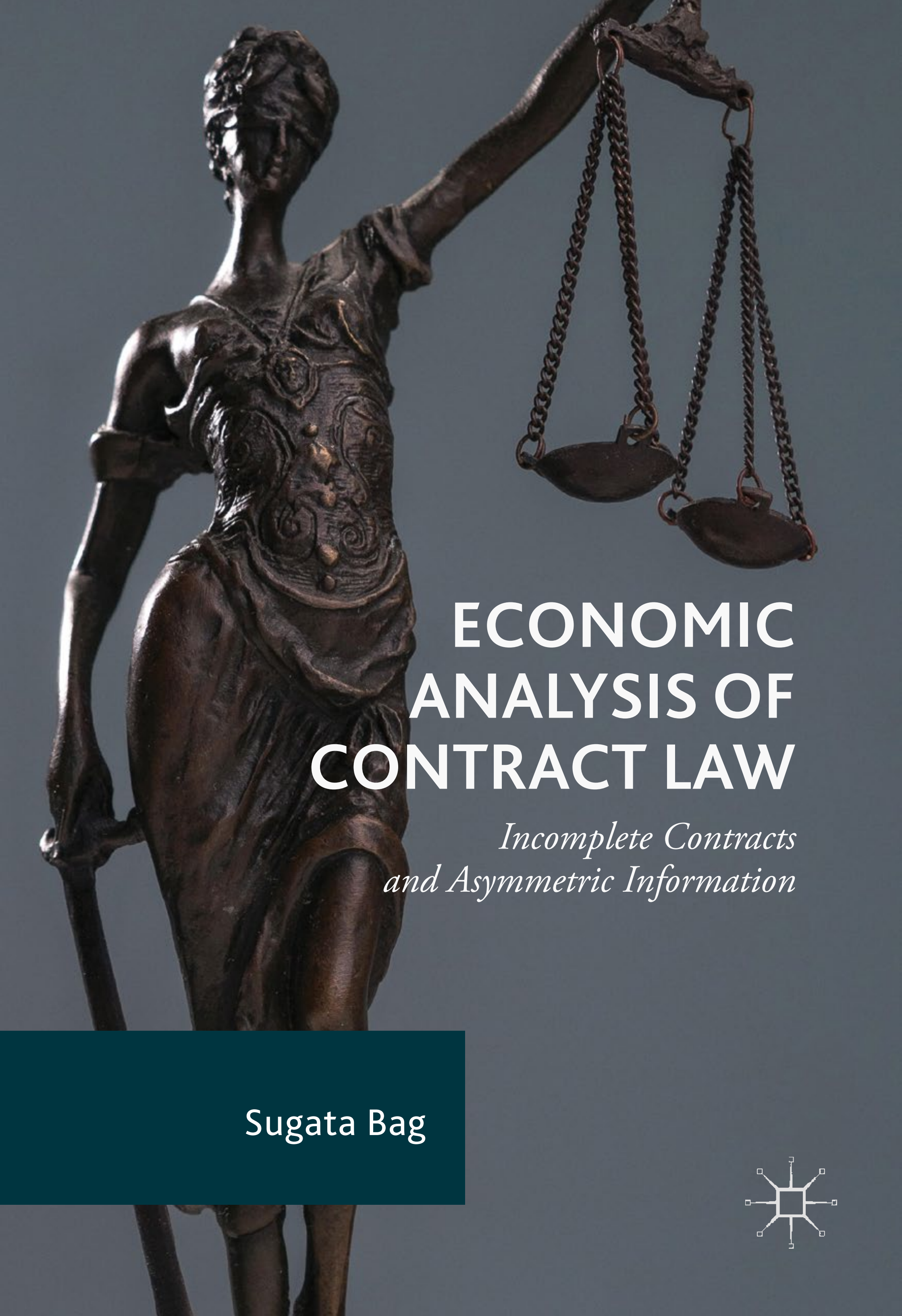

ECONOMIC ANALYSIS OF CONTRACT LAW

Incomplete Contracts and Asymmetric Information

Sugata Bag

Economic Analysis of Contract Law

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Incomplete Contracts and Asymmetric Information

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To
My Family

Preface

The economic analysis of Contract Law is a specialised branch of Law and Economics. It is essentially a synthesis of two distinct but well-established branches—Theories of Contract and Economics of Contract Law. Due to specialisation, these two fields have developed relatively independent from each other over the years, especially in that Contract Economics relies on a simplified notion of the role of law (both legislation and courts) and Law and Economics scholarship focuses on the role of courts and legal doctrine, sometimes at the expense of what parties do out of court. This book tries to make a meaningful contribution to both fields by reconnecting them.

Of late, most law schools and Economics departments offer courses in Law and Economics at both under-graduate and post-graduate level. Economic Analysis of Contract Law is taught as a small part of Law and Economics at a very rudimentary level. A stand-alone course on the Economics of Contract law is rare. The majority of the texts available for this purpose cover the entire gamut of Law and Economics. This book attempts to raise the level by bringing in the latest developments in the literature and specialised areas of contracts and Contract Law.

As a text on Economic Analysis of Contract Law, the book will appeal to scholars from both Economics and Law, particularly those who are interested in the economic foundation of law. However, there is a challenge to provide a unified analytical and pedagogical approach that can serve these two different sets of readers, who are well-versed in their own fields. This book tries to strike a balance.

The major thrust of this book lies in its dealing with the assessment of effect of damage remedies of contract law on incomplete contracting under an asymmetric information scenario. The main purpose of this book is two-fold: (1) to convey the ability of economic theory to provide a unifying framework for understanding law from an economic perspective, and (2) to draw the attention of economists, as well as of quantitative-minded lawyers, towards the latest developments in the field, by incorporating the issues of asymmetric information in incomplete contracts. The available texts on Law and Economics, which might have more of a legal orientation, are systematically omitting these aspects. The book does not attempt to cover an exhaustive set of legal topics; rather, it tries to tell a brief but coherent story about the law and how economic analysis can be used to shed more light on the efficacy of various legal rules from both the Civil and the Common Laws of contracts. This book does not, however, require the reader to have any particular familiarity with Contract Law, nor is its objective to teach Contract Law comprehensively. Rather, the objective is to apprise readers from both sides of how they can apply the tools of economic analysis to understand the basic structure and function of the law.

Organisation of the Book

This book consists of six chapters. The introductory chapter discusses the basic premise of contracts and laws, discusses the issues of contractual incompleteness and asymmetric information, and sets out the research agenda for the remaining part of the book. Chapter 2, using a multi-task model, presents an overview of the nature and the extent of the canonical hold-up problem under different modes of incomplete contracting when the trade is always economically justified. The different issues surrounding contracting for procurement under the symmetrical but non-verifiable information set-up are also touched upon. Chapter 3 attempts to set the basic framework for the analysis of the effects of the different legal rules and rank them when the parties write simple fixed-price contracts. It also searches for an optimal contract in a situation when only one party undertakes the non-observable reliance investment and the other party holds some ex post private information and contemplates contract-breach. In Chap. 4, the analysis from the previous chapter with a bilateral reliance and one-sided private information model is extended. The effects of the various court-imposed damage remedies are again assessed systematically. In Chap. 5, the analysis is taken further when either of the parties can breach irrespective of his holding private information against the backdrop of the expectation damage measure. Towards this end, extensive use is made of the mechanism design to show that assessing the correct ex post expectation damage by the court is not only flawed in the face of private information but also comes at a cost through a loss of efficiency. Chapter 6 deals with a situation when both the parties undertake reliance investments as well as holding ex post private information. This bi-dimensional information asymmetry poses great difficulties for the parties in writing a simple contract, and it creates problems for the courts in settling the expectation interest of the victim of contract-breach. Two methods of justifying the expectation interest by the courts, namely, the subjective method and objective method, are used. Finally, Chap. 7 presents the general conclusions and reflections of this study.

Instruction for Readers

Keeping the Economic Analysis of Contract Law simple and tractable for a reader who is not so mathematically oriented is a big challenge. It gets mathematically quite dense beyond a certain level; it is rather difficult to avoid the rigour from a modelling perspective. I have tried to adopt a graded approach in building the models in successive chapters so that the readers gradually get accustomed to the intricate mathematical terrain.

I would urge the reader to get themselves acquainted with the basics of optimisation procedure from any standard graduate-level mathematics text book, and economic concepts such as Consumer Theory and Game

Theory from any standard microeconomics textbook. For the sake of brevity, I had to drop the idea of having another chapter here.

Chapter 2 would be helpful for lawyers as it introduces the basics of Economic Theory of Contracts. This chapter would allow them to understand the approach of economists towards contracts and contract law. Chapters 3 and 4 introduce Economic Analysis of Contract Laws and its damage remedies in most pragmatic settings of one-sided asymmetric information. The first four chapters of the book are suitable for those who have opted for their first course on Economic Analysis of Contract Law at both undergraduate and graduate levels in Economics as well as Law. However, Chaps. 5 and 6 are directed to more advanced readers, who are familiar with advanced Game Theory and mechanism design.

Having said that, I would appeal to lawyers to go through the discussions and remarks in those chapters, which will reveal interesting and useful insights on how the trading environment coupled with laws shapes the behavioural and contracting aspects of the concerned parties.

Acknowledgements

This book traces its origin to my doctoral thesis at the Centre for Economic Studies and Planning of Jawaharlal Nehru University, India. The present version of this book is a fully revised, somewhat expanded, and hopefully improved version of my earlier works. The ideas for this book took shape over the years through the graduate-level course that I offered at Delhi School of Economics. It benefited a great deal from the classroom interactions and invaluable feedback from students of the course. I also thank two anonymous reviewers who read the manuscript. Their extensive comments have been very helpful, and many of their suggestions are incorporated into the current version.

I am extremely grateful to my doctoral supervisors Professor Satish K. Jain and Dr. Priyodorshi Banerjee for their unwavering support and encouragement in this endeavour. Their very helpful and detailed suggestions have significantly improved this version of the book. This book is

in a way my '*gurudakshina*' (token of respect) to them; they have made indelible impressions on my professional career.

I am grateful to my colleagues at Delhi School of Economics for providing a superb scholarly environment. I extend my sincere gratitude for their constant inspiration and encouragement.

Inputs received from the participants of ESNIE 2008, Singapore Economic Theory Workshop 2008, French-German Talk on Law & Economics 2009, JNU-CIGI-NIPFP Conference 2010, and ISNIE 2013 have helped me straighten out my line of argument in different chapters.

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While work should always be fun, it is never complete without a fulfilling private life. I am indebted to my parents and sister for their sacrifice, love, and wholehearted support during this endeavour. Suja, my wife, has been equally generous in supporting me over these years.

I am thankful to Taylor & Francis, UK, for allowing me to reproduce a part of my earlier work that was originally published with them.

Finally, Anna Reeve and Thomas Coughlan at Palgrave Macmillan have handled the publishing process with admirable circumspection and patience. I thank them for their invaluable support on this project.

Needless to say, I am solely responsible for any errors or imperfections that may remain in the book.

Delhi, India Sugata Bag
July, 2017

Contents

1

Introduction

> [T]he first principle of Economics is that every agent is actuated only by the self interest. The workings of this principle may be viewed under two aspects, according as the agent acts without, or with, the consent of others affected by his actions. In wide senses, the first species of action may be called war, the second, contract.
>
> – [Edgeworth (1881), p. 14]

Economic exchanges are the mainstay of modern day economies. While economic exchanges in general enhance values or welfare, not all of them take place in perfect markets but rather in imperfect ones or in situations in which markets are only of little relevance or value to the rest of the world apart from the concerned parties. Contracts have traditionally been reckoned as means by which individuals or firms (simply, the economic agents) may commit themselves (promise) to specified courses of conduct or economic exchange. However, promises are often broken, the contract is breached, which not only causes economic losses but also creates uncertainty that impedes efficient economic exchange. Contract

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law provides the legal means by which people enforce promises and promote and protect "cooperation" and exchange between individuals and firms. The economic theory of contract law examines the role of the legal system in achieving efficient exchanges. The analysis of law is of particular interest when the task is precisely to evaluate and design legal rules and institutions that promote and do not deter cooperative behaviour and enhance social welfare.

In this introductory chapter, I set out the basic scope, background, motivation, analytical framework and specific research objective. I begin by describing the elements of a valid contract, then consider the main issues arising in the economic analysis of contract law with special attention given to incomplete contracts. We will discuss both the main features of contract law as they relate to the problem of economic exchange, and how the relevant legal rules and institutions can be analysed from an economic perspective.

1.1 Basic Premise: Contracts and Contract Law

1.1.1 Economic Aspect of Contract – A Mechanism for Exchange

To an economist, a contract is an *agreement* through which the parties make reciprocal commitments in terms of their behaviour—a bilateral "coordination" arrangement. Characteristically, a contract is a specification of the actions that the parties are supposed to undertake at different times, generally as a function of the conditions that hold good during the stipulated period. Thus any contract basically covers two broad aspects—*actions* and *conditions*. The actions typically relate to the performance of services, delivery of goods and monetary payments; and the conditions include uncertain contingencies, past actions of the parties, specialised information and messages communicated by them. However, a contract is not an instrument by which the parties collectively may achieve such a commitment. Rather, they are individual commitments, and perhaps explicit and implicit enforcement guarantees.

1.1.2 Legal Perspective of a Contract – A Law Enforcing Mechanism

"A chain is only as strong as its weakest link; and the longer the chain, the more weak links." [L.J. Peter, 1986]. Similarly, both the parties' commitments are only as strong as their contracting partners' desire to hold them to their original promises. Without some forms of assertion that others will–when needed–uphold their commitments to a bargain, economic agents will reasonably be averse to rely on, to undertake investments, to give up other opportunities, or to take other actions necessary to realise the full value of exchange.

An agreement enforceable by law is a contract. Thus for the formation of a contract there must be (1) an arrangement and (2) the agreement should be enforceable by law.

> "Agreement" is defined as "every promise and every set of promises forming the consideration for each other".

And a "promise" is defined as an "accepted proposal".

> "A proposal, when accepted, becomes a promise."

Thus, concisely, a contract is an agreement; an agreement is a promise; and a promise is an accepted proposal. Every contract is an agreement, but every agreement is not a contract. An agreement becomes a contract when the following conditions are satisfied: (1) there has been some consideration of it, (2) the parties are competent to make the contract, (3) their consent is free, (4) their object is lawful.[1]

Accordingly, the law—"an obligation backed by state sanction"—that governs such agreements is critical to the functioning of free-market economies. This formulation not only touches the legal concept of a contract as a promise but also surpasses it through extending remedies for any violation, disputes or breach of contract. While the law of property determines the boundaries of our lawful possessions (i.e. the configuration of entitlements that form the basis of production and exchange), the law of torts defends individuals against the violation of those boundaries as well as against the violations of their physical persons by protecting those entitlements from involuntary encroachment and expropriation. Where a contract is a single connection between the parties, the law of contract is the portion of Civil or Common Laws that ratifies and enforces joint ventures beyond those boundaries through interpretation and enforcement of (written or verbally communicated) agreements between the parties and by resolving the disputes between them in general. It is contract law that sets the rules for exchanging individual claims to entitlements and determines the extent to which society is able to enjoy the gains from trade and thereby improve welfare for both the parties and for society.

The regime of contract law, which respects the dispositions that individuals make of their rights, carries to its natural conclusion on the liberal premise that individuals have rights. And, the economic theory of contract, which sees contractual obligations as essentially self-imposed, is a fair implication of liberal individualism. Accordingly, economists, interested in the welfare properties of specific institutions in particular, or the micro-foundations of exchange generally, have good reason to take account of the law of contracts.

> "A formal and legally enforceable contract imposing legal obligations on contracting parties to execute the actions corresponding to the desired equilibrium is one option, though it may not be workable in many settings of human interaction."

It is to be noted that courts (or laws more generally) are not to be seen as the only contract enforcement mechanism: there are other potential ways by which laws may impact on behaviour.

> "Creating common expectations on the resulting equilibrium might do the trick, with less expense, and less institutional apparatus, than formal contracting. … The Law, in an expressive function, can also serve to coordinate expectations around a focal point."[2]

Court enforcement is neither necessary nor sufficient for a market economy to function; however, there are clear advantageous alternatives to courts for enforcing promises.

1.1.3 Contractual Incompleteness: Economic and Legal Views

In recent years authors from both economics and law have recognised two basic segments in contracts, namely completely specified (or complete or comprehensive) contracts and incomplete contracts. Each discipline has focused on different aspects of the contracting problem.

Legal scholars consider a contract as complete if (1) parties can write a contract specifying the "Pareto-optimal" actions for each of the parties and each of the potential or imaginable contingencies that may arise, and (2) courts can costlessly enforce them. Conversely a contract remains incomplete if its obligations are not completely specified (Ayres & Gertner, 1992), for example a contract that fails to specify the price, quantity or time of delivery. From this perspective, even the "null contract" that states the parties have no obligations is a complete contract. Needless to say, the nature of the relationship, be it short or long term, and the use or not of reciprocity strategies, is of no importance: contract law is able to force cooperation through the use of the appropriate legal sanction.

Economists (for example, Hart & Moore, 1988), however, consider the contracts as incomplete, particularly when the relationship is long term, even if the parties fully specify the contracting parties' obligations and even if they are "insufficiently state contingent", that is, it fails to make the specified exchange contingent on all the payoff-relevant information available to the contracting parties. In other words, a contract that is not contingent on some unobservable variables is nevertheless complete if it is contingent on all variables that are verifiable by a court.

The legal definition operates to define an incomplete contract in those circumstances in which an issue of "*gap filling*" can arise and thus is well suited to the lawyer's purposes.[3] The economic definition, in contrast, includes the contracts that do not pose any opportunity for the gap filling and thus gives the parties an inducement to renegotiate or breach the original contractual terms to achieve the additional gains from trade. Hence, the economic analysis of incomplete contracts is virtually synonymous with the study of contract renegotiation and breach. However, from the lawyer's perspective, this is the key issue raised by incomplete contracting: what are the legal consequences that attach when disputes fall into the gaps of an incomplete contract?

- *Contractual Incompleteness and Informational Asymmetry*

The contracts, we observe in the real world, often fail to specify what happens in many important contingencies and are not always crafted to provide each party with the optimal incentives in such situations. They are said to have gaps (Macaulay, 1963).

Some contractual incompleteness can be explained easily enough.[4] Important aspects of the agreement are unobservable to one of the parties or both (i.e. information is asymmetric) or too costly to prove in court (information is "unverifiable").[5] These factors can then induce a "second-best" effect: the parties decide to omit from the contract certain of the observable variables for fear of unduly concentrating incentives on just what is included. From another perspective, it may be desirable to leave some factors out of the contract so that it can be used as a "potential threat" by a party who would otherwise be vulnerable to opportunism by the other party (Bernheim & Whinston, 1998).

Asymmetric information can also lead to incomplete contracts in a different way: Party A might fear that if he proposes an addition to the contract then Party B will deduce that he has private information and either be more reluctant to trade or somehow use that information against him at a later stage.

As Rasmusen (2006) put it,

> "we do have a number of explanations for why important variables are left out of contracts – unobservability, unverifiability, second-best incentives, fear of signalling undesirable characteristics, contract-writing costs, and the legal default rules. These explanations are far superior to the old phrases, "bounded rationality" and "transaction costs", in that they explain which contracts will be the most complete, but for that very reason they leave us with many contracts which ought to be complete but are not."

There is a need to set out a clear relation between asymmetrical information and contractual incompleteness. Although asymmetrical information is a necessary condition to pass from a non-contractual world to a comprehensive contractual world, it is not necessary to make sense of "incomplete" contracts. Put differently, while the parties to a contract may have symmetrical information, it is the asymmetry of information between the parties on the one hand, and outsiders (such as the courts) on the other hand, that are at the root of the problems. To use the jargon, the incompleteness arises "because the states of the world, quality, and actions are observable (to the contractual parties) but not verifiable (to the outsiders)" (Hart & Holmstrom, 1987).[6] The incomplete contractual world involves at least three agents: two contracting parties and a third party that represents an institution such as the courts, custom and reputation. The particular difficulties related to conveying the information to a third party is especially stressed in the theory of tacit knowledge (Hayek, 1974; Nelson & Winter, 1982; Polanyi, 1967). The other source of asymmetric information is more crucial to the contractual incompleteness when it exists between the two contracting parties themselves (when the valuations and/or effort levels of one party cannot be observed by the other party). Needless to say, if the courts cannot observe these variables, then the contracts obviously cannot include them.

- *Issues Concerning Contractual Incompleteness, Informational Asymmetry and Specific Investments*

The goods and assets traded in the "thin" markets (where there are few buyers and/or sellers) or those requiring "transaction-specific investment" have weaker market sanctions.[7] These trading environments may give rise to contractual difficulties particularly for the type of contracts that involves specialised assets, or those where at least one of the parties incurs significant transaction/relation specific investment or expenditure that enhance the value of performance (but must be undertaken before the performance is due).[8]

In the real world, the presence of various types of "transaction costs" (i.e. unforeseeable uncertainty and asymmetric information) can prevent the achievement of optimal outcomes.[9] The uncertainties of various types not only pose a challenge for the parties to design an optimal (complete) contract (that explicitly controls all of the possible permutations of the risk of "moral hazard"[10]), but also make it difficult for the parties to honour a binding contract. Market failure may occur due to the uncertainty, even though the transaction seems to be profitable. The uncertainty might make the profitability of the specific investments so insecure that the ex ante investments may not be undertaken (at all, or to the "desired" level). This is the famous "hold-up" problem.[11]

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

On the other hand, the associated informational asymmetry (i.e. a party's lack of knowledge about the other party, specifically about their valuations, characteristics and qualities, including their propensity to act opportunistically), not only aggravates the problem of *moral hazard* (i.e. *hidden action*[12]), but can also lead to difficulty in execution of the contract due to inefficient but *opportunistic behaviour*[13] (i.e. *adverse selection*[14]). Even though both parties may be aware of the investments being co-specific, they might not know the exact degree of relation-specificity of their own and each other's investments. This asymmetry or lack of information creates uncertainty about the bargaining power, the size of the quasi-rents, the division of the return and the ex post hold-up potentials. The establishing of commitments might not provide the required credibility if the parties do not have the satisfactory information about the others' alternatives and their values.

Asymmetric information also leads to the opportunistic exploitation of the "*valuable breach option*" by the informed party (rent-seeking through hidden information).[15] Thus asymmetric information creates an incentive problem. It can also hamper the court's choice of the appropriate remedies (when it cannot verify this private information ex post).

Both the adverse selection and the moral hazard are not mere phenomena but a result of the parties' economic decision making at the individual level. The ex post adverse selection hinders the parties from an efficient execution of the contract through a conflict in commitments, caused by rational decision making with imperfect information. The moral hazard, on the other hand, is the rational decision of a party to a contract towards an ex post readjustment of its position for its own advantage but to the detriment of the other party. Opportunism of this kind may present itself either in the form of coerced variations of the contract or the termination of the business relationship and the capture of an investment.

We are thus, in this book, precisely interested in checking how the existing contract laws respond to the problem of opportunistic rent seeking and the moral hazard that parties bring to procurement contracts.

1.2 The Tradition of Civil and Common Laws

Legal systems around the world are quite diverse, and even vary nationally from one state to another, but they usually follow either civil law or common law or a combination of the two. The civil law tradition was developed across Continental Europe at the same time and was applied in the colonies of the European imperial powers, such as Spain and Portugal. Common law systems have evolved primarily in England and its former colonies, including all but one US jurisdiction and all but one Canadian jurisdiction. For the most part, the English-speaking world operates under common law. Some countries like South Africa use a combination of civil and common law.[16]

These legal systems differ not only on the substance of their legislation, but also in their approaches to the formation, execution, breach and compensation of contracts. In common law, past legal precedents or judicial rulings are used to decide cases at hand; whereas, under civil law, codified statutes and ordinances rule the land.

The approach of common law to contracts is principally concerned with predicting the impact and potential binding legal consequences of a party's promises. Thereby, it is not so important what the contract is for (i.e. the type of good or services) or how it designed or structured, but whether the promise of performance that it is based upon is enforceable. However, this is not the case with civil law. This places utmost importance upon the classification of its legal principles—every concept must fit into one of the four distinct legal categories that define the principle's relationship to other legal precepts. The four most important classifications are the bilateral, unilateral, onerous and gratuitous contracts.

There are divergences between common law and civil law in their approach to contract formation. First, common law focuses on three basic principles: offer, acceptance and consideration; but, civil law additionally requires a demonstration that the agreement was the result of an exercise of the parties' free will. Second, civil law contracts, unlike common law ones, recognise classes of individuals incapable (lacking capacity) of entering into a valid contract. Third, civil law contracts also require the presence of a subject matter or purpose of the contract. Finally, as per civil law, the contract must have a legal cause, that is the determinative reason for the parties entering into the agreement must be legal.

Besides the above, there are differences in approaches of the two legal systems at the performance stage regarding the choice of damages or remedies. The common law and civil law systems take the opposite approach to specific performance and monetary damages.

1.2.1 A Unified Approach to Contract Laws

While there are clearly overlaps among legal systems—both have similar sources of law (e.g. both have statutes and case laws), there also exist vast differences in approach by the two traditions which seek to resolve issues in different ways, from different perspectives. Any misunderstanding of the basic contract principles of these systems or an assumption that contract methods and forms can just be exported from jurisdiction to jurisdiction can result in costly consequences. This could potentially lead to confusion and conflict in our analysis of contract law. Therefore, in this book, we need to take a functionalist perspective of contract law from the standpoint of economics and economic analysis to look behind the doctrinal language. This functionalist approach, adopted in this book, does not harm or distort the interpretation of the two legal systems, as I will attempt to deal with a specific and most pragmatic aspect of application of contract laws and their efficiency in different contractual environments. But the advantage of my analysis is that it will bring out certain positive insights that may allow for comparisons of the systems.

