makes efficient investment.

**Observations and Remarks:**

a) Observe in first equation in Lemma 2.2, that $D_L^* = V(r^*) - p^*$ i.e., in equilibrium the buyer designs a liquidated measure that is equivalent to *perfect expectation* damages.

b) Note that $D_L^* = V(r^*) - p^*$ also ensures that the seller's breach decision is always ex post efficient, given the choice of efficient ex ante reliance investment choice $r^*$ by the buyer.

This is just an application of the Coase theorem. Specifying liquidated damages in a contract allows the parties to bargain over an extra dimension - namely, the transfers that will occur in the event that the seller's costs turn out to be too high. This is just like bargaining over a price schedule that is contingent on the seller's costs – the only difference
2.5 **Concluding Remarks:**

being that in some cases the “price” is negative, and wealth flows from the seller to the buyer. This was explicitly ruled out in the other damages remedies that we have studied.

This result also bears some normative consequences for the courts in the event of contractual disputes: the courts should enforce the party-designed liquidated damage clauses, unless there is substantive reason to believe that there is some externality or any third party effect present. Furthermore, in this case, the court just need to ascertain the fact that $D_L^i = V(r^*) - p^*$ i.e. equivalent to expectation damage and it is not punitive.

We summarise our previous results in the form of following claim –

**Claim 2.2:** *In a fixed price incomplete contract that has one-sided investment and single-dimensional ex post informational asymmetry, the liquidated damage remedy results in a socially efficient outcome both in performance and investment. Moreover, this maximises the expected social surplus.*

2.5 **Concluding Remarks:**

Amongst all the court imposed damages, expectation damage measure performs better compared to any other measures, however, it still fairs quite poorly on the ground in providing incentive to efficient investment. At this point it is worth noting that the tendency for excessive reliance caused by the receipt of expectation damage can be countered if the damage level is not allowed to increase automatically to reflect the actual value of performance. The parties can devise several sophisticated mechanisms to induce efficiency in the written contract that they agree at the onset; we consider one particular case. The main idea
behind this is to devise a sophisticated expectation measure in the sense that damages are ex ante set equal to the level reflecting optimal reliance.

One note of caution before implementing these kinds of sophisticated expectation measures is that the court should be made aware of more than the actual level of reliance and actual value of performance; it must know the functional relationship between reliance and the value of performance and the entire probability distribution of production costs – everything about the contractual situation – in order to calculate optimal reliance. The parties themselves, though, would often be presumed to have approximately enough information to determine optimal reliance (or much more than the court), and so could name the expectation measure given optimal reliance in a liquidated damage provision.