Let us now delineate the basics of contract law from both legal systems that are considered in this book. Damages and specific performance are two broad types of court-designed remedies for breach of contract.

- *Expectation damages*: the breacher has to pay the amount that makes the victim as well off as if the contract was performed.
- *Reliance damages*: the harm that is caused by the breach focuses on the costs the promisee has incurred as a result of relying on the contract. As such, perfect reliance damages are meant to leave the promisee indifferent between no contract and breach of the contract. The baseline is no contract. Damages then are equal to the net reliance costs of the promisee.
- *Opportunity cost damages*: the harm that is caused by the breach concentrates on the costs the promisee has incurred as a result of foregoing alternative contracts. As such, perfect opportunity cost damages are meant to leave the promisee indifferent between a breach of the contract and the performance of the next best contract. The baseline is the value to the promisee of the next best contract. Damages then are equal to the difference between the net value of performance of the next best contract and no contract.
- *Restitution damage*: this simply requires that, in the event of a breach, the promisor must give back anything the promisee gave the promisor in exchange for the promise.
- *Disgorgement damage*: these damages are intended to eliminate the injurer's profit from doing wrong. As such, if a promisor breaches a contract by doing something wrong and profits from the wrongdoing, perfect disgorgement damages would leave the promisor indifferent between performing the contract and breaching and paying damages equal to the gain from having breached.
- *Specific performance*: this remedy simply requires the promisor to perform the contract. In the event that the court orders a specific performance, the parties to the contract can subsequently negotiate an alternative settlement, for example breach with damages paid to the promisee. An advantage it has over damages is that the court does not have to estimate the value of the performance to the promisee. Specific performance is especially attractive in cases involving special/unique goods and services.
- *Party-designed remedies/Liquidated damages*: the initial contract contains explicit terms specifying the remedy in the event of a breach.

1.3 Economic Analysis of (Contract) Law

It is often asked by the lawmakers: How will a sanction affect behaviour? Lawyers traditionally have answered by consulting intuition and any available facts; but economists look to provide a scientific theory to predict the effects of legal sanctions on behaviour. Economists and their approach to law assume that the "legal sanctions" are seen as "implicit prices" by the economic agents who are "rational individuals". And these individuals respond to these sanctions much as they respond to prices. So, the amount of legal sanctions also matters in shaping the behaviour; therefore these prices can be set to guide individual behaviour in a "socially desirable direction".

Economic analysis of law, in principle, is concerned with two basic objectives: (a) determination of the effects of the legal rules (i.e. a predictive approach), and (b) evaluation of the desirability of the effects of legal rules with respect to well-specified definitions of social welfare (i.e. an efficiency oriented approach). The orientation of the economic analysis of contract law deals with the enforcement of contractual agreements through "damage payments" by the party which commits the breach to the victims of the harm.

The economic approach can further be counterpointed with the traditional analysis of law. Under the latter, damage payments for breaches tend not to be regarded as incentives toward performance or as an implicit escape hatch; moreover, the effects of different legal rules are generally not consistently assessed. Damage payments are seen primarily as "compensation for harm" or as the proper "penalty" for "breaking a promise". However, under the economic view, the "breach of contract" should not necessarily be identified with "breaking a promise". Further, under economic analysis, the contracts that are written are not interpreted as detailed promises that parties truly want to keep, but rather as "incomplete promises" that are only rough guides for parties' behaviour, and that the parties do not want to govern when performance would be very difficult. There are two important aspects of this view. One effect of the requirement to pay damages is that it induces contractual performance, which tends to raise the value of contracts to the parties and to the society. A less obvious advantage of damage payments is that they constitute an "escape hatch" that parties can use when contractual performance becomes difficult, for they can breach and pay damages rather than bear the very high costs to perform. These points and others (notably, concerning risk allocation and incentives to invest) about the virtues of payment of damages for a breach have been analysed extensively in the economic literature on contracts.

1.3.1 Normative and Positive Analyses

The traditional legal theorists view the law as being mainly concerned with goals of fairness and justice. However, economic analysis of the law often takes two varieties: positive and normative analyses. The positive variant aims to provide an economic explanation of the law and to provide an effect-analysis of legal sanctions, that is it explains the consequences of legal sanctions on agents' behaviour. Positive analysis relies on the assumption that people respond to legal sanctions rationally. For example, positive analysis may ask questions like: How will changes in tort rules affect the accident rate? Does the expectation damage remedy induce an efficient breach? Positive analysis can even go further to assert that legal rules incline towards reflecting economic reasoning; to put it differently, efficiency is a social goal that is reflected in the law.

In contrast to positive analysis, the normative variant investigates which type of legal sanctions is the most efficient or optimal, that is it suggests how the legal system can be made more efficient. The latter variant is called normative because there is usually an implicit assumption that an efficient legal system would also be desirable.

However, either type of analysis hinges on the assumption that "efficiency" is an object that the law should reflect, and that legal rules should be modified when they fail to achieve it. In some cases this is uncontroversial, as with proposals aimed at improving the efficiency of the litigation process, though the general assertion that efficiency is a social value that the law should promote is not so universally accepted.

The analysis in this book will concentrate on general explanatory and predictive economic theories of law and thus will combine both positive and normative analyses. However, I shall primarily focus on positive analysis as that has been the thrust of most recent scholarship in the field. Moreover, in situations where the law seems to fall short of efficiency, I shall envisage to propose better alternatives.

- *Economic Theory of Contract and Law of Contract*

The theory of contract rationalises the fundamental link between contract design, on the one hand, and contract enforcement, on the other; the choice of contract terms will depend in part on the legal rules and enforcement policies that parties expect courts to follow while the enforcement practices of efficiency-minded courts will depend on what courts perceive as the purpose and impediments to contracting. In short, the analysis of contract law and its enforcement presupposes a theory of contracting behaviour, and vice versa. In spite of this interdependence, the literature on contract design and contract enforcement has been largely developed independent of each of these. Economic theories of contracting give little explicit attention to enforcement issues, the presumption being that courts will see to it (and subject themselves only to verifiability constraints) that whatever terms contracting parties arrive at are automatically satisfied. Indeed, in mainstream contract theory the court's only function is to enforce contracts as written therein (Tirole, 1999). This judicial deference to contracts in economic theory contrasts with the far more intrusive role of courts in economic analyses of contract law, in which courts are called on to adjudicate *disputes*, *fill gaps* and devise and implement *default rules*.

1.4 Analytical Framework: Welfare, Efficiency and the Principal-Agent Paradigm

The rules of contract law are powerful instruments to create incentives for cooperative behaviour in economic exchange. However, when different rules of contract law are capable of reducing the likelihood of breaching a contract, by making non-cooperative behaviour more costly and/or the gains from opportunistic behaviour less important, a vital question can be asked: Does every rule have the same potential or do they have differential impacts? This brings in the efficiency consideration to weigh between the impacts of different rules.

The economic analysis of law is based on the concepts of efficiency and the distribution of income. "While almost all economists favour changes that increase efficiency, some economists take sides in disputes about distribution" (Cooter & Ulen, 2012). In this book we follow the majority and remain concerned with efficiency only, rather than focusing on distributive aspects, as our analysis won't involve any third party.

From an economic perspective, the rules of contract law should be crafted or treated so as to create the incentives for the behaviour of contracting partners that would maximise the "welfare" of the parties affected by the contract—in more precise economic jargon, to maximise the "joint surplus" from a contractual relationship. However, welfarism in this regard varies in degrees. Some may advocate a strict version of welfarism, a Pareto welfare concept, which condemns, in social decision making, any consideration that is not embodied in the well-being or welfare of individuals. Others adopt a milder or weaker version of welfarism, a Kaldor–Hicks approach, which does not rule out other social values of the well-being of an identifiable individual. Although the differences between strict and mild welfarism are significant from a theoretical viewpoint, in the economic analysis of law we often deal with the Kaldor–Hicks version of welfare.

The theory of contracts and the "principal-agent paradigm" together play a central role in our economic analysis of the contract laws. The parties to a bilateral contract often face a thin market; neither party competes with an outside "market" to set a price. Furthermore, each party usually possesses some private information about the state of the world. This combination of a thin market and the private information gives rise to a strategic behaviour and imposes a substantial cost on the bargaining process (which is an integral part of contract formation). Because the outcomes of the bargaining games are often non-unique and process dependent, and because one can never be sure which bargaining game the parties would adopt, the robust predictions about the bargaining outcomes frequently prove elusive. This justifies the adoption of the principal-agent paradigm in our analysis as it recognises the conflicts of interest between the different economic actors, formalising these conflicts through the inclusion of the observability constraints and the asymmetries of information.

The analytical core of contract theory in general, and the agency theory in particular, is a (welfare) optimisation problem, but in imperfect competition it is an equilibrium problem. Most of the contracting analyses consider a partial equilibrium by isolating the market for one good from the rest of the economy. Thus most contract theories are based on the assumption that the parties at some initial date (say, zero) design a Pareto-optimal long-term contract. The optimality is not to be understood in a first-best sense, but rather in a constrained or second-best sense (the constraints imposed by the prevailing institutional setting through laws). It also simplifies the bargaining difficulties under asymmetric information by allocating all the bargaining power to one party and thereby facilitating the realisation of the (constrained) Pareto-optimal by maximising the utility of one party while fixing the other's utility to a given level.

In order to overcome this analytical dilemma, we take resort in a particular methodological approach from game theory called "mechanism design". This approach enables us to analyse the outcomes of the bargaining processes (and the other allocation schemes) even when the precise bargaining procedures used by the parties are unclear. Although the mechanism design techniques have obvious relevance to the study of legal institutions, and have had a revolutionary effect on the microeconomics, this methodological approach is still somewhat unfamiliar to the legal community. Of late it has been introduced into the literature of law and economics. Applying this technique to the bargaining problems, we can characterise the costs associated with strategic behaviour for all the possible negotiation procedures that the parties might employ.

There is an incentive problem underlying each agency model, which is caused by some form of asymmetric information. It is common to distinguish the models based on the particular type of informational asymmetry involved. All the models in which the agent has the pre-contractual information are dubbed an "adverse selection". However, certain models assume that agents have symmetrical information at the time of contracting.

Within the models under this category, which we refer to as moral hazard, a further distinction is useful: the case where the agent undertakes unobservable actions, and the case where his or her actions (but not the contingencies under which they were taken) may be observed (Hart & Holmstrom, 1987). Arrow (1985) has suggested the informative names "hidden action model" and "hidden information model" for these two subcategories. Finally, when the information is symmetric between the parties at the time of contracting and they undertake unobservable actions we have a moral hazard, but when it becomes asymmetric later at the performance stage, we have hidden information. Rasmusen (2006) calls this "moral hazard with post-contractual adverse selection". Throughout our model analyses we will be using this last category of the agency models.

What makes the post-contractual hidden knowledge an ideal setting for the paradigm of mechanism design is that the problem is to set up a contract that (a) induces the agent to make a truthful report to the principal, and (b) is acceptable to both the principal and the agent. There is more hope for obtaining an efficient outcome than in adverse selection. The advantage here is that the information is symmetric at the time of contracting, so neither player can use the private information to extract surplus from the other by choosing inefficient contractual terms.

1.5 Specific Research Objectives

The long discussion in the preceding section paves the way to designing the analytical questions that we are going to deal with. Accordingly we will examine the role of contract and the efficacy of various contract laws when a buyer and a seller enter into a contractual relationship for the procurement of a specialised good in the following situations: (1) either the buyer or the seller or both undertake a selfish reliance investment that is specific to the relationship between them; (2) either the cost of production or the value of the good to the buyer (or the value and cost) are uncertain at the time of contracting and are ex post private information to the respective concerned party.

The research topics of this book are premised on the hypothesis that the party-designed liquidated damage remedy performs better (in protecting the ex ante reliance investments and attaining the ex post allocative efficiency) than the court-imposed damage remedies (the expectation damage to be precise) when one or both the parties hold ex post private information (thereby efficient post-breach bargaining is not possible) and the court cannot verify the relevant variables.

The specific research objectives of this book are as follows:

1. Evaluate the welfare impacts (especially the issue of hold-ups) of the different modes of incomplete contracts when the relevant variables are observable by the parties but not verifiable in the court.
   (a) Which type of contract would the parties tend to put down in writing in the case where the parties do not use the sophisticated revelation mechanisms?
2. Analyse the effects and the desirability of the different breach remedies, and provide a plausible rationale in economic theory for every outcome.
   (a) How do the outcomes differ with the dimensions (one-sided and two-way) of informational asymmetry between the parties?
3. Theoretically examine the optimal incentive structure of the party-designed liquidated damages under the different dimensions of informational asymmetry:
   (a) When the parties' objective is to maximise social welfare.
   (b) When the parties want to induce efficient reliance investments.
4. Contribute to the legal debate over the adoption of specific breach remedies when the breach victim's expectation interest is difficult to assess.
   (a) Should the court ignore the ex post informational circumstances and simply enforce the parties' contracts as written?
   (b) Or else, should the court craft a remedy that considers these circumstances?
5. Contribute to the debate over the court's reluctance to implement a large penalty designed by the parties in the event of a breach, despite

the court itself possibly threatening the promisor with a large penalty in order to induce the promisor either to perform or to make a supra-compensatory payment to the promisee.

(a) Why can the courts do what the parties cannot? How far is it justified?

Notes

1. As stated in common law. See, (Singh, 2004), Law of Contract & Specific Relief. pp. 2–3.
2. See, Granuza and Pomar, "The Strategic Structure of Contract Law". p. 4.
3. See, Sect. 2.1.2 in the next chapter for more detailed discussion on the "gaps" in incomplete contracts.
4. There are several types of reasons for the incompleteness of contracts, that is, for why parties find it in their mutual interest to leave contracts incomplete. One category of reasons concerns the effort and cost of anticipating possible contingencies, bargaining about their resolution (given that they are anticipated), and then describing them adequately in contracts. In particular, parties will tend not to specify terms for low probability events, because the expected loss from this type of exclusion will be minimal, whereas the cost of including the terms would be borne with certainty.

   A second reason for incompleteness involves the subsequent cost of enforcing a contractual term. Notably, if the cost of providing evidence to the courts that a relevant contingency or condition has occurred is sufficiently large, then the term will not be worthwhile including.

   A third important reason for incompleteness is that some contingencies or some variables cannot be verified by courts. When a particular contingency or the value of a variable cannot be verified—i.e. if there is an asymmetry of information between the parties and the courts—then the parties may not be able to include the contingency or variable in the contract. One of the parties would generally find it in his or her interest to make a claim about the contingency or the variable causing problems.

   A fourth factor is that the expected consequences of incompleteness may not be very harmful to contracting parties. To amplify, a court might interpret an incomplete contract in a desirable manner. In addition, the prospect of having to pay damages for breach of contract may serve as an implicit substitute for more detailed terms because it may lead parties to act as they would have under more detailed terms. Furthermore, the opportunity to renegotiate a contract often furnishes a way for parties to alter terms in the light of circumstances for which contractual provisions have not been made, which will lead them to do what they would have provided for had they written a more detailed contract in the first place.

5. If the information is symmetric but unverifiable—observed by both the parties to a contract but unobservable to the court—then it may still be useful to design an agreement around that information, as the mechanism design literature tells us. This possibility brings into question unverifiability as an explanation for contract incompleteness, a controversy that is discussed in Tirole (1999).
6. In these models, whenever dispute arises in the post contractual execution scenario, the parties tend to renegotiate the existing contract terms either before arriving at court or in front of a court-appointed arbitrator once the suit is filed. In that case, the renegotiation process (if at all it is possible to design), agreed to by the parties, along with the breach remedies enforced by the courts, become critical determinants of contractual performance, and thereby effectively "complete" the contract.
7. Investments are specific in the sense that they have zero value outside the contractual relationship. In legal literature this is called "reliance". We shall be using both terms interchangeably throughout.
8. Following the work of Che and Hausch (1999), specific investments can be segregated in two ways—"selfish" and "cooperative". For example, a seller's selfish investment would reduce her own costs, whereas a buyer's selfish investment would increase his value for the contractual performance. On the other hand, a cooperative investment by the seller occurs when the seller takes an action that may increase the buyer's valuation, and vice versa.
9. Williamson (1975) distinguishes several types of transaction cost. First, future contingencies must be considered that may require long and costly studies. Second, contingencies must be unequivocally specified in the contract. Third, the agreement must be monitored and enforced by a court.
10. Moral hazard refers to the situation or presence of an endogenous variable (such as effort/investment by one party) that is not observed either by the other party or a court.
11. "Hold-up arises when part of the return on an agent's relationship-specific investments is ex-post expropriable by his trading partner. The hold-up problem has played an important role as a foundation of modern contract theory, … as the associated inefficiencies have justified many contractual practices. One interpretation of the inefficiency is the failure of the

Coase Theorem. Parties cannot achieve the efficient outcome since non-contractibility of the buyer's or the seller's investment-decisions prevents them from negotiating over that decision ex-ante." (Che & Sákovics, 2004).

Also see, Klein, Crawford, and Alchian (1978).

12. The case of moral hazard poses challenges to contracts in many ways. Firstly, moral hazard is an ex post phenomenon—thus it occurs after a contract has already made. Secondly, it derives from hidden action and is thus not foreseeable to the other party in the contract. Thirdly, hidden action in the case of moral hazard is mostly intentional so that the party undertaking it would surely not disclose this information to the other party on any occasion.
13. Opportunistic behaviours (or breach in this case) are essentially the "bad-faith" renegotiations of the contractual terms motivated by significant contract-specific investment or expenditure by one party induced by (in reliance on) a contractual promise.
14. Adverse selection arises when one (or both) of the parties hold more information than the other party (including a court) about some exogenous variables. The ability to control the flow of information to the other party and a court is a crucial element in affecting decisions.
15. Valuable breach options are the characteristics of executory contracts. The parties intend to breach a contract when production costs rise above the contract price or a better offer is received or valuation falls below the contract price or because a substitute has been found at a lower price. This makes honouring the contract either a less profitable or a totally loss making affair. The value of a breach option, particularly under asymmetric participation, varies significantly with the riskiness of the underlying asset and the dimension of private information. A breach option is significant as it not only governs the post-contractual breach decision of the promisor but also affects the ex ante reliance behaviour of both the parties.
16. For a quick review of the two system readers can refer to http://www.diffen.com/difference/Civil_Law_vs_Common_Law.

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2

Basics of Economic Theory of Contract

2.1 Introduction

The organisation of market and the institutions in many ways govern economic relationships and contracts. And any discussion of contract law, without the understanding of the basic mechanism of contracts would be futile. Therefore, in this chapter, we revisit the basics of economic theory of contracts to focus on models that take into account the full complexity of strategic interactions related to trade between two privately informed agents in well defined institutional settings.

We encompass various aspects of contracting through the simple design of a multi-task model of contracts. The model will allow us to sum up the constraints imposed by the prevailing institutional setting through a contract. The present model will set the basic analytical framework for the rest of the book. The lessons drawn from the analysis here will be integrated into the economic analysis of contract laws carried out in later chapters.

In the course of this chapter we shall explore: the need for contracts under various market modes; how market institutions and incomplete information play a role; what kinds of contract parties enter into under

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different market and informational set-ups; how these contracts help parties to reap the gains from trade; and what kinds of incentive are being provided under different contracting scenarios.

The analysis in this chapter will highlight the canonical hold-up problem, which is a central issue in a bilateral trading set-up. The main focus throughout the analysis will based on situations where the asymmetries of information develop subsequent to initiating a formal trading relation (through non-verifiability). We shall also analyse the agency problems with renegotiation, asking when it is possible to give an agent the efficient incentive to work on an asset or project that a principal will directly use or sell in the up-market. The courts can only verify (1) payments between the parties, (2) the possession (ownership) of the asset or project, and (3) the contractually binding statements such as offer, acceptance or the exercise of an option. Throughout this chapter, our maintained assumption is that *trade is always feasible and profitable despite uncertainty*. So the role of contract laws can be limited to the settlement of disputes or repudiation and enforcement of trading as intended in the contract. In the next chapter, we shall relax this assumption and allow for situations where trading becomes inefficient (or loosely speaking, infeasible) in the sense that the value of a transaction falls short of the cost of providing it. This results in the breaching of a contract by one of the parties, and the aggrieved party suing the breacher in court for a suitable damage payment.

Analysis in this chapter will proceed on two different lines so as to attempt to explain, first, why the relationships take the form that they do, and, second, what kind of impact (or incentive) the relationships' structure has within and beyond them. Following the incomplete contracts literature, we will introduce a "principal-agent" framework and assume that the principal observes the agent's action, but cannot prove it in court. We will find that inefficiency will often persist, contrary to the conclusions of the earlier works by Demski and Sappington (1991), Bernheim and Whinston (1998) and Nöldeke and Schmidt (1998). In particular, if renegotiation involves surplus sharing, as it often does, then inefficiency may be inescapable.

2.1.1 Why a Contract?

Providing incentives that motivate the economic agents when making choices is a fundamental problem of economics. In the basic competitive market model, as well as in others, private property rights and prices are two main instruments for providing incentive. In a neoclassical exchange economy of the sort analysed by Walras (1874) or Arrow–Debreu (Arrow & Debreu, 1954; Debreu, 1959), economic agents come to the market for exchanging their goods and services with others; buyers and sellers can exploit all the gains from trade through spot transactions and thus receive adequate incentives. Indeed, in spot markets, such as public markets, the parties manage reasonably well without any formal contracting. There is limited need for the contracts (or the contract law) in that situation.

The First Welfare Theorem establishes a competitive equilibrium with complete markets to be Pareto-optimal. This paradigm however ignores the hazards of real-world trading (contracting), and as a result misses a lot of the institutional details by treating the firm as a black box. In any real economy, the markets are often not perfect (not complete) and there exists imperfect information between the agents. Economic agents expose themselves to various kinds of trading hazards especially in situations when a party needs to"delegate"[1] a task to another party(ies) and thereby invoke a "commitment" to execute the task by providing the right incentive. This delegation becomes even more challenging when the informational asymmetry prevails either between the parties themselves or between the parties and the court or both. The "incentive problem" arises when the individuals/firms are not rewarded for what they do, or when both parties have different objectives in mind regarding the means of execution, or when they do not have to bear the full costs or consequences for what they do. The commitment becomes valuable in a variety of situations when: the parties' actions need to be coordinated; a temporal element is present in the exchange (e.g. insurance); a specific or customised commodity is to be traded; unobservable volatility of the cost and the valuation is possible. In all these circumstances, the incentive problems are pervasive, thus contracting may be important for achieving those commitments.

We now delineate the above issues further, before analysing, by using a simple model, the need for contracting when there is a departure from the complete competitive market framework.

- *Trade with small numbers of agents*—Williamson in his "Fundamental Transformation" (1985)—categorically demarcates this issue. Even when we start with a large number of (competitive) agents, guided by some special requirement or business opportunity when two (or more) agents engage in a relationship and undertake *relationship-specific investments*,[2] they enter into some sort of small-number bargaining situation, often called a "thin" market. The simplest example is given by bilateral monopoly bargaining. The goods and assets traded in thin markets or those especially requiring transaction-specific investment, have weaker market sanctions. These may give rise to trading difficulties.[3]

  Does the non-competitive contracting amongst a small number of agents necessarily give rise to inefficiency in trading? As argued by Coase, the answer is negative. The Coase Theorem states that in the absence of transaction costs, the outcome of private bargaining is Pareto-efficient. The idea is that the parties will always implement mutually beneficial exchanges. (The Coase Theorem can be thought of as an analogue of the First Welfare Theorem for a small-numbers situation.) This theorem can be viewed as a definition of transaction costs. The numerous sources of transaction costs have been suggested, but they can all be classified into two broad categories: incentives and bounded rationality. Contract theory studies contracting under those transaction costs.
- *Incentives*—Consider a state-contingent Arrow–Debreu delivery contract that obliges a seller to deliver a high-quality good in those states in which his or her cost is low. The contract may not be implementable when there exists asymmetric information. Informational asymmetry in a bilateral trading relationship arises either because of some factors/variables (e.g. the state of the world, the investments or the quality of the delivered good) which are relevant to a contract (in terms of formulation and enforcement) remain non-observable (non-describable)

and/or non-verifiable. Informational asymmetry between the parties can arise either (a) at the time of writing a binding contract (i.e. ex ante), or (b) subsequent to it (i.e. ex post). However, "non-verifiability" occurs when the parties to a contract share the same set of information (i.e. information is symmetric between the parties), but no third party (such as a court) can observe this information. In this light, "ex post private information" exists when only one party knows a particular piece of relevant information which is not observed by others (including the court).

In all the cases mentioned above, some factors remain non-contractible and hinder efficient trading. First, if the cost is only observed by the seller, she may have an incentive to misrepresent the state, that is to claim that the cost is high and not to deliver even when the actual cost is low. When the quality of the delivered good is only observed by the seller, she may have an incentive to deliver a low quality good instead of a high quality one. Thus, asymmetric information can create incentive problems of two kinds:

- *(i) Hidden action (Moral Hazard):* Agents may not deliver on their promises (effort/action) due to imperfect monitoring. One of the contracting parties may change its behaviour (ex post) to the detriment of the other, once the contract is signed. In the context of the principal-agent model, moral hazard arises because the incentives to the principal and the agent may not be perfectly aligned.
- *(ii) Hidden information (adverse selection):* One party may already have the information which is not available to the other, or the information accrues to her subsequent to contract formation. In either case she may not reveal the state truthfully. Or it could simply be a failure of the parties to communicate meaningfully all the relevant information. A contract in these circumstances tries to elicit the agents' information.

All these factors hinder the optimal ex ante contractual designing and the eventual attainment of the ex post allocative and the ex ante investment efficiencies, thereby resulting in a *hold-up* and other problems.

Thus the contracting becomes worthwhile when: there is a temporal element to economic exchange; trading involves certain kinds of goods which are not readily available in the market; or when there are some elements of hidden action and/or information. Transacting in such situations requires rigorous effort by the trading parties in terms of searching for a partner then fixing the different aspects of trading, that is bargaining on the quantity, quality and price of the special commodity concerned, and so on. To cope, the parties may try to form a bilateral relationship through some contract.

2.1.2 What Type of Contract? Bounded Rationality and Contractual Incompleteness

As pointed out earlier, one property of the Arrow–Debreu economy with complete markets is that all exchanges can take place at date zero, and from then on existing contracts are executed, though the markets need not reopen. The same is true in the contracting situations, even in the presence of asymmetric information. However, this conclusion is unrealistic since writing the contracts or their fulfillment has risks. While some risks are allocated explicitly, the others are not even mentioned. If a contract remains silent about a risk, the contract is said to have a "gap". In the case where a contract is complete, that is without any gap, then disputes won't arise in a court (and the laws of contract would not be necessary). However, conceiving a '*complete contract*'[4] would imply tremendous transaction costs for the parties and sometimes may not be even feasible. There might be gaps in a contract, as the parties may be unable to foresee all possible risks (states/contingencies) far ahead and write them in. Those gaps are called the *inadvertent gaps*. If the possibility of a risk is rather remote, then a gap not covering this risk is called the *deliberate gap*.

In either case the contract is called "incomplete". Thus, similar to the "incomplete markets" models, we could have *incomplete contracts*[5] models, in which not all contingents can be written. Such incomplete contracts should ideally be explained as the optimal when the parties are *boundedly rational*, for example they cannot foresee all future states of the world, or cannot write complex contracts.

2.1.3 Different Market Modes and Associated Incentives: No Contract, Spot Contract, Simple Incomplete Contract, Complex Contract

When a principal delegates a particular task to an agent, the latter may gain access to certain kinds of information not available to the former. The opportunity cost of this task, the kind of technology to be used and the quality of matching between the agent's intrinsic ability and the technology are all examples of situations when the information may become private to an agent. This asymmetric information (or the information gap between parties) has fundamental implications for the nature of the contractual arrangements between them. In order to attain an efficient use of economic resources, a contract must elicit the agent's private information. This can be done by accommodating some information-rent to the privately informed agent. Obviously there are many modes of (incomplete) contracts available to this end, and each of them ends up assigning different levels of information-rent to the agent. We will explore these shortly. Worth noting is that the information-rent is costly to the principal and that he has to trade off his desire to reach an allocative efficiency against the costly information-rent required for inducing information revelation.

In many commercial and employment contracts, the parties may become locked in to a business relation due to the need to commit irreversible investments, that is an expenditure during performance that cannot easily be used for alternative purposes, if the business relation is terminated.[6] Oliver Williamson (1985), in particular, has stressed the importance of situations where a small number of parties make investments which are to some extent relationship specific, that is, the investments that enhance the value of trade but that are of substantially less value outside the relationship. The effect of such irreversible investments is to bind the parties together in a type of bilateral monopoly, as both parties would be worse off if they terminated the relation and made an equivalent contract with another party, although there may be plenty of competition ex ante before the investments are sunk in. Since the parties cannot rely on the market once their relationship is specific, the alternative way to organise the trade is through a long-term contract, called a "relational contract". However, writing a long-term contract is not so trivial, since it bears many costs known as transaction costs. In the long-term contracts, neither party can withdraw without paying compensation to others for his or her wasted expenditure. Having become locked into this relation, both economically and legally, the parties create an opportunity for rent-seeking; moreover, a relationship specific investment generates a particular problem that Williamson (1975, 1985) dubbed a "hold-up".

Since the late 1980s (Grossman & Hart, 1986; Hart & Moore, 1999), there has been a considerable growth in the literature known as the *Incomplete Contract Theory* (ICT, hereafter). This literature sets about formalising and extending some of the insights from *Transaction Cost Theory* (TCT, hereafter) (see, Klein, Crawford, & Alchian, 1978; Williamson, 1975, 1985). These include the ideas that the parties fear opportunistic behaviour in the presence of specific investments, that is that insufficient contractual safeguards can result in an inefficient level of such investment, and that the avoidance of such inefficiencies offers a key element in the theory of boundaries of the firm.

The theory might then ask, for example: How efficient are the simple contracts that specify, at most, only one price, one product specification and one quantity? An efficient (optimal) contract is the one that gives the optimal incentives to both invest and trade. This characterisation of the approach suggests a fairly ad hoc limit on the ability of rational agents to write a contract. However, in practice, much of the literature has avoided this potential criticism by adopting one of the two directions that pose the need to specify an arbitrary restriction on the contents of the contracts.

The first direction asks: What is the minimum that must be written into a contract and what efficiency is achieved in a particular, well-specified game (defined according to the types of investment, nature of uncertainty, ex post bargaining procedures, etc.)? If the answer is that a very simple contract can achieve the first-best, then an efficient contract has been identified. There may be many other equally efficient contracts, but the one identified typically has the added virtue of simplicity. Since it is efficient, it might be thought to be a misnomer to call such a contract "incomplete".

The alternative direction asks: Why can no-contract achieve the first-best efficiency in a particular situation? In essence, there is little to distinguish this approach formally from the more traditional complete Contract Agency Theory, except that ICT puts great stress on the constraints that renegotiation places on what can and cannot be written into a contract.

We would try to find a convincing answer to the questions of what type of contract should be written, and how the incentive problem changes its course in various modes of the market mechanism. Apart from the standardised perfectly competitive market mechanism, the benchmark bilateral relationship that we shall consider here involves two parties who operate in a market economy with a well-functioning legal system. Under such a system, any contract that parties agree to put in writing will be perfectly enforced by a court, unless the agreements contravene some existing law. Judges (or courts) are perfectly rational and their concern is to stick as closely as possible to the parties' agreed terms. Penalties for breaching are sufficiently high that we can restrict our analysis to the economic (incentive) aspects of *some contract* and *no-contract*, and ignore most of the problems of breach that legal scholars are concerned with. This issue will be discussed in succeeding chapters.

We are thus primarily interested in determining the choice between no-contract and some contract for the parties in a situation when trading is always economically justified (i.e. efficient in standard welfare measures). We shall also investigate what contractual clauses rational agents are willing to sign and what type of interactions they are ready to undertake.

2.2 The Multi-Task Model: Modes of Contracting, Incomplete Information, Incentives, Hold-Up

Let us consider a simple "procurement model" with two risk-neutral parties.[7] A buyer (B) requires q units of a certain quality k of a divisible intermediate good as an input for its final production from a seller (S) or producer. The value of the good depends on its quality. The higher the quality, the more valuable the good to the buyer; but it is more costly for the seller to produce. During the production of this good, the seller can choose to make investments to reduce the cost; on the other side, the buyer can also invest to increase his or her valuation of the good. The equipment can be either a general (standard) one or a specific (customised/tailored) one. The standard equipment, because of its homogeneous nature, is available in a competitive market, whereas a specific one cannot be bought readily.

So the problem in front of the buyer has many distinct aspects. First, he has the option to buy the general equipment from a common seller in the market at a market decided price, though this standard equipment may not meet his special requirements; second, it can also be seen that the buyer may try to ensure the quality of the input by obtaining a specific one, in this case he may place a one-time order for the customised equipment at a price different from the standard market price, though this may require a contract to be agreed between the potential partners. As the incentives are different in each of these situations, let us try to find what he should or would do.

The cost of production of the general equipment by the seller is denoted by $C^g(q, k, r^s)$, where $q \geq 0$ is the quantity, $k \geq \underline{k} \geq 0$ is the quality (superior to the standard one), and $r^{s\ \max} \geq r^s \geq 0$ is the cost reducing investment (superscript s stands for seller). The value of the standard equipment to the buyer is $V^g(q, k, r^b)$, where $r^{b\ \max} \geq r^b \geq 0$ is the buyer's value enhancing investment (superscript b stands for buyer). These r^s and r^b also represent the monetary cost of incurring the respective investments by the parties.[8] These investments can be pecuniary or non-pecuniary depending upon the situation. The investments might entail time and money spent on R&D, building a factory, preparing for production or creating human and organisational capital. Following the existing literature,[9] we simply assume that these investments are non-contractible at the outset, either because these are *ex post non-verifiable* or ex ante prohibitively difficult to describe or both.

Some useful assumptions are required at this point:

Assumption 1: $C(q, k, r^s)$ is increasing and convex in q, k, but decreasing and convex in r^s.

Assumption 2: $V(q, k, r^b)$ is increasing and concave in q, k and r^b.

Assumption 3: $V(q, k, r^b = 0) \geq C(q, k, r^s = 0)$, $\forall\ q, k$; that is it is always efficient to produce and trade even without investments.

The first two assumptions above are quite conventional for the production cost of the seller and the valuation function of the buyer, respectively. For analytical simplicity, $V(q, k, r^b)$ and $C(q, k, r^s)$ are considered to be separable in quantity, quality and level of investments. Both $V(.)$ and $C(.)$ are twice differentiable in all arguments.[10]

2.2.1 A Competitive Market Solution

Let us first consider a situation where the standard equipment (of quality k) is available through a "competitive market". Without loss of generality, we assume that the buyer is a monopolist (i.e. the sole buyer in the market, later we would relax this assumption to bring more dimensions into our analysis), and that there exists a competitive market of potential sellers who can produce the good. Therefore, by construction, the buyer has all the bargaining power ex ante.

The seller's problem is to maximise his or her profit from selling general equipment[11]

$$\pi_s^g = \text{TR} - \text{TC} = p^g(k).q - C^g(q, k, r^s) - r^s \tag{2.1}$$

The first order conditions for profit maximisation of the seller can be deduced as follows:

$$\text{MR} = \text{MC} \qquad \text{i.e.} \qquad p^g(k) = C_q^g(q^g, k, r_g^s), \tag{2.2}$$

and

$$C_{r^s}^{g\prime}(q^g, k, r_g^s) = -1. \tag{2.3}$$

Our maintained assumptions on the cost function would ensure that the second order conditions are automatically satisfied in this case. The output $[q^g]$ is determined by (2.2) and investment $[r_s^g]$ by (2.3), simultaneously. In the long run, the competition among the sellers in the market for the standard equipment (of quality k) would ensure that each seller would earn a *normal profit* and adjust her production process so as to produce the commodity at the minimum point of her *long run* average cost, that is

$$\text{Price} = \text{SMC} = \text{LMC} = \text{SAC} = \text{LAC} = \text{MR}.$$

This in turn ensures that the following condition is met for her choice of reliance investment:

$$p^g(k) = \min_{r^s}\left(\frac{C^g(q^g, k, r^s) + r^s}{q^g}\right)$$

$$\text{i.e.} \qquad p^g(k).q^g = C^g(q^g, k, r_g^s) + r_g^s \tag{2.4}$$

Now when the buyer uses standard equipment k^g (and enforces k^g on the seller), then he would choose r_g^b so that his gain from trading $\pi_b^g(q^g, k^g, r^b) = V^g(q^g, k^g, r^b) - p^g(k) - r^b$ is maximised.

Thus, we infer that the seller only receives the necessary incentive to invest in the production of general equipment here, but no extra incentive for providing any higher quality in this case as the buyer reaps all the benefit (or surplus) from this trade by virtue of his monopoly power.

But, the buyer, who is driven by some special requirement, may choose specific equipment, as he may attach more value to it. The seller, if induced to produce this specific good through some bilateral relation, is also benefitted (I shall explain this shortly). Thus, it is in the mutual interest of both parties to choose to trade specialised equipment.

In the case where the buyer prefers to use specific equipment (which is not readily available in the market) of some quality k instead of standard general equipment [here, $k > k^g$], then the value accruing to him is $V(q, k, r^b)$ and not $V^g(q^g, k^g, r_g^b)$. Further, if the good is not used by the original buyer, this special type of equipment once produced may find a general market outside this relationship (of course, after some modification/alteration) at a value $V^m(q, k)$. Note that in this case the specific investment, already undertaken, does not fetch any value (i.e. the investment is sunk). In all likelihood, naturally, $V^m(q = 1, k) \leq p^g(k^g)$, when the cost of alteration is taken into account.

Now assume that the cost of producing the specific unit might be uncertain ex ante (i.e. until the production is materialised) and is denoted by $c = C(q, k, r^s) + \theta$, where $\theta \in \Theta = [-\theta, \theta]$, where θ is a random variable with the mean $E(\theta) = 0$,[12] such that $\underline{c} \leq c \leq \bar{c}$. Moreover, here, the investments by both parties are selfish investments.

Additionally, we require some more assumptions:

Assumption 4: $V(q = 0, k, r^b) = 0 = C(q = 0, k, r^s) \forall k, r^b, r^s$; that is in the case of no trade with special equipment, no value accrues to either party into a bilateral relation.
Assumption 5: $V(q, k, r^b) - r^b - [C(q, k, r^s) + r^s] \geq \pi_b^g(q^g, k^g, r^b) \geq 0$, $\forall\ q, k, r^s, r^b$.
Assumption 6: $p^g(k).q \geq V^m(q, k)$.
Assumption 7: $V_{r^b}^{g\prime}(., k^g, r^b) \leq V_{r^b}^{\prime}(., k, r^b)$, for all r^b
Assumption 8: $V_k^{m\prime}(q, k) \leq V_k^{\prime}(q, k)$, for all k

Let me explain these assumptions. Assumption 5 states that it is always more efficient for the buyer to adopt specific equipment. The notion can be interpreted as follows. When the buyer uses a special type of equipment rather than the general standard one, his value, net of investment cost, is higher. Further, Assumption 6 states that the seller may recover her cost and can at the most expect to get a competitive price, that is $p^g(k^g)$, once she produces the specific equipment but is forced to sell it to any other buyer in the competitive market than the original one after some modification. Thus, Assumptions 5 and 6 together imply that:

$$V(q, k, r^b) > V^m(q, k), \qquad \text{for all } q, k, r^b \tag{2.5}$$

meaning that the equipment is buyer-specific, and thus we can derive the following:

$$V(q,k,r^b) \geq \pi_b^g(q,k^g,r^b) + r^b + V^m(q,k), \quad \text{for all } q,k,r^b. \tag{2.6}$$

The expression (2.6) states that it is always ex post efficient for the buyer to use specific equipment once it is produced and all investments are sunk.

The last two assumptions reflect the marginal returns (effects) of the value-enhancing investments and quality provisions. Assumption 7 states that the buyer's investment yields more return if he uses specific equipment (recall here, Eq. (2.5); and Assumption 8 states that the qualitatively improved equipment compared to the standard one has more value to the original buyer than anybody else. Notice here that the investments are specific and, for simplicity, have zero value outside the relationship. Similarly, in the absence of trade and the relevant investments, both parties make zero profits (as they have no outside options).

2.2.2 Bilateral Relations

A buyer has the opportunity to make a one-time trade with a seller. Assume that the parties are risk neutral. The trade involves the seller selling q units of a good of quality k to the buyer at some price p. Before trading, both parties can make specific investments. These investments are costly for the party that makes it.

Sequence of the Game

The sequence of events is as follows. The two parties can write an ex ante contract before $t = 1$. At $t = 1$, the parties make specific investments. At $t = 2$, some pay-off-relevant uncertainty is resolved. Once the individual valuation and cost are known, the parties (may) renegotiate over q and k and settle the price in this intermediate period. At $t = 3$, trade takes place. Most of the models in the ICT literature are similarly standardised.

As we shall see, the basic role of a contract in this model will be to design a structure of trading so as to provide the “incentives” to the parties to make the “right” levels of investment. What kind of contracts can be written will depend on the assumed “information structure” in the model. We will elaborate on this below. Our maintained assumption is that once the two parties make the specific investments, the investment levels will be common knowledge between them but not verifiable.

Pay-Offs and the Nature of Investments

At $t = 1$, the buyer and the seller undertake selfish investments, $r^b \geq 0$ and $r^s \geq 0$ respectively. Given an investment vector (r^b, r^s), which is already sunk and known to the parties, and a trade (q, k, p) [where p is the per unit price], the “trading pay-offs” (evaluated after $t = 1$) to the parties are: $[V(q, k, r^b) - p.q]$ for the buyer, and $[p.q - \{c(q, k, r^s) + \theta\}]$ for the seller. Here “θ” is a random uncertainty factor related to cost, with mean zero.

Since the parties are risk-neutral and do not discount the future, if trade occurs at price p, then the “ex ante expected payoffs” to the parties (evaluated before $t = 1$) are: $\{V(q, k, r^b) - p.q - r^b\}$ for the buyer, and $\{p.q - c(q, k, r^s) - r^s\}$ for the seller. If they do not agree, then what happens depends on who owns the right to control the asset. If only one of them does, then he or she can use it to trade in a competitive market at the market equilibrium price.

The First Best Outcomes

Given the investment vector (r^b, r^s), a trade (q, k, p) and for some realisation of the uncertainty factor θ, the “trading surplus” is denoted by $G(q, k, \theta, r^b, r^s) = V(q, k, r^b) - C(q, k, r^s) - \theta$.

Let $q^+(r^b, r^s, k, \theta) = \arg\max_{q \in Q}\{G(q, k, \theta, r^b, r^s)\}$ be the maximiser of trading surplus at the performance stage (ex post) when reliance investment and the uncertainty factor are given. We assume that $0 < q^+ < \infty$ for all (r^b, r^s, k). Note that this quantity is so chosen that on average each party's marginal return from investments in respective valuation functions (for the good of quality k) is equal to the social marginal return.

Also, let $G^{+}(k, r^b, r^s, \theta) = G(q^{+}(k, r^b, r^s, \theta), k, r^b, r^s)$ denote the maximised trading surplus, corresponding to q^{+} above.

We define the *ex ante surplus* as:

$$W(k, r^b, r^s) = \{E_\theta[G^{+}(k, r^b, r^s, \theta)] - r^b - r^s\}.$$

We assume that it has a unique maximiser (r^{b*}, r^{s*}, k^*), where r^{b*} maximises $\{E_\theta[G^{+}(r^b, r^{s*}, k^*, \theta)] - r^b\}$, r^{s*} maximises $\{E_\theta[G^{+}(r^{b*}, r^s, k^*, \theta)] - r^s\}$, and k^* maximises $\{E_\theta[G^{+}(r^{b*}, r^{s*}, k, \theta)]\}$. Thus in the first-best outcome, the buyer and the seller invest r^{b*} and r^{s*} respectively, and the parties would eventually trade an amount $q^*(r^{b*}, r^{s*}, k^*, \theta)$ at some price p.

Now we elaborate in explicit terms the above maximisation of the ex ante *joint surplus* for the agents which is given by:

$$W = V(q, k, r^b) - C(q, k, r^s) - r^b - r^s \tag{2.7}$$

For this purpose, we assume that there exists a unique interior solution to the above problem which is denoted as $(q^*, k^*, r^{b*}, r^{s*})$ which satisfies the following (towards this end, for notational simplicity, we keep only the concerned choice variable and suppress others with no loss of generality):

$$V'_q(q^*) = C_q(q^*)\ , \tag{2.8}$$

$$V'_k(k^*) = C_k(k^*)\ , \tag{2.9}$$

$$V'_{r^b}(r^{b*}) = 1\ , \tag{2.10}$$

$$C'_{r^s}(r^{s*}) = -1\ . \tag{2.11}$$

At the beginning, both parties are symmetrically uninformed about the random component (i.e. θ) of the production cost of specific equipment. The choices of investments, r^s and r^b, are hidden actions and are observed only by the concerned party who is incurring it. As opposed to this, V, k, c are *observable* to both parties but *not verifiable* to a court or to any other third party, meaning that any claim based on the values taken by these variables are not contractible.[13] However, trade itself is contractible.

2.3 Arm's-Length Transactions and Incentives

The incentives in a business relation vary according to the nature of the relationship. To show this aspect, we shall analyse two modes of governance of arm's-length transactions, which are spot market and incomplete contracts. Under incomplete contracts, we shall mainly focus on the simple fixed price contracts and briefly discuss the outcomes of more complex contracts.

2.3.1 Spot Contract (Ex Post Bargaining)

Here the concerned parties first undertake their respective investments and production decisions individually, and then they meet at the market to negotiate over the terms of trade and the quantity to be traded. Thus there's no explicit ex ante contract in place before they invest.

Because of our non-verifiability assumption on the characteristics of commodity and the specific investments, there can be no contract ex ante even though ex post trade is always efficient. After investing, the parties bargain with each other to determine a trade (q, p) given the disagreement point of no trade (i.e. $q = 0, p = 0$) and contingent upon quality k. What will be the outcome of such a game?

We adopt the commonly used Nash Bargaining Solution. Given that the bargaining starts after the investment vector (r^b, r^s) is common knowledge, it is reasonable to posit that the parties will agree on an efficient trading quantity $q^*(r^b, r^s, k, \theta)$. The agreed price will depend on the *relative bargaining strengths* of the two parties. Let us assume that these are such that the seller gets $\alpha \in (0,1)$ fraction of the bargaining surplus.[14]

Let us now bring out the distinction of markets in terms of the nature of commodity. We say a *thick* market exists for a commodity when there are close market substitutes. For the specialised exchanges that do not have the close substitutes, we say a *thin* market exists. The parties' bargaining threat-points differ across the two cases. It is worth noting at this point that, although the focal point of this book remains on the issues concerning a thin market, we shall briefly discuss the case of a thick market as well to highlight the importance of property rights therein. Let us first consider a thin market.

Case A: Thin Market (Following Williamson)

As the disagreement point is $(q = 0, p = 0)$, then the bargaining surplus is $G^{+}(q=0, k, r^b, r^s, \theta)$ when quantity traded is zero. So, the contracted quantity (ex post) would be $q^{+}(r^b, r^s, k, \theta) = \arg\max_{q \in Q}\{G(q, k, r^b, r^s, \theta)\}$. Given the above bargaining process and the quantity choice, we assume that there exists a unique (*ex ante*) Nash equilibrium investment vector (r^b_w, r^s_w). Here subscript w represents a thin market as per Williamson. Note that r^b_w maximises $\{(1 - \alpha).E_\theta[G^{+}(q^{+}, k_w, r^b, r^s_w, \theta)] - r^b\}$, and r^s_w maximises $\{\alpha.E_\theta[G^{+}(q^{+}, k_w, r^b_w, r^s, \theta)] - r^s\}$. And there's a quality k_w which maximises $\{\alpha.E_\theta[G^{+}(q^{+}, k, r^b_w, r^s_w, \theta)]\}$. Where $\alpha \in (0,1)$ denotes the relative bargaining strength of the seller, so that the residual bargaining power $(1-\alpha)$ is with the buyer.

Now, we derive the first-order conditions as follows:

$$(1-\alpha).V'_{r^b}(r^b_w) = 1 \;, \tag{2.12}$$

$$\alpha.C'_{r^s}(r^s_w) = -1 \;, \tag{2.13}$$

$$\text{and,} \qquad V'_k(k_w) = C'_k(k_w) \;. \tag{2.14}$$

Thus, if there is no ex ante explicit contract, and there is an ex post bargaining once the investments are made, there is under-investment in equilibrium, that is $r_w^b < r^{b*}$ and $r_w^s < r^{s*}$. The quality provided here is always optimal though, that is $k_w = k^*$. This is the *hold-up problem*. Each party is being held up in the ex post bargaining phase in that its marginal pay-off from an incremental unit of investment is smaller than the increase in trading surplus that the investment generates. This results in under-investment relative to the first-best.

To summarise the ongoing discussion in the form a proposition:

Proposition 2.1. *When a thin market for the commodity exists, under spot contracts, the hold-up incidence is the norm, that is an apportionment of the ex post bargaining surplus leads both the seller and the buyer to under-invest, whereas the seller always has an optimal incentive to provide quality.*

- *Incomplete Contracts in a Thick Market and Property Rights*

ICT allows the question of *property rights* to be associated with the legal tradition. In particular, when the contracts are incomplete, it is no longer the case that any rights conferred by ownership can necessarily be contracted away, since it may be impossible to describe these rights unambiguously. An incomplete contract will have gaps, missing provisions or ambiguities, and so the situation will arise in which some aspects of the utilisation of the non-human assets are not specified. In such cases, ownership is a source of power.

Grossman and Hart (1986) argued that property rights should be seen as the *residual control rights* or the *right to exclude*: when any unforeseen contingency arises, the owner of the asset has the right to decide how it should/could be used. The owner also enjoys an exclusive right on all income streams that have not been shared in advance by a contractual arrangement. These rights certainly have no value when contracts are complete, because by definition no unforeseen contingency can arise. This is in contrast to the more standard definition of the ownership structure, whereby an owner possesses the residual income from an asset rather than its residual control rights. As Hart (1995) stresses, there are two crucial ingredients of the property rights approach: "the incomplete contracts, and the residual rights of control over non-human assets". Given the non-contractibility of the relationship specific investments, the first ingredient is important because it leads to a hold-up problem. The second ingredient is important because it implies that the changes in ownership could curb the hold-up problem.

This leads us to our next case where we bring out the importance of property rights in a thick market setting.

Case B: Thick Market (A Particular Case)

As we have already pointed out earlier that the final price will depend on the bargaining threat-points to the parties, these threat-points in turn are now determined by the rights. Therefore, the investment incentives to the parties will now depend on the initial allocation of the property rights, as will the efficiency. There are three different environments possible, depending upon the situation as to who holds the property right. Outcomes in these three situations will differ considerably. Let us illustrate them one by one.

(i) *Seller holds the right.*

If the seller holds the right to the price negotiation between the trading parties, the status quo pay-offs are 0 (zero) and $V^m(q, k)$ for the buyer and the seller respectively. The reason for this is simple: once the specific equipment is produced, then no trading on this would leave the buyer with 0 valuation and also the investment undertaken by the buyer is wasted but the seller can sell the equipment in the general market after modification.

The trading surplus, which is $\{V(q, k, r^b) - V^m(q, k)\}$, from a successful negotiation over the price, is divided between the two parties and the agreed price will depend on the *relative bargaining strengths* of the two parties, as before. [The parties can pre-contract quantity $q_s(k, r^b, r^s)$ such that $\{V(q, k, r^b) - V^m(q, k)\}$ is maximised.]

As before, let us assume that these are such that the seller gets $\alpha \in (0, 1)$ fraction of the bargaining surplus. [At the time of negotiation over price, since the cost is already sunk, the production cost and the ex post asymmetric information on cost have no impact on the bargaining outcome.] In this case, if the seller disagrees with the buyer on a price, he or she can produce and sell the equipment going to the competitive market. Then, the already sunk investment by the buyer goes in vain. Thus, when the parties negotiate over a trade price P, the seller makes a gain $\{P - V^m(q, k)\}$, while the buyer gains $\{V(q, k, r^b) - P\}$. Thus the negotiated price would be:

$$\begin{aligned} P &= \alpha.\{V(q_S, k, r^b) - V^m(q_S, k)\} + V^m(q_S, k) \\ &= \alpha.V(q_S, k, r^b) + (1 - \alpha).V^m(q_S, k) \end{aligned} \tag{2.15}$$

The point to be noted here is that this price is not a per unit price, as opposed to the earlier case, and is rather the total payment to be made by the buyer to the seller when trade takes place.

$$\begin{aligned} \text{Thus, } P &= V(q_S, k, r^b), \text{ if } \alpha = 1 \text{ (i.e. all bargaining power is with the seller)} \\ &= V^m(q_S, k), \text{ if } \alpha = 0 \text{ (i.e. all bargaining power is with the buyer)} \\ &= \frac{V(q_S, k, r^b) + V^m(q_S, k)}{2}, \text{ if } \alpha = \frac{1}{2} \text{ (power is equally divided)} \end{aligned}$$

Therefore, the ex ante pay-off to the seller would be:

$$P - C(q_S, k, r^s) - r^s = \{\alpha.V(q_S, k, r^b) + (1-\alpha).V^m(q_S, k)\} - C(q_S, k, r^s) - r^s \tag{2.16}$$

The seller would choose k_S and r^s_S, where subscript S indicates the outcome of a spot market transaction that satisfies the following equilibrium conditions:

$$\alpha.V_k'(k_s) + (1 - \alpha).V_k^{m\prime}(k_s) = C_k(k_s)\ , \tag{2.17}$$

and,
$$C_{r^s}'(r^s) = -1\ , \tag{2.18}$$

This implies that $r_S^s = r^{s*}$ and $k_S < k^*$. Note, it is implicitly assumed here that the seller's equilibrium pay-off from producing the specific equipment is positive, otherwise the spot market would not be used for the transaction.

The ex ante pay-off for the buyer would be:

$$V(q_S, k, r^b) - P - r^b = (1-\alpha).V(q_S, k, r^b) + (1-\alpha).V^m(q_S, k) - r^b. \quad (2.19)$$

The buyer's investment choice, r_s^b, solves:

$$(1-\alpha).V'_{r^b}(r_S^b) = 1 \quad (2.20)$$

and this implies $r_S^b < r^{b*}$. So the buyer is under-investing (as $(1-\alpha) < 1$), which is again the famous hold-up incidence in the literature on contracts.

(ii) *Buyer owns the right.*

When the buyer holds residual control, in the case of any disagreement he or she can ask the seller to operate at the competitive price $P^g(k)[:= q^g.p^g(k)]$, then the original seller's specific investment goes in vain. Otherwise, trading increases the buyer's gain by $\{P^g(k) - P\}$ and the seller's gain by $\{P - C(q, k, r^s)\}$. Again, calculations, similar to the previous case, will show that the buyer invests efficiently (i.e. achieves first-best), whereas the seller under-invests; the quality provided here is also less than optimal.

(iii) *Joint ownership.*

When neither party can operate the asset without the consent of other, trade occurs only upon mutual agreement. The pay-offs to the seller and the buyer are $\{P - c\}$ and $\{V(.) - P\}$ respectively; in the case where they disagree then trade does not take place and each party loses the value of the investment. The ex post equilibrium price would be: $P = \frac{V(q,k,r^b)+c}{2}$.

Thus, given the price, the final respective pay-offs to the buyer and the seller will be: $\left\{\frac{[V(q,k,r^b)-C(q,k,r^b)-\theta]}{2} - r^b\right\}$ and $\left\{\frac{[V(q,k,r^b)-C(q,k,r^b)-\theta]}{2} - r^s\right\}$.

It is easy to show that both parties invest less than the efficient levels, since the equilibrium conditions are: $V'_{r^b}(.) = 2$ and $C'_{r^s}(.) = -2$. However, the seller provides the optimal quality.

Here is a summary of the previous discussion in the form a proposition:

Proposition 2.2. *When a thick market for the commodity exists, the spot market transactions induce the party, explicitly holding the property right, to undertake an efficient level of investment and the other party to under-invest irrespective of the level of bargaining power; there is also some, but less, optimal incentive to provide quality (however, the provision of quality increases with the bargaining power to the seller).*

Remark. From the discussion above, it is evident that either of the exclusive property rights ownership types—by buyer or seller—can be optimal from the perspective of the hold-up problem, depending upon the precise shapes of the cost and the value functions. Joint ownership is the worst possible case for reliance investment. The important factor that comes out from this section is that when the contracts are incomplete, the property rights protect their holder from the possible hold-up in his or her specific investments. Thus it is clear that ownership matters for the incentive to invest, because it affects the disagreement point, which in turn affects the incentives through the ex post bargaining. But if ownership rights only affect the decision to trade or not, then, needless to say, it has no bearing on investment incentive.

Where there is a monopoly, and also where there is an oligopoly (a few sellers or a few buyers) on either side of the market, the contract terms will not be Pareto-efficient and will excessively benefit the party with market power. Thus while the terms of the contract will be mutually beneficial, they will not be efficient. The terms will be more onerous on the weaker party and will result in an inefficiently low level of contractual activity, production and sales, and as a result resources will not gravitate to their highest-valued uses.

2.3.2 Simple Incomplete Contract (Fixed Price Contract)

In the case where the trading parties form a contractual relationship towards the exchange of a specific equipment, they can sign an ex ante procurement contract for the same. However, assuming that the contracts are complete is obviously very strong. Typically the contracts take into account a limited number of variables; for example, the most relevant ones, or those the most easily verifiable in court. Naturally, most real world contracts are incomplete.

By assumption, the investment vectors r^s and r^b are either not ex ante describable or not ex post verifiable by a court, and the uncertainty component θ present here, related to the cost of the production of specific equipment, is ex ante unobserved by both parties. Thus, there exists an asymmetry of information between the parties. So a contract is necessarily incomplete, since the contract cannot be contingent on any of r^b, r^s, k, V or C. For simplicity, let us first consider a fixed price incomplete contract.

The parties can write an ex ante contract (q_F, p_F), that is it specifies a price and a level of trade and remains silent on the investment levels and quality. This contract may be renegotiated later.[15] We will call this a "simple" incomplete contract. Under a fixed price contract, the price is agreed upon ex ante; then the seller delivers the good at a later period and the buyer pays the agreed price upon delivery. In the case where parties disagree at the renegotiation stage, the court may enforce the contract as written. In this regard we segregate the analysis into two parts depending upon the types of quantity choice—binary or continuous. By the binary quantity choice we mean that when a commodity (say a table with four legs) is to be produced, then either the complete table is to be delivered or nothing at all. Conversely, in the continuous quantity case, there may be some intermediate quantity (say a table with three legs, instead of four; or an unfinished house) that can be produced and delivered.

The Case of Binary Quantity Choice

When the quantity choice is binary, that is $q \in \{0, 1\}$, the analysis is very simple. In this case, the seller would optimise her ex ante pay-off which is:

$$P_F - C(q_F, k, r^s) - r^s \ , \quad \text{where } P_F = q_F.p_F \text{ and here } q_F = 1$$

Obviously, the seller, being rational, would choose $r^s_F = r^{s*}$ [as the first-order condition is $C'_{r^s}(r^s_F) = -1$], whereas at the same time, being opportunistic[16] towards saving her cost, would choose $k_F \leq k^*$, where subscript F indicates that the choices are made under a fixed price contract.

On the other hand, the buyer chooses $r^b_F = r^{b*}$ to maximise his ex ante payoff:

$$V(q_F, \underline{k}, r^b_F) - P_F - r^b_F$$

The first order condition for the buyer's maximisation problem is $V'_{r^b}(r^b_F) = 1$.

The contractually agreed price here depends on the individual party's relative bargaining strength, and this does not affect the incentives associated with the contract. And it is easy to see that the price might be fixed at $P_F = C(q_F, \underline{k}\ , r^{s*}) + r^{s*}$, such that the seller just *breaks even* while providing the commodity of lowest quality (i.e. $\underline{k}$) if the buyer is bestowed with all the bargaining power.

If the courts can enforce the contracted price and the delivery,[17] there is no incentive to renegotiate this contract ex post since there are no other mutually beneficial changes available to the original terms. If one party tries to renegotiate, the other can appeal straightaway to the courts which are expected to enforce the contract.

The Case of Continuous Quantity Choice

In all likelihood the contracted quantity q_F may be different from that of the ex post efficient quantity $q^+(r^b, r^s, k, \theta)$ for a particular realisation of θ. In this case, since renegotiation is possible and efficient, the parties would end up trading the quantity $q^+(r^b, r^s, k, \theta)$ for a gain in total surplus. We call the potential gains from renegotiation the *renegotiation surplus*. This is computed with respect to the disagreement point (also called, threat point), which constitutes of the respective individual utilities that they can get through a non-cooperative action, instead of a bargain. The threat points in the renegotiation game in this case are the respective ex post pay-offs:

$$\text{for the seller,} \qquad \pi^s = \{P_F - C(q_F, k, r^s) - \theta - r^s\}, \tag{2.21}$$

$$\text{and for the buyer,} \qquad \pi^b = \{V(q_F, k, r^b) - r^b - P_F\}\,. \tag{2.22}$$

Thus the renegotiation surplus would be:

$$\begin{aligned} RS = &\{V(q^+(r^b, r^s, k, \theta), r^b) - C(q^+(r^b, r^s, k, \theta), r^s)\} \\ &-\{V(q_F, k, r^b) - C(q_F, k, r^s)\}, \text{[as } \theta \text{ cancels out].} \end{aligned}$$

If in the contract it is assumed that during the renegotiation all the surplus goes to the seller, then her final pay-off turns out to be:

$$\begin{aligned} \pi_S^{RS} &= \{P_F - C(q_F, k, r^s) - \theta - r^s\} + RS \\ &= V(q^+(r^b, r^s, k, \theta), r^s) - C(q^+(r^b, r^s, k, \theta), r^s) \\ &\quad -V(q_F, k, r^s) - \theta - r^s + P_F\,. \end{aligned} \tag{2.23}$$

The buyer, who is stuck at his original threat point π^b[refer to Eq. (2.22) above], thereby chooses to invest at a level $r^b(q_F)$ given the condition $V'_{r^b}(q_F, r^b(q_F)) = 1$.

However, under reasonable conditions, for instance, if $V(q, k, r^{b*})$ is continuous in q and satisfies the *Inada conditions:* $V'_{r^b}(q = 0, k, r^{b*}) = \infty$ and $V'_{r^b}(q = \infty, k, r^{b*}) = 0$, there exists a q_F^* such that $r^b(q_F^*) = r^{b*}$. Then in the initial contract, by specifying a disagreement option of trading this q_F^* at any price P_F, the buyer can invest efficiently. And for the buyer's efficient investment, the seller's renegotiated payoff would clearly be maximal in r^{s*}. However, the seller would choose a quality, if she anticipates renegotiation is due, $k_F < k^*$ given by the condition:

$$V'_k(q^+(r^b, r^s, k, \theta), r^s) - V'_k(q_F, k, r^s) = C'_k(q^+(r^b, r^s, k, \theta), r^s)\,. \qquad (2.24)$$

Thus both parties can invest efficiently and later renegotiate to trade the efficient quantity, though the seller won't get the required incentive to provide optimal quality even though she has all the renegotiation surplus.

The above result is summarised as follows:

Proposition 2.3. *Under a fixed price incomplete contract (both under binary and continuous quantity choices), the buyer and the seller both have the right incentive to make efficient investments; however, the seller gets no incentive to provide the quality.*

One important remark here is that, although in both cases of quantity choices parties are getting the right incentive to make an efficient investment, the underlying mechanisms are different. For the binary quantity case, as the renegotiation over quantity is not possible, parties automatically receive an efficient incentive for investment. For the continuous quantity case, efficient investment is attained if parties that are upfront in the contract include a suitable disagreement option on trading quantity during the ex post renegotiation process. The parties foresee this possibility of intermediate quantity choice at the renegotiation stage which ensures ex ante efficient investment. So if an ex post efficient renegotiation is not possible, then our result breaks down.

2.3.3 Complex Incomplete Contracts

Next, we consider a more general contract type where the price can be made contingent on whether the transaction takes place or not, that is $P = P(t)$ where $t \in \{0, 1\}$. Here $P(1)$ and $P(0)$ represent two different respective payments made by the buyer to the seller when the trade takes place and when it does not. Additionally, let the contract allocate ex ante rights among the parties to make the trade decision (i.e. choose t) ex post after the equipment is produced. Then, there would be four possible types of allocation of the property rights: (i) exclusive rights conferred to the buyer to decide on whether or not to trade under the contractual price schedule (a buyer's option contract); (ii) the exclusive right conferred to the seller (a seller's option contract); (iii) the right is jointly owned by both the parties (i.e. each party has veto power over the trade); and finally (iv) no one has the right (i.e. trade must take place). And this final type is equivalent to the fixed price contract.

The general contract specified above would be renegotiated in the case of failure to trade under the contract terms. Under the renegotiation process, the relevant status quo pay-offs are $\{-P(0)\}$ for the buyer, and $\{P(0) + V^m(q, k)\}$ for the seller. Therefore, the renegotiated price P_r will be:

$$P_r = P(0) + \left[\frac{V(q, k, r^b) + V^m(q, k)}{2}\right] \tag{2.25}$$

If the preliminary contract is renegotiated in equilibrium, it is then clear that the parties' choices of the quality and the investments are the same as that under spot market trading.

In the case of type (iii) allocation rights, where both parties enjoy the rights jointly, it can be seen that if one party has the incentive to trade at the contractually specified price $P(1)$ then either party would necessarily exercise its veto power and force a renegotiation process to obtain a new trading price, which would be P_r, as seen earlier. Thus, in plain words, the preliminary contract would always be renegotiated.

Finally, for allocation types (i) and (ii), there are two possibilities. First, the option holder exercises the option ex post; in that case the parties would trade at the pre-decided price $P(1)$. This would result in an equilibrium where the investments and the quality choices are just the same as those under the fixed-price contract. The second possibility is that the option holder lets the option expire and renegotiates the trading price afresh; in this case the outcome would coincide with that of spot market trading.

To summarise the above discussion:

Proposition 2.4. *A contract that specifies a price schedule contingent on the ex post trading decision and an allocation of the rights to the parties to make such a decision does not bring any extra incentive beyond those achieved under spot market trading and fixed-price contracting.*

2.3.4 Issues Related to Uncertain Product Specifications

Suppose that the exact specification of the product is not known at the beginning (i.e. Time 0). Tirole (1999) suggests three sources of transaction costs that might be faced in this case: (1) the unforeseen contingencies; (2) the cost of writing contracts; and (3) the cost of enforcing a contract. In the ICT, major emphasis is placed on the first point. If a single specification can be foreseen and described, then it is straightforward to write a specific performance contract, and it is reasonable to expect the courts to be able to interpret it and verify the terms. However, if it cannot be described at Time 0, or if there are numerous potential describable specifications, each of which is equally likely, but only one of which becomes optimal once the uncertainty has been resolved at Time 2, then a contract is unlikely to induce the efficient investment (Hart & Moore, 1999). This is because a renegotiation must be expected at Time 3 in order for the appropriate specification to be traded (i.e. for the efficient trade): this however entails a surplus-sharing unless (one of) the investor(s) has all the bargaining power. If the contract can allocate all the bargaining power to the investor, or if the investment is useful across an appropriate class of specifications, then a contract for a single specification within this class, together with a pre-decided fixed price, contributes some positive investment incentives even if the optimum is not achievable.

Conjecture I: Uncertain Specification

In the event that the product specification is very uncertain ex ante, the "no-contract" can be (weakly) optimal. For some types of investment, a simple contract for one specification may be helpful for the incentives, but only as a device to affect the bargaining during the anticipated renegotiation. This contrasts sharply with a complete contracting view that suggests the inclusion of an elaborate set of contingencies in an optimal contract. In the case of one-sided investment, another function of the contract may be to allocate the bargaining power to the investor.

Conjecture II: Selfish Investments and No Uncertainty

For a transaction with specific self-investments plus complete information over the demand, cost and specifications, a simple contract specifying a price, a quantity and a product specification is efficient. It makes no difference if one or both parties invest. No further safeguards are necessary.

This should be understood in the context of what would be a sufficient contract in the absence of an investment specificity. In such cases, the spot contracts are efficient.

2.4 Conclusion

In the above set-up, the stylised model helps us to understand different aspects of the governance structure and how each mode stimulates the incentives among the trading partners. A spot market transaction is without any contract. This leads both parties to under-invest due to the hold-up problem. But at the same time it gives the seller some incentives for providing the quality. If, instead, an incomplete contract is used by the parties in an arm's-length transaction, only the fixed-price incomplete contract amongst all the alternatives under this class becomes relevant (given the contractibility assumption). The simple incomplete contract irons out the hold-up problem but does not provide any incentive for the seller to provide the quality.

According to TCT, the bounded rationality of the contracting parties implies that all the complex contracts are unavoidably incomplete and that many are maladaptive. The reasons are twofold: many contingencies are unforeseen (and even unforeseeable) and the adaptations to those contingencies—that have been recognised and for which the adjustments have been agreed to—are often mistaken. As Nelson and Winter (1982) justly explain, these maladaptations are related to the learning process, since the parties acquire deeper knowledge of the production process and the demand during the contract execution than they possessed at the outset. The practical significance of the entire exercise of reconnoitring the incentive scheme of the different modes of the incomplete contracts is that all the relevant contracting actions cannot be concentrated in the ex ante incentive alignment, though some may spill over into ex post governance. TCT combines the incompleteness with the far-sighted contracting by describing the contracting process as one of "incomplete contracting in its entirety" (Williamson, 1996). "Plausible farsightedness", as opposed to hyper-rationality, is considered to be a sufficient theoretical assumption. Thus in the light of the above results, our focal point for the rest of the analysis hinges mostly on the fixed price contract with a specific commodity.

The current discussion shows that a contract in some form brings certain incentives to the trading parties. But our Assumption (3), which enables the parties to *trade always*, is too restrictive. We imposed this assumption deliberately to bring out the systematic disposition of the hold-up incidence. For a more realistic view of the world we should drop this assumption. And the moment we do that, as has been done in all ensuing chapters, this leads the parties to face the possibility of a breach of contract.

In a "transaction costs or friction free" world, the parties can achieve optimal outcomes on their own. In reality, many types of transaction costs (e.g. non-foreseeable uncertainty and the presence of asymmetric information) interfere with the contracting parties. This prevents them from achieving optimal outcomes. The costly disputes are explained by the incomplete information about some aspect critical to reaching an agreement, such as the party's reservation price. The informational differences provide an appealing explanation for bargaining inefficiencies.

If the information relevant to the negotiation is privately held, the parties then must learn about each other before they can identify the suitable settlement terms. This task or learning is difficult because of the incentives to misrepresent private information. The bargainers may have to engage in costly disputes to signal credibly the strength of their bargaining positions. The laws of contract can be useful instruments in this kind of situation by protecting the interests of each party. Contract theory is the body of legal thought that inquires into the normative or conceptual problems in contract law. The central problem of contract theory is: Why are contracts enforced? The answer lies in the economic benefits of enforcing the bargains. The foundations of contract theory lies on the principle of Pareto-efficiency, where the Pareto-optimum outcome is achieved. Subsequent chapters will deal with the different aspects of each of the contract laws and their performances under a set of varied market structures.

Notes

1. Delegation may be motivated either by the possibility of benefitting from some increasing returns associated with the division of the task, or by the principal's lack of time or ability to undertake the task by him or herself, or by any other form of the principal's bounded rationality when faced with a complex problem.
2. A specific investment is one that is more valuable when applied to a specific pair of trading partners than it is to trade with an alternative buyer or seller.
3. A further (and related) matter is that the nature of the relationship between the parties is different from the sale of goods contract and is governed by impersonal market forces where the "identity" of the buyer and seller is not an issue; for contracts with significant transaction-specific reliance, one or both parties become "locked-in" and identity is important—i.e. they can be described as personal or relational transactions/contracts.
4. A first-best (or a Pareto-efficient complete-contingent state) contract is one that cannot be modified to raise the expected utility of both of the parties. Fully informed rational agents would enter into a first-best contract if there are no transaction costs and no verification or enforcement problems ex post. Also see, Kaplow and Shavell (2006).

5. A second-best (or economically incomplete) contract is the best set of contractual terms that the parties can enter into given the existence of transactions costs, asymmetric information or ex post verifiability and enforceability problems [Cf. Kaplow and Shavell].
6. In a commercial contract, these expenditures might include the purchase of particular machinery, the development of designs and technical specifications, or the investment in a plant. In the employment relation, these expenditures may involve the employer's investment in training, and the employee's investment in learning job-specific skills, which cannot be used if a job is taken with another employer.
7. This model is an adaptation of the model of Salanié (2005), Holmstrom and Milgrom (1991, 1994) and the hold-up model of Grossman and Hart (1986); it is also related to the incomplete contracting framework used by Holmstrom and Tirole (1991) and Hart et al. (1997). Both papers use the incomplete contracting framework to study the trade-off between quality provision and cost reduction in other contexts (transfer pricing and the scope of government respectively).

   A more closely related paper is by Bajari and Tadelis (2001), who compare fixed price contracting with cost-plus contracting in the context of construction contracts. The authors show that the fixed-price contract gives the contractor incentives to save on construction costs but can cause ex post maladaptation. On the other hand, the cost-plus contract gives them the required flexibility to ex post efficient adaptation though the agent would have a lesser incentive to save on cost.
8. Here we are not imposing any particular structure on the cost of investments; rather we simply assume that the amount of money required for investment is raised from the concerned market at a zero interest rate.
9. Two assumptions are axiomatic in ICT. The first closely follows TCT that many important investments are ex post observed by economic agents, but are not verifiable in a court of law—in ICT jargon, investments are not contractible. In particular, a contract cannot condition prices (or anything else) on ex post investments. The second is that parties to a contract cannot prevent themselves from renegotiating the terms if it is mutually beneficial to do so (Hart & Moore, 1988).
10. Notations we use are:

$$V'_q(q) \equiv \frac{\partial V(q,k,r^b)}{\partial q} > 0,\ V'_k(k) \equiv \frac{\partial V(q,k,r^b)}{\partial k} > 0,\ V'_{r^b}(r^b) \equiv \frac{\partial V(q,k,r^b)}{\partial r^b} > 0,$$

$$C'_q(q) \equiv \frac{\partial C(q,k,r^s)}{\partial q} > 0,\ C'_k(k) \equiv \frac{\partial C(q,k,r^s)}{\partial k} > 0,\ C'_{r^s}(r^s) \equiv \frac{\partial C(q,k,r^s)}{\partial r^s} < 0.$$

11. Here we assume that price depends on quality. "In practice, every delivery contract specifies the characteristics of the good. If these characteristics can be described by few parameters, then it is not hard to condition the price on them, and a court can verify the relevant characteristics upon delivery. These assumptions become much stronger for a complex good". See, Salanié (2005, p. 198).
12. This is a very simple way of incorporating uncertainty; and key results remain qualitatively unaffected if alternative formulations are used.
13. By this, we reject the possibility of using a message contingent game as in Grossman and Hart (1986).
14. Thus, the gains from trade are shared in full, so bargaining is assumed to be efficient. Such efficiency is standard in ICT models. It is often assumed either $\alpha = 0$ or $\frac{1}{2}$ or 1. The assumption of $\alpha = 0$ or 1 has very strong efficiency (or inefficiency) implications because there is no surplus sharing. In some models, effectively the same result is achieved if an outside option is binding in a Rubinstein-type bargaining game because the party whose outside option does not bind receives all the marginal surplus.
15. We can see in what way the renegotiation is important for this model; the parties could achieve ex post efficiency only if they can renegotiate freely (more specifically under continuous quantity choice).
16. Oliver Williamson (1975, 1985) and his transaction cost economics of the firm (henceforth TCE) conceptualized incomplete contracts by opportunism and specific investment, which have now become standard terms in the literature.
17. In terms of legal remedy, this is known as "specific performance", which means both parties are forced to fulfil the contracted terms unless there is mutual agreement otherwise. This is discussed in more detail later.

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3

Economics of Damage Remedies I: *Unilateral Reliance, One-Sided Information Asymmetry*

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

3.1 Introduction

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

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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. there existed *symmetric information* between the parties), thereby enabling ex post (re)negotiation. Under symmetric information, the analysis of renegotiation in particular is much more tractable than under 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 literature's 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 imperfect and asymmetric information. The problems encountered by these contracts are commonly illustrated by insurance contracts, although many other different types of contract suffer from the same potential for inefficient incentives and breaches, such as agency agreements, employment contracts and contracts between the suppliers and the buyers (sub-contractors) for the procurement of a particular commodity.

In a symmetric information framework, as in the previous chapter, the hold-up problem can disappear when one party has 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. In this chapter we will study the hold-up problem with a non-observable investment by one party and 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. The buyer's chief concern is to give them the incentives to disclose their types later, which gives the game a flavour close to that of 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 always positive*. Sometimes it can be negative and the possibility of an ex post contract breach arises. We will show that the simple fixed price contract in this situation is no longer efficient and that legal penalties are required to protect the promisee's reliance. It will further be shown that the adoption of 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 ex ante. Additionally, there are no third parties, no liability constraints and no pre-contractual private information (i.e. ex ante *adverse selection*).[1] Instead, the present model highlights the interaction between the incentive provision and the allocative efficiency.

Such results are the striking features of *optimal contracts*, which depend in a crucial way on the degree to which the seller's incentive constraint binds at the optimum. First, when the incentive constraint binds to a low degree, that is 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. One purpose of this analysis is to fill this small but surprising gap in the literature.

3.1.1 Hold-Ups: Divergent Economic and Legal Views

The 'hold-up literature[2] 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 his or 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, predict the reverse. This literature has studied the contractual and non-contractual solutions to this hold-up problem. 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 good to be traded will, fairly generally, induce efficient investments if they are "selfish" in nature, that is if each party's investment directly affects only his or her own profit (Edlin & Reichelstein, 1996). Second, and in contrast, "no contract", however complicated, is of any value in reducing inefficiency if the investments are "cooperative" in nature, that is 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, show that the standard breach remedies lead to an *inefficient trade* (i.e. traded quantity is less than optimal or there is a frequent breach of contract) or an *inefficient investment* (i.e. either over-investment or under-investment depending upon the situation) or both (see, Goetz & Scott, 1977; Shavell, 1980). Rogerson (1984) and Shavell (1984) expanded the analysis by allowing for costless renegotiation, which implies that the trade is always optimal (Coase, 1960)—that is the first concern of inefficient trade is taken care of—so the only efficiency concern that remains is determined by the parties' investment choices. Both 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 allows for high punitive damage for the parties that deviate from the equilibrium path (Aghion, Dewatripont, & Rey, 1994; Chung, 1991; MacLeod & Malcomson, 1993). Others have focused on relatively more complete contracts, such as *fill-in-the-price contracts* (Hermalin & Katz, 1993; Konakayama, Mitsui, & Watanabe, 1986) and *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 usage of these various clauses (e.g. knife-edge, fill-in-the-price and liquidated damages) the role of the court is reduced to only 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 (Hermalin & Katz, 1993). Unfortunately, *fill-in-the-price* contracts and *liquidated damage* clauses can be very complex, perhaps indescribably so (see, Hart & Moore, 1999; Maskin & Tirole, 1999, 1999). Furthermore, 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 and Reichelstein (1996) demonstrate that the parties can write contracts that provide the incentive for efficient investment under the expectation damage and the specific performance remedies. However, Che and Chung (1999) showed that for some types of investments—the so-called cooperative investments where the investment by one party directly impacts on 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 an 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 et al. (1978). Balancing this under-investment from hold-ups against the over-investment generated by standard breach remedies, Edlin and 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.[3] Edlin and Reichelstein also argued that the Rogerson and Shavell over-investment result was an example 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).

3.1.2 Where the Present Analysis Stands

Following the existing literature, the present analysis mainly deals with a particular family of contracts 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*[4]), 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 will set aside questions of litigation costs but assume renegotiation is not possible (under the ex post asymmetry) 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 closer to that of Shavell than that of Edlin and Reichelstein (1996) and Rogerson (1984).

Keeping in mind the earlier formal differences in approach, and the contradictory 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 to 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 the present analysis a unique character in the literature since most of the legal literature, as we explored in the previous subsection (e.g. Shavell and Edlin), generally uses an informational environment where the contracting parties are ex post symmetrically informed.

The 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). I have followed both 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.

Various damage measures for breach of contract have been studied and compared their efficiency, similar to Shavell (1980, 1984), and Miceli (2004). It is also explored how damage measures served as an implicit substitute for completely specified contracts and reliance actions. The general result obtained here—no court-imposed damage remedy upheld the first best—is not any the more novel than that obtained in the works of Shavell and Miceli.

But the ensuing analysis establishes the importance of liquidated damage remedy in an asymmetric information framework, as it not only achieves the first best but maximises social welfare as well. The magnitude of the stipulated damage actually reflects the *perfect expectation damage* (see, Shavell, 1980) and does not contravene the theory often presented by 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 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: (1) providing incentives for the efficient breach, (2) efficiently screening among the different types of buyers and sellers, and (3) providing incentives for the efficient investment. Specifically, in this analysis, we will 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 a 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 the buyer's optimal valuation; therefore the stipulated damages will almost always fall short of the actual losses from the breach (ex post).

We may 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.

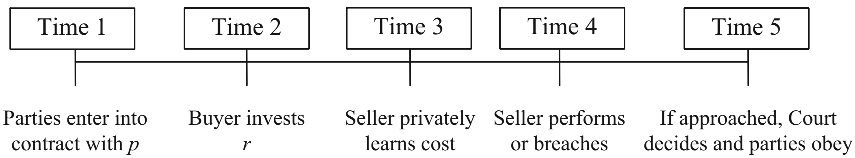
3.2 The Model: Unilateral Reliance and One-Sided Private Information

3.2.1 The General Setting

Consider a particular setting with a single (male) buyer, B, who contracts to purchase one unit of an *indivisible* specific good[5] from a single (female) seller S. Both are risk-neutral. The parties enter into a simple *fixed-price* contract at Time 1 (see the figure below). Without any loss of generality, and for simplicity, we assume that the buyer has all the 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 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 price p. Further, we assume that the price of the good is a constant and is agreed upon at Time 1 but payable only upon the delivery of the good.[6]

At the beginning (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[7] in accordance with a strictly positive probability density function $f(c) > 0$; the corresponding cumulative distribution function denoted by $F(c)$ from the interval $[\underline{c},\bar{c}]$ where $0 < \underline{c} < \bar{c}$. 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 $r^b > 0$, which directly affects the buyer's valuation of the good, denoted by $V(r^b)$; this is non-stochastic (and thereby invertible), and ex post observable to both parties and also verifiable to the court. This value accrues to the buyer *iff* the good is actually delivered. We assume that r^b 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: $V(r^b)$ is monotonically increasing and strictly concave in r^b, that is $V'(r^b) > 0$ and $V''(r^b) < 0$ where the prime denotes the derivatives. Moreover, to avoid the corner solutions, we assume that the *Inada conditions* $V'(0) > 1$ and $V'(r^b) \to 0$ for $r^b \to \infty$ are satisfied.



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 $V(r^b) - r^b > p$ or $V(r^b) > p + r^b$ or $V(0) > p$; that is a fixed price with no possibility of default by the buyer, whereas $\underline{c} \leq p \leq \bar{c}$ for the seller.[8] 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 accruing 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 the future (and therefore assume no renegotiation[9]) despite the fact that the specific investment involved on the part of the buyer increases his risk and may pave the way for renegotiation.

3.2.2 The First Best: Efficient Breach and Efficient Investment

The modern theory of *efficient breach*[10] 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 grounds 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 he 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 the breach are greater than the money 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, satisfy not only the *Kaldor–Hicks* standard of hypothetical compensation but the more restrictive *Pareto* standards of efficiency as well: 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 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 preconditions are met, that is when the breaching promisor internalises the costs of his or 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.

Breach decision: once the seller realises a cost c (i.e. in the ex post sense), the breach of contract will only be efficient iff: $V(r^b) < c$, that is the value of the performance is less than the cost of providing it; 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 parties would be recovering their respective expenses. The set of all possible realisations of c such that $c > V(r^b)$ is called the breach set.

Therefore, the probability of efficient performance is:

$$\Pr[c \leq V(r^b)] = \int_{\underline{c}}^{V(r^b)} dF(c) = F[V(r^b)]$$

And the probability of an efficient breach is:

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

Next we turn to the reliance decision as the analysis of the breach decision is now complete. We summarise the first-best investment decision in the following lemma.

Lemma 3.1. *(In a no-gap situation*[11]*) the first-best amount of reliance investment under one-sided uncertainty must be less compared to that of 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 an 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:

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

i.e. $$\mathrm{EPJ} = F[V(r^b)].[V(r^b) - E(c|c \leq V(r^b)] - r^b \tag{3.1}$$

To check the investment incentives for the contracting parties, we differentiate the above expression and obtain the following[12]:

$$\mathrm{EPJ}'(r^b) = f(V(r^b)).V'(.).V(r^b) + F[V(r^b)].V'(.) - f(V(r^b)).V'(.).V(r^b) - 1$$

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

Let us explain these assumptions. Our third assumption states that both $\frac{1-F(x)}{f(x)}$ and $\frac{f(x)}{F(x)}$ are decreasing in x. This is a standard and fairly mild assumption often used in the literature. The first assumption implies that necessarily $V(0) \geq \underline{c}$, that is 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*} (a Kaldor–Hicks efficient level of investment r^b that maximises this joint value) for the following first-order condition to Eq. (3.1):

$$F[V(r^{b*})].[V'(r^{b*})] = 1 \tag{3.2}$$

Therefore at the efficient level of investment, we have:

$$V'(r^{b*}) = \frac{1}{F[V(r^{b*})]} > 1, \text{ since } \int_{\underline{c}}^{V(r^b)} dF(c) < \int_{\underline{c}}^{\bar{c}} dF(c) \tag{3.3}$$

Now for comparison purposes, 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:

$$\max_{r^b} V(r^b) - r^b \tag{3.4}$$

We solve for $r^b = r^b_c$ that satisfies the first-order condition as follows:

$$V'(r^b_c) = 1 \tag{3.5}$$

where r^b_c is the investment level under no uncertainty.

The term $F[V(r^b)]$ 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 $V'(r^{b*}) > 1 = V'(r^b_c)$, this means that, as $V''(r^b) < 0$, 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. ■

3.3 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 a breach. Typically in the incomplete contract framework, the damage measures are expected to fulfil three aspects: first, it should serve as an implicit substitute for a more complete contract; second, it should induce efficient reliance or effort; and lastly, it should induce optimal risk-bearing (see, Posner, 1972 and Shavell, 1980). Notice that as both agents are risk neutral risk-bearing is not therefore a concern here.

A contract may include a breach mechanism (as per the requirement of civil law, or otherwise) 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 release herself from 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 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 to renegotiate or to terminate it before completion). Thus, the specific performance, from an analytical perspective, can be seen as 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^b, then the reliance damage amounts to $D = r^b$. However, sometimes the reliance damage may not be implementable in the case where r^b is not verifiable (i.e. if the value enhancing investments by the agents are truly hidden actions). When the breach occurs, 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^b.

Thus the law of contract has more than one rule for resolving disputes. Now, in the case of a 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. Let us now turn to evaluate the effect of each of these rules one by one.

3.3.1 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, then $D_s = 0$. 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 $V(r^b) > p$ in any contract, it must be that the seller breaches too often when compared to the first-best level of an efficient breach.

The probability of performance is now: $\int_{\underline{c}}^{p} dF(c) = F(p)$.

Given this, the buyer's expected payoff from the contract is:

$$\begin{aligned}\mathrm{EP}_S^b &= F(p).[V(r^b) - p - r^b] + [1 - F(p)].(0 - r^b)\\ &= F(p).[V(r^b) - p] - r^b\ . \end{aligned} \tag{3.6}$$

$$\text{The first order condition is: } F(p).V'(r_s^b) = 1. \tag{3.7}$$

Note that, since $V(r^{b*}) > p$, we must have $\int_{\underline{c}}^{p} dF(c) < \int_{\underline{c}}^{V(r^{b*})} dF(c)$, and therefore we have the following:

$$V'(r_s^b) = \frac{1}{F(p)} > \frac{1}{F[V(r^{b*})]} = V'(r^{b*}). \tag{3.8}$$

The expression (3.8) suggests that with no explicit damages, the buyer under-invests in reliance, that is he is effectively being held up by the seller. The intuition is that although the buyer fully internalises any social cost of the breach, the seller breaches too often, and thereby the buyer is induced to under-invest.

Remarks.

1. In absence of any contractual liability, that is 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. That is why the hold-up problem arises.
2. Note that the seller's private information may play a significant role in the investment incentives to the parties through her price setting power (price p goes up in that case, so does $F(p)$). Therefore the buyer's investments do increase with the price-setting power of the seller. The reason being that, as the price increases, the possibility of a breach decreases, so the buyer's incentive to invest gets a boost.
3. 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).

3.3.2 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 a breach is $\{-r^b\}$. Reliance damages are computed as the difference between these two: $D_{r^b} = 0 - (-r^b) = r^b$.

Let us consider the seller's choice problem first. Once again, she performs only when:

$$p - c \geq -D_{r^b} \quad \text{or when:} \quad p - c \geq -r^b \quad \text{or when:} \quad c \leq p + r^b. \tag{3.9}$$

Thus, *reliance damages under-compensate the buyer (aggrieved party) in the event of breach, and therefore charges the seller a "price" of breaching that is too low.*

$$\text{The probability of performance is: } \Pr[c \leq p + r^b] = F(p + r^b). \tag{3.10}$$

Let us now consider the buyer's choice problem. Given the probability of a breach by the seller, and the reliance damages D_{r^b}, the expected payoff to the buyer is:

$$\begin{aligned} \mathrm{EP}_R^b &= F(p + r^b).[V(r^b) - r^b - p] + [1 - F(p + r^b)].(D_{r^b} - r^b) \\ &= F(p + r^b).[V(r^b) - r^b - p]. \end{aligned} \tag{3.11}$$

The first-order condition is:

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

$$\text{or,} \qquad V'(r_R^b) = 1 - \frac{f(p + r_R^b)}{F(p + r_R^b)}[V(r_R^b) - r_R^b - p] \leq 1. \tag{3.12}$$

Therefore, the buyer over relies $r_R^b > r^{b*}$ under the reliance damage remedy.

Remarks.

1. *Intuitions:* (a) As r^b is returned to the buyer, by the court, in the event of a breach the buyer ignores the loss of r^b 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 damages measure, this excessive reliance arises 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 a breach, and this in turn he can accomplish by increasing his reliance—the higher is the reliance by the buyer, the more the seller will have to pay in damages if she breaches, and thus the less often will she commit a 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 here is that 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.

3.3.3 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 pay-off is: $[V(r^b) - p - r^b]$.And if the contract is not performed, the buyer's position is: $[0 - r^b]$.

Thus, expectation damage is simply the difference between the two amounts derived above:

$$d_e = \{V(r^b) - p - r^b\} - [0 - r^b] = V(r^b) - p. \tag{3.13}$$

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 the gain from the performance exceeds the damages to be paid in the event of a breach). This means that the performance will occur *iff*:

$$p - c \geq -d_e \qquad \text{or:} \qquad p - c \geq -[V(r^b) - p] \qquad \text{or:} \qquad V(r^b) \geq c. \tag{3.14}$$

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

The probability of performance is now: $\int_{\underline{c}}^{V(r^b)} dF(c) = F[V(r^b)]$.

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

$$\begin{aligned} \mathrm{EP}_e^b &= F[V(r^b)][V(r^b) - p - r^b] + [1 - F[V(r^b)]](d_e - r^b) \\ &= V(r^b) - p - r^b > 0\,, \quad \text{[replacing } d_e\text{]}. \end{aligned} \tag{3.15}$$

And the seller's expected payoff would be:

$$\begin{aligned} \mathrm{EP}_e^s &= F[V(r^b)].[p - E(c|c \leq V(r^b)] - [1 - F[V(r^b)]].d_e \\ &= p - F[V(r^b)].E(c|c \leq V(r^b)) + [1 - F[V(r^b)]].V(r^b). \end{aligned} \tag{3.16}$$

The buyer chooses r^b to maximise his pay-off in Eq. (3.15). Let us denote the reliance investment under expectation damages by r_e^b. The first-order condition is:

$$V'(r_e^b) = 1\,, \tag{3.17}$$

which maintains that investment r^b will be adjusted to a level such that the marginal return equals the marginal cost. This means that $r_e^b > r^{b*}$, 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.

   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 it in Eq. (3.3)].

3.3.4 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 $D \in R^+$) 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 $p - c < -D$, that is $c > p + D$; 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, the expected joint value of contract can be calculated as follows:

$$\begin{aligned} \text{EPJ} &= [1 - F(p + D)].[(D - r^b) + (-D)] \\ &\quad + F(p + D).[\{V(r^b) - p - r^b\} + \{p - E(c|c \le p + D)\}] \\ &= F(p + D).[V(r^b) - E(c|c \le p + D)] - r^b \end{aligned}$$

We want to maximise this expected joint pay-off with respect to a D bounded in the region $[0, p - \underline{c}]$. 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 3.1. *Define the optimal damage as* $D^* = \arg\max \text{EPJ}(D)$*; thus* $D^* = \min[V(r^b) - p, p - \underline{c}]$.

Proof. The first-order condition gives us:

$$\begin{aligned} \text{EPJ}'(D) &= f(p + D).1.V(r^b) - f(p + D).1.(p + D) \\ &= \{(V(r^b) - (p + D)\}.f(p + D)\ . \end{aligned}$$

And the second-order condition gives us:

$$\text{EP}''(D) = f'(p + D).V(r^b) - [f'(p + D).1.(p + D) + f(p + D).1]\ .$$

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

$$\begin{aligned} &\text{EP}'\{V(r^b) - p\} = 0 \\ \text{and,} \qquad &\text{EP}''\{V(r^b) - p\} = -f(V(r^b)) < 0 \end{aligned}$$

Of course, this requires $V(r^b) - p \le 0$. But this contradicts our assumption, thus we have $D^* = \left\{V(r^b) - p\right\}$, and if not then we get $D^* = \{p - \underline{c}\}$, depending upon the claim. ■

From the expression above, it is clear that the joint pay-offs are highest when $D^* = \{V(r^b) - p\}$ or, $\{p - \underline{c}\}$. The first term, $\{V(r^b) - p\}$, corresponds to the expectation damages breach remedy under which the breach decision is always efficient. And the second term, $\{p - \underline{c}\}$, refers to the case synonymous with specific performance; this measure although capable of maximising joint surplus forces the seller to perform irrespective of her cost of performance since if she contemplates a 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 parties are willing to enter into the relationship.

We now rank these breach remedies in terms of efficiency, for a given price $p < V(r^b) - r^b$. As noted above, the expectation damages rule $D = V(r^b) - p$ 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, that is $D = 0$. This breach remedy is (weakly) dominated by the reliance damages $D = r^b$. However, since $p + r^b < V(r^b)$, 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 $\{V(r^b) - r^b - c\}$. 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 an inappropriate breach. In general, this can go either way (See, Shavell, 1984). Finally, in the case where 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*,[13] in the case where 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 that the expectation damage rather than any other court-specified breach remedy available under Civil or Common Laws. Exactly how the joint surplus is divided (i.e. how large a price p is) depends on the bargaining power of both parties at the contracting stage.

To summarise the ongoing discussion in the form of a claim:

Claim 3.1. *Under a fixed price contract that has unilateral self-investment (by the non-breaching party) and single-dimensional ex post asymmetry (uncertainty) pertinent to the breacher, none of the court-imposed damage remedies result in an efficient outcome. Only the expectation damage measure provides optimal incentives to perform, yet it does not provide optimal incentives to rely on.*

3.4 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 on and the proper incentives to perform. To elaborate this issue we now focus on other measures that are available to the parties; namely liquidated damages which is a more sophisticated version of expectation damages.

3.4.1 Liquidated Damage *(Party-Designed Damage)*

Often 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 "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 a 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:

$$p - c \geq -D_L \qquad \text{or if:} \qquad c \leq p + D_L \tag{3.18}$$

Let us call $(p + D_L) \equiv T$ the *breach cost*. Therefore, the probability of performance turns out to be $F(p + D_L) = F(T)$ and that of the breach becomes $[1 - F(p + D_L)] = [1 - F(T)]$.

Now, the buyer's expected pay-off is:

$$\mathrm{EP}_L^b = F(p + D_L).[V(r^b) - p] + [1 - F(p + D_L)].D_L - r^b \tag{3.19}$$

And the seller's expected pay-off is:

$$\begin{aligned} \mathrm{EP}_L^s &= F(p + D_L).[p - E(c|c \leq p + D_L)] + [1 - F(p + D_L)].(-D_L) \\ &= F(T).T - D_L - F(T).E(c|c \leq T) \end{aligned} \tag{3.20}$$

Therefore, the joint expected pay-off under liquidated damage is:

$$\mathrm{EP}_L^J = F(p + D_L).V(r^b) - r^b - F(p + D_L)E(c|c \leq p + D_L).$$

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

$$\max_{p+D_L,\, r^b} \mathrm{EP}_L^b(p, D_L, r^b)$$

$$\text{subject to} \quad \mathrm{EP}_L^s \geq 0 \qquad [IR] \tag{3.21}$$

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 ($p' = p - \varepsilon$, $D'_L = D_L + \varepsilon$), $\varepsilon > 0$ and very small. Since $p' + D'_L = p + D_L = T$, we show that the buyer's pay-off goes up, while the seller's pay-off has gone down.

Note that $\mathrm{EP}^b_L = F[p+D_L].[V(r^b)-p]+\{1-F[p+D_L]\}.D_L-r^b$, can also be written as $\mathrm{EP}^b_L = F[T].V(r^b)+D_L-F[T]\}.T-r^b$, which means that EP^b_L is strictly increasing in D_L. In a similar vein, the seller's expected pay-off $\mathrm{EP}^s_L = F(T).T - D_L - F(T).E(c|c \leq T)$ is strictly decreasing in D_L. Thus, since ε 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

$$\max_{p+D_L,\, r^b} \left[F(p + D_L).V(r^b) - r^b - F(p + D_L).E(c|c \leq p + D_L)\right] \tag{3.22}$$

This is exactly the total expected surplus maximisation problem; hence the resulting pay-offs 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 all the 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 pay-off, and then manipulate the price term in the contract to ensure the seller's expected pay-off is zero.

Thus optimisation of expression (3.22) gives us the followings:

$$f(p + D_L).[V(r^b) - (p + D_L)] = 0\ , \tag{3.23}$$

and

$$F(p + D_L).V(r^b) - 1 = 0\ . \tag{3.24}$$

We derive the following lemmata:

Lemma 3.2.

$$
\begin{aligned}
p^* + D_L^* &= V(r^{b*}) \, , \\
D_L^* &= F[V(r^{b*})].V(r^{b*}) - F(V(r^{b*})).E(c|c \leq V(r^{b*})) \, , \\
p^* &= [1 - F[V(r^{b*})].V(r^{b*}) + F[V(r^{b*})].E(c|c \leq V(r^{b*})) \, , \\
\mathrm{EP}_L^b &= D_L^* - r^{b*} , \\
\mathrm{EP}_L^s &= 0 \ .
\end{aligned}
\tag{3.25}
$$

Proof. p^* and D_L^* are directly derived from Eq. (3.23) since $f(p + D_L) \neq 0$. $\mathrm{EP}_L^s = 0$ has been already established. Using $\mathrm{EP}_L^s = 0$ and $p^* + D_L^* = V(r^{b*})$ gives us the second condition. Therefore, the buyer's equilibrium payoff is:

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

Lemma 3.3. *The buyer, uninformed contract proposer, under liquidated damage measures takes on the socially desired efficient level of investment, when there is one-sided private information held by the seller.*

Proof. Using the previous lemma and Eq. (3.24), we derive the condition for the present lemma: $F(p^* + D_L^*)V'(r^{b*}) = 1$. $\blacksquare$

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^b and the breach decision. Let us consider the choice of p and D_L at the start 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 Eq. (3.25), 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^b by the buyer into account, then when the buyer comes to choose r^b, he will not over-invest but rather make an efficient investment.

Remarks.

1. Observe in the first equation in Lemma 3.2 that $D_L^* = V(r^{b*}) - p^*$, that is in equilibrium the buyer designs a liquidated measure that is equivalent to *perfect expectation* damages.
2. Note that $D_L^* = V(r^{b*}) - p^*$ also ensures that the seller's breach decision is always ex post efficient, given the choice of efficient ex ante reliance investment r^{b*} 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 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 damage 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 third-party effect present. Furthermore, in this case, the court just needs to ascertain the fact that $D_L^* = V(r^{b*}) - p^*$, that is equivalent to expectation damage and is not punitive.

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

Claim 3.2. *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.*

3.5 Conclusion

Amongst all the court imposed damages, the 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 damages 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 the 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.

Notes

1. Note that from a pure contract-theoretic point of view, the model developed here 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.
2. This hold-up literature spans industrial organisation, labour and comparative institutions (see, for example, Grout, 1984; Hart & Moore, 1988; Klein, Crawford, & Alchian, 1978; Williamson, 1975, 1985). Hold-ups play a central role in recent attempts, for example, Grossman and Hart (1986),

to broaden and deepen the investigation begun by Coase (1937) into the boundaries of the firm.

3. When investments are purely cooperative, the parties tend to under-invest and the best initial contract is no contract at all. See, Che and Chung (1999).
4. Cooperative investments are particularly natural if the seller produces the good at Time 1 (efforts increase the quality of the 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 Time 2 valuation by investing in Time 1. See Che and Chung (1999) for more on deferred exchange and nature of investment.
5. Indivisibility is just a standard assumption in the contract literature (e.g., Besanko & Spulber, 1992). It simplifies our analysis by suppressing the issue of quantity choice and helps highlight the issues of a breach—a particular concern to us since the court does not treat this as a divisible contract (as was the case for Edlin and Reichelstein).
6. 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 the ex ante bargaining power of the parties.
7. It could be discrete or continuous. Analysis could proceed on either premise, but here we concentrate on a continuous case.
8. Note here that $\underline{c} \leq \underline{V} \leq \bar{c} \leq \bar{V}$. This signifies that the gains from trade are not always positive. Depending upon the realisation of the cost and value pair, the gains from trade may be negative.
9. See, Note 4 in Chap. 6 for a detailed discussion on our no-renegotiation assumption.
10. For more details see Posner (1986).
11. 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 common knowledge between the parties that the gains from trade exist always.
12. For differentiation we have used the following formula of the fundamental theorem of integration:

$\frac{d}{dt}\int_{g(t)}^{h(t)} f(x)dx = f(h(t)).h'(t) - f(g(t)).g'(t)$

13. A mutually optimal completely specified contract is one in which 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 this kind of contract.

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4

Economics of Damage Remedies II: *Bilateral Reliance, One-Sided Information Asymmetry*

4.1 Introduction

In this chapter we extend our basic unilateral investment model discussed in the previous chapter into a setting of two-sided reliance investments in an environment where one of the contracting parties in the post-contracting phase receives information about his or her utility privately,[1] (i.e. profit or cost function that remain hidden to the other party and to the courts). As usual, reliance investments are specific to the relationship, but not contractible. As for the quantity choice of the specific commodity, we stick to binary performance choice for the analysis in this chapter and extend it to allow for continuous choice.[2] All the usual court-imposed damage measures are systematically explored. We begin 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 the courts.

When both parties undertake selfish investments in the individual valuation function and thereby augment the social surplus, any damage measure—to be optimal—should induce efficient ex ante reliance investments for both parties as well as ex post allocative efficiency. One

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might conjecture that mutual reliance will produce a confidence building effect—in economic jargon called *hostage-taking*balance—through which the under-investment problem will be eliminated automatically. Our analysis in this chapter will show, however, that mutual reliance by both parties does indeed help to increase the level of reliance of each of them to some extent but that the conjecture is not valid entirely. It is observed that when parties write a fixed-price contract the non-availability of any damage measure, for example restitution damage, still 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 parties with inefficient and differential incentives to rely on: we get an interesting result where the victim of the breach over-invests whereas the breacher under-invests.

4.2 The Model: Bilateral Reliance and One-Sided Private Information

4.2.1 General Setting

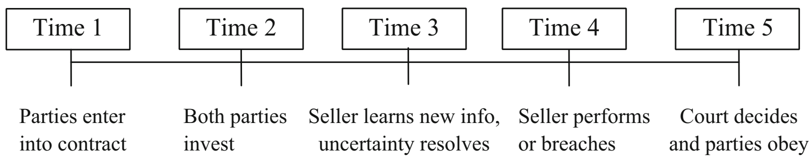
Let us consider a particular contract where there is a single (male) buyer, B, who contracts to purchase one unit of an indivisible specific good from a single (female) seller S. Both are risk neutral. The parties enter into a simple fixed-price contract at Time 1. At the time of contracting, the parties are in a bilateral bargaining situation. The seller then will 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 maximum $\bar{V} = \max_{r^b \in R} V(r^b)$ and a minimum $\underline{V} = \min_{r^b \in R} V(r^b) > 0$. Note that $V(r^b = 0) > 0$, that is the value of trade is never zero, even if the buyer chooses not to invest. 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 the 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 around the seller's production cost, denoted by $c \in [\underline{c}, \bar{c}]$, which may be due to potential fluctuations in the market prices for the inputs. We here denote the seller's production cost as $c = C(r^s) + \theta$, where the expected value of cost (i.e. 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 the 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 obtain 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 the case where they are verifiable ex post in court, then reliance damage may be applicable. The rest of the assumptions related to the contract price and others are just the same as in the previous model in Chap. 2.

Periodic Structure for the Contract Model



The sequence of events can be summarised as follows.

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

4.2.2 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 the 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), a contract breach is efficient iff $v < c$; otherwise performance is efficient.

$$\begin{aligned}\text{Thus,}\quad \Pr[\text{performance}] &= \Pr[c \leq V(r^b)] = \Pr[C(r^s) + \theta \leq V(r^b)] \\ &= \Pr[\theta \leq V(r^b) - C(r^s)] \\ &= F[V(r^b) - C(r^s)] \end{aligned} \tag{4.1}$$

$$\begin{aligned}\text{And,}\qquad \Pr[\text{breach}] &= 1 - \Pr[\text{performance}] \\ &= 1 - F[V(r^b) - C(r^s)] \end{aligned} \tag{4.2}$$

Thus the expected joint pay-off would be:

$$\begin{aligned}\text{EPJ} &= F(.).[\{V(r^b) - r^b - p\} + \{p - E(c|c \leq V(r^b)) - r^s\} \\ &\quad +\{1 - F(.)\}.\{0 + 0 - r^b - r^s\} \\ &= F[V(r^b) - C(r^s)].\{V(r^b) - E(c|C(r^s) + \theta \leq V(r^b))\} - r^b - r^s \\ &= F[.].V(r^b) - F[.].E[C(r^s) + \theta|C(r^s) + \theta \leq V(r^b)] \\ &\quad -r^b - r^s \end{aligned} \tag{4.3}$$

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

for the buyer, $\text{EPJ}'(r^b) = 0$, which gives us:

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

$$\text{i.e.}\qquad F[V(r^b) - C(r^s)].V'(r^b) = 1$$

$$\text{i.e. } V'(r^{b*}) = \frac{1}{F[V(r^{b*}) - C(r^{s*})]} > 1, \; [\because V'(r^b) > 0, V''(r^b) < 0] \tag{4.4}$$

for the seller, $\text{EPJ}'(r^s) = 0$, which gives us:

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

$$\text{i.e.} \qquad F[V(r^b) - C(r^s)].C'(r^s) = -1$$

$$\text{i.e.} \quad -C'(r^{s*}) = \frac{1}{F[V(r^{b*}) - C(r^{s*})]} > 1, \; [\because C'(r^s) < 0, C''(r^s) > 0] \tag{4.5}$$

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. ■

4.3 Court-Imposed Remedies for Breach

Given the conditions for socially optimal breaches and investments, we now turn to assess the impact of the available remedies. We start with reliance and restitution damages.

4.3.1 Reliance and Restitution Damage Measures

Since we consider here a case of a 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 in court (we put off the debate on verifiability of reliance for the time being). Notice here we have identified a relationship between reliance damage and restitution damage measures through the variation in the value of β; when $\beta = 1$, the full reliance cost is recoverable; and when $\beta = 0$, no damage is recovered, which is synonymous with restitution damage.

Now the seller's pay-off when the contract is honoured is $P - c$; and when she breaches, her wealth is $-D_r$. Thus the seller chooses to perform when $P - c \geq -D_r$ that is $P + \beta.r^b \geq c$, otherwise she breaches. So the seller breaches too frequently relative to the first-best level.

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

Now the buyer's expected pay-off would be:

$$\text{EPB} = F(.).[V(r^b) - r^b - P] + \{1 - F(.)\}.\{\beta.r^b - r^b\} \tag{4.6}$$

The first-order condition for the buyer's pay-off maximisation is:

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

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

$$\begin{aligned} V'(r^b) &= (1 - \beta)/F(.) + \beta - \beta.[V(r^b) - P - \beta.r^b].f(.)/F(.)\,, \text{ if } 0 < \beta < 1 \\ &= 1 - [V(r^b) - P - r^b].\frac{f[P + r^b - C(r^s)]}{F[P + r^b - C(r^s)]}, \qquad \text{if } \beta = 1 \\ &= \frac{1}{F[P - C(r^s)]}, \quad \text{if } \beta = 0, \text{[this equals restitution damage]} \end{aligned}$$

Similarly, the seller's expected pay-off would be:

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

The first order condition (f.o.c) for the seller's pay-off maximisation is:

$$\text{EPS}'(r^s) = F[P + \beta.r^b - C(r^s)].[-C'(r^s)] - 1 = 0$$

thus we get:

$$-C'(r^s) = \frac{1}{F[P + \beta.r^b - C(r^s)]}, \qquad \text{if } 0 < \beta < 1$$
$$= \frac{1}{F[P + r^b - C(r^s)]}, \qquad \text{if } \beta = 1$$
$$= \frac{1}{F[P - C(r^s)]}, \qquad \text{if } \beta = 0,$$

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

Restitution Measure (when $\beta = 0$)

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

$$\text{For the buyer,} \qquad V'(r_S^b) = \frac{1}{F[P - C(r_S^s)]} > \frac{1}{F[V(r^{b*}) - C(r^{s*})]} \tag{4.7}$$

This implies that the buyer under-invests in reliance compared to the first best.

$$\text{For the seller,} \qquad -C'(r_S^s) = \frac{1}{F[P - C(r_S^s)]} > \frac{1}{F[V(r^{b*}) - C(r^{s*})]} \tag{4.8}$$

which implies that seller also makes less investment with respect to the first best.

Comparing (4.4) with (4.7) and (4.5) with (4.8), we can establish the following proposition (the "hold-up" consequence for both the parties):

Proposition 4.1. *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 the 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 as long as the benefit, in terms of 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", namely, he does not capture the full benefit of her reliance, but only a fraction of it, the buyer 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 the case of a breach she does not need to make any monitory payment; and, second, as she breaches too frequently, given a contractually specified low price, her motivation to investment in reducing the cost does not get the required encouragement.
3. Note that in the case where the seller, during the bargaining of the contractual price, 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.

Reliance Measure (when $\beta = 1$)

$$\text{For buyer,}\quad V'(r_R^b) = 1 - [V(r_R^b) - P - r_R^b].\frac{f[P + r_R^b - C(r_R^s)]}{F[P + r_R^b - C(r_R^s)]}$$

$$\leq 1 < \frac{1}{F[V(r^{b*}) - C(r^{s*})]} \tag{4.9}$$

This implies that the buyer would over-invest compared to first best.

And for the seller,
$$-C'(r_R^s) = \frac{1}{F[P + r_R^b - C(r_R^s)]} > \frac{1}{F[V(r^{b*}) - C(r^{s*})]} \tag{4.10}$$

This means that the seller still will be investing less relative to the first best; but the amount is higher when compared to the no-damage situation, as $F[P - C(r_S^s)] < F[P + r_R^b - C(r_R^s)]$.

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

Proposition 4.2. *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, that is the informed breacher, would under-invest in reliance always irrespective of the level of reliance of the buyer.*

Remarks. Intuition—Under reliance damages, the victim party (buyer) can shift the cost of reliance to the other party only in the event that the contract is breached, because this is the contingency where the seller 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 a 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 the breach is $V(r^b)$, the seller would sustain only a fraction of it, which is r^b. Note also that the reliance investments by both parties tend to increase as the contracted price increases.

4.3.2 Expectation Damage

Expectation damages are measured ex post and are calculated to make the injured party exactly as well off as if the contract were fully performed. As before, the expectation damage would be measured as $D_e = V(r^b) - p$. Therefore, the seller would perform only when $p - c \geq -D_e$ that is $c \leq V(r^b)$, otherwise she would prefer to breach the contract.

Now, $\Pr[\text{performance}] = F[V(r^b) - C(r^s)]$.

Thus the buyer's expected pay-off becomes:

$$\begin{aligned}\text{EPB}_e &= F(.).[V(r^b) - r^b - p] + [1 - F(.)].[D_e - r^b] \\ &= V(r^b) - r^b - p, \qquad \text{Replacing } D_e = V(r^b) - p.\end{aligned}$$

Therefore the f.o.c. gives us,

$$V'(r_E^b) = 1, \tag{4.11}$$

which means the buyer makes an over-investment in reliance.

Similarly, the seller's expected pay-off becomes:

$$\begin{aligned}\text{EPS}_e &= F(.).[p - E(c|c \leq V(r^b)) - r^s] + [1 - F(.)][-D_e + p - r^s] \\ &= p - r^s - V(r^b) + F(.).V(r^b) - F(.).E(c|c \leq V(r^b)).\end{aligned}$$

The f.o.c. requires $\text{EPS}_e'(r^s) = 0$, which implies that:

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

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

i.e. $$-C'(r_E^s) = \frac{1}{F[V(r_E^b) - C(r_E^s)]} < \frac{1}{F[V(r^{b*}) - C(r^{s*})]} =: -C'(r^{s*}) \tag{4.12}$$

that is the seller makes an over-investment in reliance. ■

Observations.

1. *The promisee (buyer) would over-invest in reliance.*
   Intuition: Suppose that the buyer can make an investment that will increase in value only if the parties trade. If the trade turns out to be inefficient, that is the seller's production cost exceeds the buyer's value, the investment will have been wasted. The buyer, in choosing an investment level, thus should consider the return on the investment in the states of the world in which the parties trade (positive) and the return on the investment in the states of the world in which the parties do not trade (zero). Contract law, however, awards the buyer the difference between his valuation given his investment 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. *The promisor (seller) engages in an over-investment in reliance.*
   Intuition: The reason for this excessive reliance by the seller is that, under the expectation measure, the buyer chooses an excessive level of reliance, and the seller has to internalise fully the buyer's actual loss from the 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 would be quite interesting to analyse the case where the buyer makes a selfish investment and the seller engages in a reliance investment that only augments the buyer's value of performance (cooperative investment). It may well be socially beneficial for the seller to undertake that reliance, but her incentive to do so may be limited if this were to increase the damages she would have to pay under the expectation measure. These issues are left open for future research.
4. With the help of the following corollary, we establish that, when one of the two contracting parties, possessing ex post private information, simultaneously controls the 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, that is$\{0,1\}$.

Corollary 4.1 (Case of Unilateral Investment by Promisor). *In a unilateral investment case, expectation damage induces first-best investment and a breach (even in a binary trading choice) when the informed party explicitly controls breach and investment decisions.*

Proof. As before, when $r^b = 0$, the expectation damage would be measured as $D_e = V(0) - p$. Therefore, the seller would perform only when $p - c \geq -D_e$, that is $c \leq V(0)$, otherwise she would like to breach the contract.

Thus, Pr[efficient performance] = $F[V(0) - C(r^s)]$.

Therefore the buyer's expected pay-off becomes:

$$\text{EPB}_e = F(.).[V(r^b) - r^b - p] + [1 - F(.)].[D_e - 0] = V(0) - 0 - p, \quad (4.13)$$

Similarly, the seller's expected pay-off becomes:

$$\begin{aligned} \text{EPS}_e &= F(.).[p - E(c|c \leq V(0)) - r^s] + [1 - F(.)][-D_e + p - r^s] \\ &= p - r^s - V(0) + F(.).V(0) - F(.).E(c|c \leq V(0)) \end{aligned} \quad (4.14)$$

The f.o.c. implies that $\text{EPS}_e'(r^s) = 0$, which gives us

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

i.e. $$C'(r^s) = -1/F[V(0) - C(r^s)] \quad (4.15)$$

This exactly corresponds to the first best condition where we insert $r^b = 0$ in Eq. (4.5). This means the seller makes an efficient investment again when only she invests. ■

Remark. In a unilateral investment case, our result is more general in the sense that even with binary quantity choice expectation damage induces efficient investment. Edlin and Reichelstein (1996) established the efficiency of expectation damage in a divisible and continuous trading choice (with the help of renegotiation). The seller, whose cost is uncertain and non-verifiable, controls both the breach decision and reliance. To see why control matters, suppose that g is the expectation return of the victim and denote the surplus under a contract as W; the surplus is the sum of the parties' profits. The breaching party thus receives the amount $(W-g)$, the surplus that remains after compensating the victim. Suppose that this party could make a self-investment. The investment benefits her by increasing the total surplus but it (being selfish) does not directly affect the victim's return g. The breaching party thus is the full residual claimant and so she makes investments whose return exceeds the cost.

We can establish the following important claim from the above discussions:

Claim 4.1. *In the case of one-sided asymmetry under a fixed price incomplete contract with a binary trading choice then: (a) for 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) for bilateral investment, the expectation damage remedy would induce both parties to over-invest. An efficient breach is always achieved.*

Note. Thus when the parties form a contract they should choose the price in such a way that the party who is investing and has uncertainty related to its valuation becomes the potential breacher. This would ensure efficiency not only in performance but also in reliance. In the next chapter in Sect. 5.3.1 (case SB) we shall deal with these issues in more detail.

4.4 Party Designed Liquidated Damage

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

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

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

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

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 that consists of his opportunity costs p and the damage D_L.

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

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

Given the probability performance, the buyer's expected pay-off is:

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

And the seller's expected pay-off is:

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

$$\text{So,}\quad \mathrm{EP}_L^b + \mathrm{EP}_L^s = F(.)\{V(r^b) - E(C(r^s) + \theta | C(r^s) + \theta \leq p + D_L)\} \\ -r^b - r^s.$$

We obtain the following lemma:

Lemma 4.1. *For any given $T \equiv p + D_L$ and $p > 0$, the buyer can always be made strictly better off by increasing D_L and decreasing p by the same amount, thereby keeping T constant.*

Proof. Note that the buyer's expected pay-off can also be written as:

$$\mathrm{EP}_L^b = F[T - C(r^s)].V(r^b) + D_L - F[T - C(r^s)].T - r^b$$

which is strictly increasing in D_L.

The lemma implies that, for a given T, the 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 to lowering p due to the non-negativity constraint and the seller's participation requirement. ■

Under asymmetric information, the principal cannot observe the agent's effort. Since the buyer, as a principal, determines p and DL to maximise his expected pay-off, thus the buyer's programme is then to offer the seller a contract (p, D_L) that will maximise his expected pay-off subject to a participation constraint (IR), so that the agent receives a non-negative utility, and an incentive constraint (*IC*) for the seller, so that she is incentivised to adopt an efficient level of reliance. Note that this IC was absent in the maximisation problem (3.21) in the last chapter, as the seller was not undertaking any reliance. We assume that the buyer has all the bargaining power in contracting, that is he makes a take-it-or-leave-it offer to the seller, who can accept or reject the contract. If she rejects, the outcome is $(q, p) = (0, 0)$. This is the seller's reservation bundle, so her reservation utility is $c = 0$ as there is no market alternative.

Thus we have the following optimisation problem:

$$\max_{p,D_L,r^b,r^s} \mathrm{EP}^b_L(p, D_L, r^b)$$

$$\begin{aligned} \text{subject to} \quad (i) \quad & \mathrm{EP}^s_L \geq 0 && [\mathrm{IR}] \\ (ii) \quad & \max_{r^s} \mathrm{EP}^s_L && [\mathrm{IC}] \end{aligned} \tag{4.16}$$

Aside, the seller's maximisation problem gives us the following f.o.c.:

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

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

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

$$\begin{aligned} &\max_{p,D_L,r^b,r^s} \mathrm{EP}^b_L(p, D_L, r^b) \\ &\text{subject to} \quad \text{(i)} \quad \mathrm{EP}^s_L \geq 0 \qquad [\mathrm{IR}] \\ &\qquad\qquad\quad \text{(ii)} \quad F(.).C'(r^s) = -1 \qquad [\mathrm{IC}] \end{aligned}$$

The buyer, by assumption, has the entire bargaining power and thus extracts the entire ex ante surplus, which entails that the participation constraint is binding in the light of Lemma 4.1.

We additionally derive the following lemmata:

Lemma 4.2.

$$\begin{aligned} p^* + D^*_L &= V(r^{b*}); \\ D^*_L &= F[V(r^{b*}) - C(r^{s*})].\{V(r^{b*}) - E(c|c \leq V(r^{b*}))\} - r^{s*}; \\ p^* &= \{1 - F[V(r^{b*}) - C(r^{s*})]\}.V(r^{b*}) \\ &\quad + F[V(r^{b*}) - C(r^{s*})].E(c|c \leq V(r^{b*})) + r^{s*}; \\ \mathrm{EP}^b_L &= D^*_L - r^{b*}; \\ \mathrm{EP}^{s\,*}_L &= 0. \end{aligned} \tag{4.17}$$

Lemma 4.3. *Both the seller (promisor) and the buyer (promisee) make efficient investment vis-à-vis the socially desired level of investments under liquidated damage remedy when one-sided private information (pertinent to the promisor) is present.*

Proof of Lemmata 2 and 3. We provide a joint proof of the lemmata as they are interlinked with each other.

Substituting IR into the objective function we get:

$$F(.)V(r^b) - F(.)E[C(r^s) + \theta | C(r^s) + \theta \leq p + D_L] - r^b - r^s \tag{4.18}$$

Now replacing IC, the previous expression can be rewritten as:

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

Maximising the expression just above with respect to r^b gives us the following:

$$-\frac{1}{C'(r^s)}.V'(r^b) = -1 \qquad \text{or,} \qquad V'(r^{b*}) = C'(r^{s*}) \tag{4.19}$$

that is marginal returns from reliance investments by the parties are equal.

Now maximising the expression (4.17) with respect to r^s gives us the following:

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

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

$$\text{i.e.} \qquad V(r^{b*}) = (p^* + D_L^*), \qquad [\text{since } f(p + D_L - C(r^s)) \neq 0] \tag{4.20}$$

that is the optimum total breach cost is equal to the optimum valuation of the buyer. Thus we have $r^{b*} = V^{-1}(p^* + D_L^*)$.

Putting $p^*$and D_L^* into the seller's pay-off function, we get the seller's equilibrium pay-off:

$$\begin{aligned}\mathrm{EP}_L^{s*} &= F[p^* + D_L^* - C(r^{s*})].[p^* - E(c|c \le V(r^{b*}))] \\ &\quad +[1 - F[p^* + D_L^* - C(r^{s*})]](-D_L^*) - r^{s*} \\ &= F[p^* + D_L^* - C(r^{s*})].[p^* - E(c|c \le V(r^{b*}))] \\ &\quad +[1 - F[p^* + D_L^* - C(r^{s*})]].(p^* - V(r^{b*})) - r^s, \\ &= p^* - F[p^* + D_L^* - C(r^{s*})].E(c|c \le V(r^{b*})) \\ &\quad -[1 - F[p^* + D_L^* - C(r^{s*})]].V(r^{b*}) - r^{s*} \qquad (4.21)\end{aligned}$$

When we set $\mathrm{EP}_L^{s*} = 0$, then

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

Thus, $D_L^* = F[p^* + D_L^* - C(r^{s*})].\{V(r^{b*}) - E(c|c \le V(r^{b*}))\} - r^{s*}$
Therefore, the buyer's equilibrium pay-off is:

$$\begin{aligned}\mathrm{EP}_L^{b*} &= F[p^* + D_L^* - C(r^{s*})].[V(r^b) - p^*] \\ &\quad +[1 - F[p^* + D_L^* - C(r^{s*})]].D_L^* - r^{b*} \\ &= F[p^* + D_L^* - C(r^{s*})].[p^* + D_L^* - p^*] \\ &\quad +[1 - F[p^* + D_L^* - C(r^{s*})]].D_L^* - r^{b*} \\ &= D_L^* - r^{b*} \qquad \blacksquare \quad (4.22)\end{aligned}$$

Note that so long as the buyer's valuation is observable, the breach cost $T = v$ is the unique optimum. The corresponding contract price offered by the buyer is p^*, which just satisfies the reservation price of the seller. Similarly, if the seller has all of the bargaining power, then she will maximise profits subject to the buyer's acceptance of the terms (i.e.

$EP_L^b \geq 0$), which is identical to the buyer's programme above, and so we again find $T = v$. Note, however, that the price paid by the buyer to the seller under this scheme is $p = v$, which extracts all of the buyer's rent.

Finally, if a *broker* proposes a contract to the parties, he or she 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 a breach will occur if and only if it is efficient.

Liquidated damages are meant to compensate fully the promisee. At first sight, liquidated damages seem to be equivalent to the expectation measure. "Fully" includes the expected profits (only in cases where the expected profits are compensated, the promisee is really indifferent with regard to performance or breach).

Notes

1. Akerlof (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.
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 a similar line, Bebchuk (1984) has 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 his paper, one party is assumed to have superior information about the other party's expected pay-off, and not only his own, in the case where 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 a somewhat different domain to that which our present work focuses upon.

As opposed to the scenarios described above, similar to Fudenberg and Tirole (1983) and Rubinstein (1985), we consider the private information that is held by parties only to concern their own preferences, and thus only about their own pay-offs.

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5

Economics of Damage Remedies III: Incentives Under Expectation Damage With One-Sided Private Information – A Mechanism Design Approach

5.1 Introduction

In this chapter we continue to consider a trading environment where both parties undertake selfish reliance investment in their respective value functions; however, once the contract is written, one of the two parties receives information about his or her valuation or cost function that remains hidden from the other party and to the courts. However, we shall introduce an interesting twist to our analysis. Thus far, up to the last chapter, we have been considering a case where the only party (i.e. seller), who obtains ex post private information (about her cost), chooses to breach the contract, so assessing the expectation interest of the victim (buyer), who does not hold any private information (on value), by a court was possible. However, here the twist is that we rather permit the breach by either of the two parties irrespective of whether private information is obtained or not.

When the non-breaching party holds the private information, the verification of expectation damage is difficult. In this situation, the victim of a breach may be denied the full recovery of expectation damage as the courts may be unable to gauge it correctly. This has a direct implication

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for the incentives to the parties under expectation damage.[1] This chapter focusses on this aspect of expectation damage remedy only, as the analysis of other damage remedies are tractable along the lines of previous chapters. Further, we shall consider the trading of a divisible good, which is a departure from the previous two chapters. This 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 fundamental forces that shape optimal contracts as well as the optimal damage remedy in this canonical contracting problem. We then discuss the application of these damage measures in situations where the courts cannot perfectly assess the victim's valuations of the contract (as it is information private to the concerned party).

Earlier economic analyses of contract law have shown (e.g. Shavell, 1980, 2005) that in an environment with unilateral reliance investment and ex post symmetric information, there will be incentives toward excessive reliance both under the expectation measure and reliance 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, questioned the over-reliance result. In a setting of continuous quantity choice, they show that the expectation or specific performance damage measure provides 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 choice in the contract is a powerful tool to adjust incentives. But when both 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 pay-off functions). They also observe that a specific performance remedy induces a symmetry that allows simple contracts to obtain the first best for a particular class of pay-off function.

Whether expectation damage provides efficient incentives or not, if granted, it must be verified in the courts. Accordingly, we segregate two cases according to whether the victim's expectancy is ex post verifiable or not. When the valuation of the victim of a breach is observable and verifiable to a court, our analysis, in either setting of binary or continuous performance choice, shows that while allocative efficiency is achieved under expectation damage remedy, it leads both parties to rely excessively. On the other hand, if the victim of a 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 the 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 liquidated damage clauses. Schweizer (2006) in a similar setting of asymmetric information (but unilateral reliance case) shows that the performance of expectation damages falls short of what more general mechanisms could achieve. Schweizer (2000) is also closely related. The analysis also considers whether these solutions to the valuation problem alleviate or exacerbate opportunistic behaviour by the parties.

Thus we focus especially on the issue of assessing expectation damages under ex post asymmetric information. We use a particular class of revelation mechanisms of the *Groves-Clarke* type that assess expectation damages correctly, and further 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 only performance decisions 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 (1983). Therefore, assessing expectation damages correctly is at odds 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 the (ex post) symmetric information framework of ER.

To sum up, while expectation damages may work well under (ex post) 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.

5.2 The Model

5.2.1 The General Setting

Let us delineate the general setting of the model, which is an adaptation of the model by Schweizer (2006) with unilateral reliance and one-sided asymmetric information. We augment the model set up to accommodate bilateral reliance. We follow a similar sequence of events, as in the last chapter, that can be summarised as follows:

The parties sign a contract and may specify the delivery price p at Time 1. $\longrightarrow$ Next, at Time 2, both make the reliance investment. $\longrightarrow$ At Time 3 uncertainty becomes resolved and private information accrues (θ, see below) either to the buyer or seller. So the seller observes her cost of production $C(.)$ with private information or without it, consequently the buyer realises his value $V(.)$ without private information or with it (respectively). $\longrightarrow$ At Time 4, either the seller or buyer decides whether to respect (perform) the contract or repudiate it (irrespective of holding private information). If the seller (buyer) breaches, the buyer (seller) files a lawsuit at no cost in-between Time 4 & 5. $\longrightarrow$ The court awards damages of D, which may be a function of investments and p at Time 5.

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 $\Theta = [\theta_L, \theta_H]$ with $\theta_H > \theta_L \geq 0$; where θ is a random variable whose 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 $Q = [q_L, q_H]$.[2] Notice here the departure: 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. Although we are adopting the trading of a divisible good with continuous performance choice, we shall make the necessary comments related to binary setting at the relevant places.

Let us introduce the general functional forms for the valuations of trading parties. Depending upon who holds the ex post private information, for any quantity choice q and their respective reliance investments, we specify two sets of functions for each agent here, as follows:

$$\text{for the buyer : } V(r^b, \theta, q), \text{ if he obtains the private information}$$
$$V(r^b, q), \quad \text{if he does not obtain it}$$

$$\text{for the seller : } C(r^s, \theta, q), \text{ if she obtains the private information}$$
$$C(r^b, q), \quad \text{if she does not obtain it}$$

As before, the buyer's value function is monotonically increasing and strictly concave in its investment, that is $V'(r^b, .) > 0$ and $V''(r^b, .) < 0$; whereas the seller's cost is monotonically decreasing and convex in investment, that is $C'(r^s, .) < 0$ and $C''(r^s, .) > 0$. As usual, reliance investments are specific to the relationship, but not contractible, and each party's investment does not directly affect the other party's pay-off, only indirectly via the optimal quantity, which is higher the more the parties invest.

Suppose, ex post trading surplus (between Time 4 & 5) amounts to:

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

$$\text{and, } G_S(r^b, r^s, \theta, q) = V(r^b, q) - C(q, \theta, r^s), \text{if S obtains private information.}$$

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. We shall be treating these two situations separately. Following the flow of analysis so far, we shall first take up the cases where only the seller holds the private information but either party can unilaterally choose to breach, and later demonstrate the buyer's private information case.

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

Let us explain these assumptions. Assumption (a) requires that the buyer's pay-off net of investment costs be strict monotonically increasing and concave as a function of performance choice. Assumption (b) requires that the seller's pay-off net of investment costs be monotonically increasing (and concave). Assumption (c) guarantees that the buyer's pay-off increases with respect to the increase in θ, that is private information. Similarly, Assumption (d) requires that as the private information factor rises for the seller, her cost decreases.

5.2.2 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 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) where reliance investment and the movement of nature are given. Note that this performance choice is unique[3] for each type. Correspondingly, when S holds private information, we define the social surplus net of investment costs as follows:

$$W(r^b, r^s, \theta, q^+) = V(r^b, q^+) - C(r^s, \theta, q^+) - r^b - r^s.$$

Thus efficient reliance investments are then defined as:

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

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

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 $q^*(\theta) = q^+(r^{b*}, r^{s*}, \theta)$, that is this is the socially best response to efficient reliance investments. It then follows that:

$$r^{b*} \in \arg\max_{r^b \in R} E_\theta[W(r^b, r^s, \theta, q^*(\theta))] \tag{5.1}$$

and

$$r^{s*} \in \arg\max_{r^b \in R} E_\theta[W(r^b, r^s, \theta, q^*(\theta))] \tag{5.2}$$

must also hold. ■

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 the parameter).

The key to ensuring monotone comparative statics is the following[4]:

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, $\forall\, j = b, s$.

The condition (e) is a well-known *single-crossing property* (SCP)[5] 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 relation specific. Finally, Assumption (f) is known as *Increasing Difference* (ID).[6] With these standard assumptions borrowed from the mechanism design literature, the complexity of our analysis of contracting under asymmetric information is dramatically simplified—we now can compare agents on the basis of their types, as they can be *ordered* monotonically, that is the higher types choose a higher performance or consumption.

We now establish the following three important lemmata for future reference.

Lemma 5.1. *If $W(r^b, r^s, \theta, q)$ is continuously differentiable in q and satisfies SCP, and q is in the interval of Q, then $W(r^b, r^s, \theta, q)$ satisfies ID.*

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

$$\begin{aligned} W(r^b, r^s, \theta'', q'') - W(r^b, r^s, \theta'', q') &\equiv \int_{q'}^{q''} W_q(r^b, r^s, \theta'', q)dq \\ &> \int_{q'}^{q''} W_q(r^b, r^s, \theta', q)dq \\ &= W(r^b, r^s, \theta', q'') - W(r^b, r^s, \theta', q'). \end{aligned}$$

Note that if the agent's value function $V(., \theta, q)$ satisfies ID, then the indifference curves for two different types of the same 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, the maximisers of this objective function are non-decreasing in the parameter value θ. Moreover, if SCP holds and the maximisers are in the interior of their respective supports (i.e. there are no corner solutions), they are strictly increasing in the parameter. Formally,

Lemma 5.2. *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; that is* ex post *efficient performance choice will typically be state-contingent and interior.*

In other words:

Let $\theta' > \theta$, $q^{+}(r^b, r^s, \theta') \in \arg\max_{q \in Q} W(r^b, r^s, \theta', q)$, and

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

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 the 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 and high levels of quantity.*

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 an information parameter. In this regard, without any loss of generality we suppress the reliance arguments for notational simplicity.

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

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

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

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:

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

and, $$W(., \theta, q^+(., \theta)) < W(., \theta', q^+(., \theta)).$$

This implies that ex post efficient performance choice is positively dependent on 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 then have:

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

and, hence,

$$\begin{aligned} W(., \theta, q_h(., \theta)) &< W(., \theta, q^+(., \theta)) - \left\{W(., \theta', q^+(., \theta)) - W(., \theta', q_h(., \theta))\right\} \\ &\leq W(., \theta, q^+(., \theta)). \end{aligned}$$

That is, 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 5.2 is hereby 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', and a small increase in q would increase $W(.)$. Since by Assumption (a), $q^+(., \theta') \geq q^+(., \theta)$, we must have

$$q^+(., \theta') > q^+(., \theta). \qquad \blacksquare$$

This implies that 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.

Let us now have our third lemma:

Lemma 5.3. *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 the 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 Assumption (f) we have:

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

Now taking expectation on both sides and changing sides we get:

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

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

Observe, if the difference in Assumption (b) is strictly monotonically increasing in r^j and if efficient performance is inner (i.e. $q^*(\theta) \in [q_L, q_H]$) with positive probability then the claims of Lemma 5.3 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 5.3 that an intermediate performance decision $q^{oo} \in Q$ [i.e. $q_L < q^{oo} < q_H$] exists such that:

$$r^{j*} \in \arg\max_{r^j \in R} E_\theta[W(r^b, r^s, \theta, q^{oo}], \ \forall j \text{ holds.}$$

Moreover, it follows from the assumed structure of social surplus that:

$$\arg\max_{r^b \in R} E_\theta[W(r^b, r^s, \theta, q^{oo})] = \arg\max_{r^b \in R} \left[V(r^b, q^{oo}) - r^b\right], \tag{5.3}$$

$$\text{and,} \quad \arg\max_{r^s \in R} E_\theta[W(r^b, r^s, \theta, q^{oo})] = \arg\max_{r^s \in R} \{E_\theta[C(r^s, \theta, q^{oo})] - r^s\} \tag{5.4}$$

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

5.3 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 a contract breach. The parties, when confronted with such problems of hidden information, may take resort in sophisticated revelation mechanisms. The general setting as introduced earlier in this chapter allows us to implement the first-best solution with a mechanism of the *Groves-Clarke* 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, 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. We adopt, following Shavell (1980) and Edlin and Reichelstein (1996), an initial contract $[q^o, T^o]$ that categorically specifies contractual obligations for parties: 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.

Two situations will be distinguished according to which party obtains private information and which party considers breaching the contract. Hence four cases arise, two of them related to a situation where the seller obtains the private information and the seller or buyer decides to breach, and another situation where the buyer obtains information but a breach can be contemplated by either party. In the course of the analysis we will also highlight two important informational structures—depending upon the verifiability of the reliance actions, when reliance investments are observed by the parties and verifiable in front of a court, we call the information structure partial private information (PPI), and when the investments are purely hidden actions, the environment is termed complete private information (CPI). Let us start with the two cases related to the seller's private information, followed by the buyer's case.

5.3.1 Seller Obtains Private Information

Case SB

In the case SB, it is the seller who obtains private information but the buyer who considers a breach. Suppose, just before the seller starts production, the buyer notifies the seller to accept delivery of some quantity $q \leq q^o$. So he breaches for the remaining quantity and therefore owes 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, $[C(r^s, \theta, q^o) - C(r^s, \theta, q)]$, as she is supposed to produce less than her original contractual obligation. The difficulty here is that as the seller's cost is hidden information, the courts may no longer be able to administer such a price reduction correctly.

Had it been properly administered, and if we were in a situation where the *information is symmetric between the parties*, then the seller's pay-off would have been:

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

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

The seller would thus choose her investment according to:

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

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 5.3) and the buyer to mitigate damages as per actual expectancy of the seller resulting from the breach.

If the buyer announces an 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 pay-off amounts to:

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

and is, up to the first term, dependent 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, that is $q^+(r^b, r^s, \theta)$. Anticipating such a performance choice at the investment stage, the buyer would have the incentive for efficient reliance investments, as:

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

provided the seller invests efficiently.

Note here, the expectation damages remedy entails asymmetric treatment of the contract breacher and the victim of the breach. This asymmetry creates a tension between providing efficient incentives for one party and providing incentives for the other. Because damages give the injured party exactly her expectancy, she is overcompensated for her investment; 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 state-contingent actual compensation is not possible. The buyer's choice of quantity will not be state contingent but arbitrarily depend upon how the court settles the expectancy of the seller. So anticipating his choice of an ex post (inefficient) quantity (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 conjecture that the informed party, here the 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 5.1. 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 court (i.e. the information structure is PPI) or by $T(m, q)$ if investments are hidden action (the environment is CPI). The incentives provided by each of the above transfer schedules can be calculated by backwards induction. We consider the PPI environment case first.

Partial Private Information (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:

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

By 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:

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

that maximises her pay-off. Therefore, 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 pay-off 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 pay-off (and the underlying transfer schedule) is said to reflect expectation damages correctly if:

$$I(r^b, r^s, \theta) = T^o - r^s - C(r^b, \theta, \eta(r^b, r^s, \theta))$$

holds for all information parameters θ. In fact, the seller would then be awarded the 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 5.3, the solution will typically fail to be ex post efficient.

Definition 5.2. Any mechanism to be efficient must satisfy:

(a) the participation constraints are met. [IR]
(b) the incentive constraints are met. [IC]

Let us explain 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 the 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 a tariff is quite general, and as we will later see we lose nothing by restricting attention to this form of a contract. Therefore the following two inequalities must hold $\forall\ \theta, \theta' \in \Theta$:

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

and,

$$\begin{aligned} [\text{IC}]: \quad & \tau(r^b, r^s, \theta) - r^s - C(r^s, \theta, \eta(r^b, r^s, \theta)) \\ & \geq \tau(r^b, r^s, \theta') - r^s - C(r^s, \theta, \eta(r^b, r^s, \theta')) \\ \text{i.e. } \; & \tau(r^b, r^s, \theta') - \tau(r^b, r^s, \theta) \geq C(r^s, \theta, \eta(r^b, r^s, \theta)) - C(r^s, \theta, \eta(r^b, r^s, \theta')). \end{aligned}$$

Here (IR) stands for the familiar individual rationality (or participation) constraint. The inequality in (IR) reflects the fact that the agent of type θ has the option of choosing performance $\eta(r^b, r^s, \theta) = 0$, that is rejecting the tariff, but preferring to choose $\eta(r^b, r^s, \theta)$ which is meant for his type. (IC) stands for incentive compatibility or self-selection or truth telling constraint. The inequality in (IC) reflects the fact 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 about the information. If the agent announces θ' and then the principal supplies the agent with quantity $\eta(r^b, r^s, \theta')$ in exchange for payment $t(., \theta')$. Since the inequality in (IC) is to be satisfied, each agent will prefer to announce his true type $\theta' = \theta$, rather than lying. Thereby, as the (IR) inequality is satisfied, each type of agent will accept this mechanism.

Before proceeding further, using Definition 5.2, we derive the following lemma:

Lemma 5.4. *Suppose SCP is met for* $W(., q, \theta)$ *then by construction the negative of the seller's valuation, that is* $[-C(., q, \theta)]$*, also satisfies SCP. Then, for all* $\theta, \theta' \in \Theta$*, the seller's incentive constraint requires that:*

$$\begin{aligned} & C(r^s, \theta, \eta(r^b, r^s, \theta)) - C(r^s, \theta', \eta(r^b, r^s, \theta)) \\ & \quad \leq I(r^b, r^s, \theta') - I(r^b, r^s, \theta) \\ & \quad \leq C(r^s, \theta, \eta(r^b, r^s, \theta')) - C(r^s, \theta', \eta(r^b, r^s, \theta')). \end{aligned}$$

Moreover, if $\theta < \theta'$ *then* $\eta(r^b, r^s, \theta) \leq \eta(r^b, r^s, \theta')$ *that is 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:

$$\begin{aligned} I(r^b, r^s, \theta) &= T(r^b, r^s, m_S(r^b, r^s, \theta), q_B(r^b, r^s, m_S(r^b, r^s, \theta))) \\ & \quad - C(r^s, \theta, q_B(r^b, r^s, m_S(r^b, r^s, \theta)) - r^s \\ &= \tau(r^b, r^s, \theta) - C(r^s, \theta, \eta(r^b, r^s, \theta)) - r^s \\ &\geq T(r^b, m_S(r^b, r^s, \theta, q_B(r^b, r^s, m))) - C(r^s, \theta, q_B(r^b, r^s, m)) - r^s \end{aligned}$$

which must hold for any other message $m \neq m_S(.)$, $\forall\ m, m_S \in M$. 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:

$$\begin{aligned} I(r^b, r^s, \theta) \geq {} & T(r^b, r^s, m_S(r^b, r^s, \theta'), q_B(r^b, r^s, m_S(r^b, r^s, \theta'))) \\ & - C(r^s, \theta, q_B(r^b, r^s, m_S(r^b, r^s, \theta')) - r^s \\ = {} & \tau(r^b, r^s, \theta') - C(r^s, \theta, \eta(r^b, r^s, \theta')) - r^s \end{aligned}$$

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 the 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. ■

Armed with all these lemmata, we now have our two propositions of the chapter:

Proposition 5.1. *Suppose Assumptions (a), (b) and (e) are met. If the transfer schedule $T(r^b, r^s, m, q)$ reflects the correct expectation damages along the equilibrium path then the seller will meet her obligation, that is $\eta(r^b, r^s, \theta) \equiv q^o$ 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 5.3 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:

$$\begin{aligned} &C(r^s, \theta', \eta(r^b, r^s, \theta')) - C(r^s, \theta'', \eta(r^b, r^s, \theta')) \\ &\quad \leq C(r^s, \theta', q^o) - C(r^s, \theta'', q^o) \\ &\quad \leq C(r^s, \theta', \eta(r^b, r^s, \theta'')) - C(r^s, \theta'', \eta(r^b, r^s, \theta'')); \end{aligned}$$

because, in this range of information parameters, the seller's pay-off 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 the two information parameters $\theta' < \theta < \theta'' < \theta^o$ from this range and apply the above findings pair-wise. 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 the information parameters from the range $\theta^o < \theta < \theta_H$. For such parameters, $q^o < \eta(r^b, r^s, \theta)$ must hold following the monotonicity of the equilibrium performance choice. Moreover, in this range, the net pay-off of the seller amounts 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 incentive constraints from Lemma 5.3, leads to:

$$\begin{aligned} &C(r^s, \theta', \eta(r^b, r^s, \theta')) - C(r^s, \theta'', \eta(r^b, r^s, \theta')) \\ &\quad \leq C(r^s, \theta', \eta(r^b, r^s, \theta'')) - C(r^s, \theta'', \eta(r^b, r^s, \theta')) \\ &\quad \leq C(r^s, \theta', \eta(r^b, r^s, \theta'')) - C(r^s, \theta'', \eta(r^b, r^s, \theta')), \end{aligned}$$

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

$$\begin{aligned} &C(r^s, \theta'', \eta(r^b, r^s, \theta')) \geq C(r^s, \theta', \eta(r^b, r^s, \theta'')) \\ \text{and,} \qquad &C(r^s, \theta', \eta(r^b, r^s, \theta'')) \geq C(r^s, \theta', \eta(r^b, r^s, \theta')). \end{aligned}$$

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:

$$\begin{aligned} \eta(r^b, r^s, \theta) &= q^o \\ &\leq \eta(r^b, r^s, \theta') = q'; \end{aligned}$$

and from the incentive constraints we have:

$$
\begin{aligned}
I(r^b, r^s, \theta') - I(r^b, r^s, \theta) &= C(r^s, \theta, q') - C(r^s, \theta', q^o) \\
&\leq C(r^s, \theta, \eta(r^b, r^s, \theta')) - C(r^s, \theta', \eta(r^b, r^s, \theta')) \\
&= C(r^s, \theta, q') - C(r^s, \theta', q^0);
\end{aligned}
$$

and, hence, that $C(r^s, \theta, q') \geq C(r^s, \theta, q^o)$ must hold. By making use of the monotonicity of utility as a function of performance choice, it follows that $q^o = q'$ must hold. Proposition 5.1 is thus established. ■

Recall from the previous section that, under suitable differentiability, q^{oo} will exist if the performance choice is continuous. If, however, performance choice is binary then under-investment and over-investment would result from a contract specifying $q^o = q_L$ and $q^o = q_H$, respectively, as follows from Lemma 5.3.

Complete Private Information (CPI) Environment: The next proposition shows a transfer schedule $T^*(m, q)$ to exist that leads to the first-best solution even if reliance investments are a hidden action. However, as follows from Proposition 5.1, the efficient transfer schedule $T^*(m, q)$ cannot reflect expectation damages correctly.

Proposition 5.2. *In a CPI environment, there exist a message space M and a transfer schedule $T^*(m, q)$ that in equilibrium lead to the first-best solution.*

The proof of Proposition 5.2 will be given at the end of the analysis of case BB. The efficient price schedule will be based on the direct, incentive-compatible mechanism that follows from that analysis as a by-product.

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 Eq. (4.17) could be administered by the 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 are facing excessive incentives for reliance investments as follows from Lemma 5.3 and Eq. (5.3).

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, the buyer's incentives for reliance investments would be suboptimal. In a similar vein, as ex post efficient performance through renegotiation is anticipated by the seller so 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 over-reliance 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 a price in terms of efficiency loss.

Case SS

In case SS, it is the seller who obtains private information and who considers whether or not to 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 the rest of the quantity then following the expectation damage rule she owes damages of $D(r^b, q) = \max[V(r^b, q^o) - V(r^b, q); 0]$ to the buyer. This compensation then makes the buyer at least as well off as if the 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 in the case where $V(r^b, q^o) - V(r^b, q) < 0$ he even enjoys a windfall gain from the seller neglecting her obligation. Common law legal practice allows the buyer to keep such windfall gains for free. Since the buyer does not obtain private information, such damages can be verified in the courts provided that reliance investments are observable.

The seller's pay-off then amounts to:

$$\Psi(r^b, r^s, \theta, q) = T^o - C(r^s, \theta, q) - r^s - \max[V(r^b, q^o) - V(r^b, q), 0].$$

And therefore 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 the purpose of analytical results and a definite conclusion.

First: $D(r^b, q) \neq 0$

If the contract specifies a delivery choice q^o, such that windfall gains to the buyer will never arise, then the seller's pay-off is

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

which is, up to the first term, dependent on actual performance choice and equal to the social surplus; hence, the seller takes the performance decision

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

and coincides with the socially best response performance choice, that is $q^+(r^b, r^s, \theta)$.

If the seller announces the breach $q \leq q^o$, upon receiving the expectation damage payment, the buyer's pay-off amounts to

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

which is, up to the first term, independent of the actual performance, equal to the social surplus corresponding to the initial contractual quantity choice q^o and which does not depend on the ex post actual state contingent performance choice by the seller. Anticipating such a pay-off, at the investment stage the buyer would have the incentive for reliance investments, as

$$\begin{aligned} r_E^b &\in \arg\max_{r^b \in R} E_\theta[\Phi(r^b, r^s, \theta, \mathbf{q}^o)] = \arg\max_{r^b \in R} E_\theta[W(r^b, r^s, \theta, \mathbf{q}^o)] \\ &\neq \arg\max_{r^b \in R} E_\theta[W(r^b, r^s, \theta, \mathbf{q}^+(r^b, r^s, \theta))] = r^{b*}\end{aligned}$$

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 5.3; in that case there would be efficient investment by the buyer).

Anticipating the buyer's investment choice r_E^b, the seller would thus choose her investment level according to:

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

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 internalise fully the cost of a 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 5.3) and the seller to mitigate damages as per the actual expectancy of the buyer resulting from a breach.

Second: $D(r^b, q) = 0$

Then the seller's pay-off would be:

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

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

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

Note here that since both parties' pay-offs, up to the first term in their respective expressions above, are dependent on the ex post actual performance choice, 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 reliance investments are a hidden action. Under this mechanism, the informed party (seller) is directly asked to reveal his private information. This direct mechanism is of the Groves-Clarke type. We shall prove this in a while as a by-product from the analysis of case BB. Please note that the very same mechanism has been used in Eq. (4.4) of Chap. 4 on liquidated damage in a more concrete set-up.

5.3.2 Buyer Obtains Private Information

Let us now turn to situations where the buyer holds the private information. We, therefore, given our assumptions in Sect. 5.2, denote the ex post trading surplus as: $G_B(r^b, r^s, \theta, q) = V(r^b, \theta, q) - C(q, r^s)$. The ex post socially best response performance choice is $q^+(r^b, r^s, \theta) \in \arg\max_{q \in Q} G_B(r^b, r^s, \theta, q)$ that maximises social surplus at the performance stage (ex post) where reliance investment and the movement of nature are given. Correspondingly, we define the ex ante social surplus:

$$W_B(r^b, r^s, \theta, q^+) = V(r^b, \theta, q^+) - C(q^+, r^s) - r^b - r^s.$$

Thus efficient reliance investments are defined as follows:

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

$$\text{and} \qquad r^{s*} \in \arg\max_{r^s \in R} E_\theta[W_B(r^b, r^s, \theta, q^+(r^b, r^s, \theta))]$$

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 $q^*(\theta) = q^+(r^{b*}, r^{s*}, \theta)$, which is the socially best response to efficient reliance investments. Then it must also hold that:

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

$$\text{and,} \qquad r^{s*} \in \arg\max_{r^s \in R} E_\theta[W_B(r^b, r^s, \theta, q^*(\theta))].$$

Given our assumptions, the earlier Lemmata 5.1–5.3 also hold here in similar fashion. Thus we now directly proceed with our analysis of breach and damage remedy when the buyer holds ex post private information.

Case BS

In case BS it is the buyer who obtains private information but the seller who is the party considering breaching the contract. The seller neglects her obligation by deciding $q \neq q^o$ (obviously $q < q^o$), and thus according to the expectation damage remedy of contract law she is liable to pay a sum to the tune of:

$$D(r^b, \theta, q) = \max[\{V(r^b, \theta, q^o) - V(r^b, \theta, q)\}, 0] \tag{5.5}$$

to the buyer. In the case of a breach, if the buyer receives such compensation then he would be at least as well off as if the seller had met her obligation. More precisely, he would be exactly as well off, if $\left\{V(r^b, \theta, q^o) - V(r^b, \theta, q)\right\} \geq 0$; well in line with expectation damage remedy. On the other hand, in case $\left\{V(r^b, \theta, q^o) - V(r^b, \theta, q)\right\} < 0$, he may even enjoy a windfall gain when the seller neglects her obligation. But, as θ remains the private information of the buyer, the courts would not be able to assess and award state-contingent damages $D(r^b, \theta, q)$ correctly.

Now this case can be handled along the line of case SB in the previous subsection, so we suppress the analysis here.

Case BB

In case BB, it is the buyer who obtains private information and who contemplates breaching. Since it is the buyer who chooses to breach, the breach would be of the *anticipatory type*. After having obtained his private information, the buyer may announce that he is only going to accept delivery $q \leq q^o$. Since, at the time of announcement, the seller has not yet started production (by assumption), therefore upon receiving announcement from the buyer she should deliver q but claim compensation from him to mitigate damages for her lost profits due to his announcement. In any case, the seller must grant a reduction of payments in the amount of her cost savings $[C(r^s, q^o) - C(r^s, q)]$, which can be easily monitored as there is no private information. Thus her final pay-off after the adjustments amounts to

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

Thus the seller in the face of an anticipatory breach is as well off since the contract is honoured when compensated through expectation damage. The seller's final pay-off then strictly depends on the initial contractual quantity choice, which is q^o. Notice, in this case where the seller does not obtain private information, this price reduction can easily be administered by the courts. Thus in this case she would choose a level of investment according to:

$$r^s \in \arg\max_{r^s \in R} \{T^o - C(r^s, q^o) - r^s\}.$$

hence she would have an incentive to rely (maybe higher than the socially best level) which corresponds to the quantity choice q^o and not to any state contingent quantity choice q.

If the buyer announces anticipatory breach $q \leq q^o$, upon receiving the benefit of reduction in payment to the tune of $[C(r^s, q^o) - C(r^s, q)]$, his net pay-off amounts to

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

and is, up to the first term, dependent on actual performance, equal to social surplus.

Hence, the buyer's performance choice in equilibrium solves

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

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

$$
\begin{aligned}
r^{b*} &\in \arg\max_{r^b \in R} E_\theta[\Phi(r^b, \mathbf{r}^{s*}, \theta, q^+(r^b, r^s, \theta))] \\
&= \arg\max_{r^b \in R} E_\theta[W_B(r^b, \mathbf{r}^{s*}, \theta, q^+(r^b, r^s, \theta))]
\end{aligned}
$$

would hold, provided the seller invested efficiently (given an initial contractual quantity choice $q^o = q^{oo}$ according to Lemma 5.3). Otherwise, there would be over-investment (under-investment) if the seller over-invests (under-invests). In case the seller does not invest and the buyer is the only investing party, then the first-best solution can be implemented by just requiring the producer to mitigate damages resulting from an anticipatory breach, a solution which is independent of any initial contractual quantity. This result even holds good in a binary quantity choice.

Such practice gives rise to a direct and efficient mechanism, which is incentive compatible and works even if reliance investments are a hidden action. Under this mechanism, the informed party buyer is directly asked to reveal his private information.

Proof of Proposition 5.2. Let us imagine that the true information is θ but the buyer reports $\theta' \in \Theta$ which may be false. The direct mechanism then imposes the performance choice $\eta(\theta') = q^*(\theta')$ that would be the socially best response if the buyer had invested efficiently and reported truthfully. Moreover, the buyer is required to pay $\tau(\theta') = C(r^s, q^*(\theta'))$ to the seller. This direct mechanism is of the Groves-Clarke type. It provides the following incentives:

Suppose that the buyer makes reliance investments r^b and plans to reveal information $\theta' = t(r^b, \theta)$, if he later obtains private information θ. At the investment stage, his expected pay-off under the direct mechanism would amount to the LHS of the following expression:

$$
\begin{gathered}
E_\theta[V(r^b, \theta, q^*(\theta')) - C(r^s, q^*(\theta'))] - r^b \leq E_\theta \\
[V(r^{b*}, \theta, q^*(\theta)) - C(r^s, q^*(\theta))] - r^{b*}
\end{gathered}
$$

and that could not be higher than the pay-off if he had invested efficiently and revealed truthfully (RHS). In this sense, the above direct mechanism is incentive compatible, assigns the social surplus to the buyer and, as a consequence, provides efficient investment incentives to the buyer. To gain the consent of the seller, the buyer would have to make an upfront payment that, however, would not affect incentives. In fact, with upfront payment $\{T^o - C(r^s, q^o)\}$, the direct mechanism would lead to exactly the same solution since the producer must grant a price reduction for an anticipatory breach in the amount of cost savings.

This direct mechanism may also serve as a basis for the efficient transfer schedule $T^*(m, q)$, whose existence is claimed by Proposition 5.2. Suppose message space $M = \Theta$. If the buyer has announced $m = \theta' \in M = \Theta$ and the seller takes performance choice $q \in Q$ then the net payment schedule

$$T^*(\theta', q) = T^o + C(r^s, q) - [V(r^{b*}, \theta', q) - V(r^{b*}, \theta', q^*(\theta'))]^2$$

provides efficient incentives. Indeed, since the seller is compensated for actual production costs, he has the incentive to minimise the square term by deciding $q = q^*(\theta')$ at the performance stage. The buyer's pay-off then amounts to

$$V(r^b, \theta, q^*(\theta')) - T^*(\theta', q) - r^b = V(r^b, \theta, q^*(\theta')) - T^o - C(r^s, q^*(\theta')) - r^b$$

and, obviously, provides incentives to report truthfully and to invest efficiently. Proposition 5.2 is established.

5.4 Conclusion

There is a long history of legal practice facing hidden information. In an asymmetric information environment the legal proceedings, both in common law and civil law countries, either resort to *objectifying* damage measures or allow the victim of a breach to opt for reliance damages. Our analysis in this chapter has examined such practices. As discussed above, the issue of verifiability arises in the two cases BS and SB, where the uninformed party considers breaching. In such cases expectation damages must be based on the informed party's expectation interest that depends on the private valuation or cost functions and, hence, cannot be verified in the courts.

In the setting of case BS, where the victim of a breach holds some private information, objectifying expectation damages by the court would mean fictitiously postulating an objective type $\theta^o \in \Theta$, based on which expectation damages amounting to:

$$D^o(r^b, q) = \max[V(r^b, \theta^o, q^o) - V(r^b, \theta^o, q), 0]$$

would be awarded to the buyer. Needless to say, the buyer's private information may actually differ from the objective type. Objectified expectation damages lead to an effective transfer schedule:

$$T(r^b, q) = T^o - D^o(r^b, q)$$

that does not depend on any message from the informed party. Such schedules must necessarily lead to an outcome that fails to be state contingent. In fact, the seller would choose a performance decision following:

$$q_S(r^b, r^s) \in \arg\max_{q \in Q} \left\{ T(r^b, q) - C(r^s, q) \right\},$$

independent of the actual state θ, though it only depends on the choice of the amount of damage. Anticipating her own performance choice, the seller would choose her reliance level following:

$$r_S^s \in \arg\max_{r^s \in R} \left\{ T(r^b, q_S(r^b, r^s)) - C(r^s, q_S(r^b, r^s)) - r^s \right\}.$$

Anticipating the seller's performance choice, the buyer then makes reliance investments:

$$r_B^b \in \arg\max_{r^b \in R} \left\{ E_\theta[V(r^b, \theta, q_S(r^b, r^s))] - T(r^b, q_S(r^b, r^s)) - r^b \right\}.$$

While it may still be feasible to generate efficient reliance incentives, the solution typically fails to be ex post efficient because performance choice is constant, no matter which movement of nature has materialised.

We have some important remarks to make here. Some legal systems allow the promisee to opt for recovery of reliance expenditures instead of expectation damages. Allegedly, the option was introduced to accommodate the promisees that have difficulties verifying their true expectation damages in the courts. In Chap. 4, we have already established that in the case of bilateral investments both the reliance and the restitution remedies lead to inefficient outcomes: both in a breach decision and in the incentive for reliance on 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 breaches by the promisor. To put it concretely, since reliance damages also lead to an effective transfer schedule $T(r^b, q)$ that does not depend on nature's movement, ex post efficiency would not be restored. Finally, when expectation damage can be assessed by a court properly and awarded, it first ensures efficient performance and second induces efficient reliance for the breaching promisor (if she invests at all) but leads the promisee to over-rely. And this result holds good irrespective of the situation as to whether (selfish) investment is unilaterally or bilaterally undertaken.

To sum up, practical 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.

For a reliance setting with hidden information, the present analysis thus 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 an efficient breach of contract whereas revelation mechanisms leading to the first-best solution would fail to assess damages correctly.

Legal practice seems to rely on two remedies. First, damages may be awarded that are of an objective type. This approach is shown to be defective as it neither assesses expectation damages correctly nor does it provide incentives for an efficient breach. Second, the party suffering from a breach and failing to verify her expectation damages in the courts may opt for recovery of reliance damages instead. The outcome, again, cannot be state contingent and, hence, ex post efficiency will not be achieved.

Since the revelation mechanisms were available that would generate the first-best solution, at least for the present setting, justifying such legal practice from the economic perspective remains a challenging task for future research. With this we will turn to a more challenging environment in our next and final chapter, where we shall consider bilateral selfish reliance by the contracting parties, where additionally each of them will obtain private information in the post-contracting scenario.

Notes

1. In a working paper, Urs Schweizer (2006) sought to advance the analysis in the same direction. A part of the model discussed here abstracts the bargaining procedure from Schweizer. He focuses on a unilateral reliance, whereas we focus on bilateral investment.
2. Alternatively it may be just binary $Q = \{q_L, q_H\}$, equivalently $\{0, 1\}$, i.e. $(q_L = 0)$ stands for not performing and $(q_H = 1)$ means performing. In the case of continuous performance choice, q can be thought of as the quantity or quality of a divisible good to be exchanged.
3. Uniqueness of efficient trades help us in simplifying the exposition, but all results can be restated for multiple efficient trades. Indeed, note that Lemma 5.2 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.
4. Note here that we use a discrete type just for analytical convenience and tractability.

5. In a differentiable setting, this would hold if the second derivative $W_{\theta q} > 0$ is positive. The SCP was first suggested by Spence (1973) and Mirrlees (1971). Our definition is a simplified version for preferences that are quasi-linear in transfers t. Our SCP was introduced by Edlin and Shannon (1998) under the name "increasing marginal returns".
6. This property is more precisely called *strictly increasing difference* (Topkis, 1998).

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6

Economics of Damage Remedies IV: *Incomplete Contracts, Bilateral Reliance, Two-Sided Asymmetric Information*

6.1 Introduction

So far, we have been dealing with situations where one of the two contracting parties obtains certain private information related to his or her cost or valuation in the post-contractual scenario. However, it often happens that both parties may obtain private information. Therefore, in this chapter, we extend our previous analyses, by allowing two-sided ex post private information that creates an environment where either party contemplates breaching despite investing in reliance in their respective valuations.[1] Post-contractual private information in many ways makes the goal of full information revelation within a particular market unattainable. Moreover, it poses a challenge for legal executions as courts may not be able to ascertain the expectations interest of privately informed victims of breach exactly.

The selfish motive of parties for keeping information private often suffers from two particular interests—secrecy and compensation. Driven by a "secrecy interest" , the parties, rather than revealing information, prefer to forego a suit in the event of breach, change their patterns of contracting and/or important aspects of the terms on which they deal,

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or even forego the transaction entirely. On the other hand, guided by a "compensatory interest", the parties seek to compensate their expectation loss in the event of a contract breach. These two interests are often in direct conflict and cannot be reconciled simply by elevating one over the other ex post. When the secrecy interest is sufficiently strong, the cost of revealing underlying private information may well surpass the aggrieved party's expected recovery from a trial. As a consequence, the aggrieved party may not file suit and may thereby may not receive any compensation. As the potential breacher might be informed about the existence of such secrecy interest by the victim, she may breach too often. Conversely, if compensatory interest is stronger then the victim of a breach not only brings a suit and asks for expectation damages, but also, in all likelihood, may over-state his valuation to obtain higher compensation over and above his loss, which is a pure rent-seeking motive.

Asymmetric information complicates the matter at the contract execution stage: (a) a party, who obtains private information, may start behaving strategically or opportunistically to gain advantage of the situation, due to which an inefficient contract breach may happen; (b) if reliance investment is involved, it may give rise to a moral hazard problem. Two-sided information asymmetry immediately exacerbates these problems at double margin.

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

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

The analysis here focuses on the question of whether the first-best outcome is possible (with or without the support of legal remedies), when investments undertaken in reliance by both parties are unobservable and the good's value and cost are also private information (ex post). This is not a trivial problem. Two distinct cases can be identified: first, when there is a "gap" between the supports of the seller's cost and the buyer's valuation, second, when there is "no gap" between the supports. In the "gap" case, trade is always feasible. When it is common knowledge between the parties that gains from trade exist, contract theory says that efficiency is attained quite trivially by a single-price mechanism: trade for sure at a price belongs to the gap. This is *incentive compatible (IC)*, since the outcome does not depend on the report. Also it is *Individually Rational* (*IR*), since each party receives a non-negative pay-off in every realisation. (See, Ausubel, Cramton, & Deneckere, 2002.) We thus concentrate on the non-trivial case where there is "no gap". The bargaining does not conclude with probability 1 after any finite number of periods. One basic question is whether the private information prevents the bargainers from reaping all possible gains from trade.

Myerson and Satterthwaite (1983) show that if there is a positive probability of gains from trade, but it is not common knowledge that gains from trade exist, then no incentive compatible, individually rational, *budget balanced* mechanism can be ex post efficient. In the *Groves-Clarke mechanism* (similar to Vickrey's (1961) *second price auction* mechanism), both parties have the incentive to announce truthfully their valuations to the court. Indeed, this is the only scheme where truth-telling is implementable as a dominant strategy Green and Laffont (1979). At this point, we would like to remind the reader that we have already made use of this mechanism in our last chapter, in the case of one-sided information asymmetry, to find a transfer payment schedule that reflects the expectation of the informed party. Despite this very attractive feature, the Groves-Clarke mechanisms are problematic, especially in the case of two-sided asymmetric information, because they do not provide a *balanced budget* (*BB*). The "basic" Groves mechanism generates an expected deficit. In other words, it satisfies *IR* but violates *BB*, whenever the expected gains from trade are positive. More general Groves mechanisms can try to finance the deficit by taxing the agents, but *IR* limits the magnitude of those taxes (see, Ausubel et al., supra).

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

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

While optimal contracts that induce first-best trading under bilateral asymmetry are often quite complicated, real world contracts seem to be rather simple. Most often the parties come up with fixed-price incomplete contracts which are generally renegotiated later (if not prohibited by the courts). Hence, it is an interesting question to ask whether in this case it is also possible to achieve the first best. Taking this route Schmitz (2002), using a mechanism design approach, demonstrates that voluntary bargaining over a collective decision under asymmetric information may well lead to ex post allocative efficiency as well as ex ante efficient reliance if the default decision is non-trivial (and the parties' valuations are symmetrically distributed). By a non-trivial default decision Schmitz argues that the parties merely specify an unconditional intermediary level of trade, $q^o \in [0, 1]$; that is the default decision is an interior choice. Schmitz was motivated by the solutions to hold-up problems using simple contracts that just specify a threat point for future negotiations, given that the parties are symmetrically informed (see, Aghion, Dewatripont, & Rey, 1990, 1994; Chung, 1991; Edlin, 1996; Edlin & Reichelstein, 1996; Nöldeke & Schmidt, 1995, 1998). However, all these findings are based on the premise that renegotiation can always exploit any inefficiency remaining after a contract has been written under a complete information setting. This assumption, unfortunately, does not seem compelling in an ex post incomplete information setting. Any efficient renegotiation process must be *interim individually rational*; that is, having observed his or her private information, each party must always expect to become at least as well off from participating in the renegotiation process as from not participating and enforcing the existing contract. Otherwise, in some instances efficient breach opportunities will be lost. Accordingly, we can directly apply the theorem of Myerson and Satterthwaite and state the impossibility of efficient renegotiation. As a consequence, ex post efficiency is still under question.

In the light of the discussion above, instead of renegotiation, in this chapter we consider standard breach mechanisms (that specify a fixed compensation paid by the contract breacher) following the usual *Sub-Game Perfect Nash Equilibrium method*.[3] As noted in the last chapter, under asymmetric information, when problems of establishing the valuation are extreme, the legal proceedings (in common law and civil law countries) may either turn to assess the expectancy of the victim of a breach or allow opting for reliance damages by the victim of a breach. Generally, courts adopt two methods to establish the *expectation interest* of the victim—an *objective method* and a *subjective method*. Objective damage measures are based on "prudent" or "reasonable" investment behaviour and/or on the "average type of fictitious agent". By construction, these measures differ from subjective expectation damages that were required to compensate the promisee for her exact loss. We try to examine the efficacy of such practices and analyse whether these solutions to the valuation problem alleviate or exacerbate opportunistic behaviour by the parties, both in terms of breach and reliance decisions. We begin with a standard analysis of the behavioural effects of restitution and reliance damages. We then proceed to the application of various expectation damage measures in a world where the courts are not perfectly informed about the parties' valuations of the contract.

The analysis in this chapter reveals some interesting results under two-sided information asymmetry: (a) as opposed to the conventional under-investment result under the restitution (no-damage) remedy here, both parties tend to over-invest relative to first-best levels; (b) the reliance damage remedy leads to as usual over-investment; (c) analyses of *subjective valuation* and *objective valuation* (i.e. expected expectation damage, henceforth EED)—two court-adopted methods of establishing the breach victim's expectation interest under asymmetric information—draw the conclusion that the EED is superior to the others but still falls short of what party-designed liquidated damage could achieve; (d) however, first best is generally not achievable.

We further establish two important but compelling facts. First, the parties may deliberately use a high penalty as a liquidated damage to induce efficient relation specific investment, which however may not induce ex post efficiency or augment social welfare. Second, the optimal rule that can be chosen ex post by the court under bilateral incomplete information corresponds to the EED rule that maximises social welfare but induces an inefficient incentive to invest. These results complement the existing literature on the issue of optimal breach remedies, which has been mostly concerned with the ex ante reliance efficiency issue when information is complete (and hence renegotiation is assumed to make the ex post outcome always efficient). [See, Chung, 1991; Edlin and Reichelstein, 1996; Rogerson, 1984; Shavell, 1980; Spier and Whinston, 1995.]

Private Information and Litigation

There exist three strands of literature that are closely related to the present analysis. Among the first strand, the extant literature covers the comparative advantage of various contract damage measures. Birmingham (1970), Barton (1972), Goetz and Scott (1977), Shavell (1980, 1984), and Miceli (2004), and many others, have studied various damage measures for breach of contract and compared their efficiency. Edlin and Schwartz

(2003) summarise this literature. Without much exception these studies assume that the non-breaching party would always opt for some damage remedy in the case of a contract breach regardless of her post-breach valuation. Thereby, these studies ignore the endogenous option that accrues to the non-breaching party not to litigate the case if her post-breach valuation is smaller than the contracted price. In contrast, in our model we incorporate the embedded option to accede rationally to a breach and we demonstrate that this has important efficiency implications.

The second strand of literature, in an ex ante private information scenario, compares the different information disclosure effects of these remedies (see, Adler, 1999; Ayres & Gertner, 1989; Bebchuk & Shavell, 1991). Bebchuk and Shavell (1991) show that awarding *expected expectation damages* by the court leads to better *information disclosure* at the time of contracting from the already privately informed party and thus makes the estimation of expectation damage more accurate, leading to more efficient breach decisions. Conversely, we deal with a framework where the parties to the contract have no private information at the contracting stage, thus no information disclosure incentives need to be created at that stage. The advantage of expected expectation damages over actual damages arises ex post in our model because, first, it maximises the expected social pay-off and, second, the seller has a distorted incentive to breach under actual damages due to the non-breaching party's option not to file a lawsuit.

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

6.2 The Model Setting

We consider a procurement contract between a seller and a buyer in a situation where after contracting neither party can find any other buyer or seller in the market for the specific commodity but some unforeseen contingencies may induce a situation for breach after an agreement has been reached. Thus it is a thin market, and investments are agent specific. Parties recognise this possibility but may have the opportunity to write a fixed-price contract. This price, essentially a device to divide the ex post surplus, depends on the relative bargaining strength of the parties at the contract formation stage. Parties may also specify a damage remedy in the contract, which the breacher agrees to pay the victim in the event of not honouring the contractual obligations. Some of our discussion of breach remedies will be couched as if the remedy selection were made by the courts.

To formalise the model, let two risk-neutral parties—a seller and a buyer—meet to consider a project. At Time 1, the buyer offers the seller a take-it-or-leave-it contract with price P for exchanging one unit of an indivisible specific good. The price will be paid when the seller performs. Once the contract is signed it becomes binding and no further alteration is allowed. The project will certainly fail unless both parties invest in it, though it may still fail even if both invest. If the parties do not reach an agreement and thereby do no trade, then the investments undertaken by them are wasted, that is their investments are fully relation specific and of the selfish type. At Time 2, each party invests in her respective cost and valuation.

Now let us describe the ex post uncertainty features of the model. The first source derives from the seller's cost of production of a specific commodity. Suppose this specific commodity may be further used as an intermediary input by the buyer to manufacture a final good whose uncertain demand is yet to be seen in the market. Thereby, the second layer of uncertainty comes from the buyer's valuation of the contract due to future fluctuations in the market prices of the products the buyer ultimately manufactures and sells. At the end of Time 2, all uncertainties relating to cost and valuation are resolved in the sense that all new information, unknown at the time of contracting, is now revealed. But the information related to the cost or valuation remains private to the respective party.

Therefore, at Time 3, once the seller realises her exact cost of performance, she decides whether to perform the contract or to repudiate. It is useful to consider a situation where the breach-contemplating seller does not know the actual loss it will cause to the buyer—a paradigmatic case of asymmetric information. The same is true if the buyer chooses to breach or repudiate. Ideally, anyone can move first and communicate the breach. Thus in deciding whether or not to breach, the promisor will attempt to estimate the expected value of the damages she will be ordered to pay if a suit is brought (though it may not). So, she decides on the basis of two factors: first, the pre-decided price P; and second, the forthcoming default legal damages regime a court will adopt and apply at Time 5 if the seller does not deliver at Time 3 and a lawsuit is filed by the buyer at Time 4.[4]

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

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

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

6.2.1 Technical Assumption

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

Thus the buyer's valuation is denoted by:

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

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

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

The buyer's expected valuation $E(v) = V(r^b)$ is concave and increasing in r^b; whereas the seller's expected cost $E(c) = C(r^s)$ is convex and decreasing in r^s. And we assume that there is a starting gap between the expected value and the cost of the agents (i.e. $E(v) \geq E(c)$), which diverges further as the parties invest more. Here θ and ϕ represent the information parameters respectively for the seller and the buyer. These information parameters are random variables and can be thought of as agent types; once realised by one particular agent, it is not observed by the other agent and thus is not contractible. So a contract cannot directly depend upon it. Let $f(.)$ and $F(.)$ respectively be the probability density function and the corresponding distribution function of the seller's uncertainty component θ; and let $g(.)$ and $G(.)$ represent the same for the buyer. We assume that $f(.)$ and $g(.)$ are continuous and positive in their respective domains and that they are independent (i.e. the seller's private information does not affect the buyer's valuation for the contracted commodity, and vice versa). The distributions $f(.)$ and $g(.)$ are common knowledge between the parties. Furthermore, we customarily assume that both $f(.)$ and $g(.)$ follow a monotone hazard property. In some contingencies ex post, for the particular realisation of θ and ϕ, there can be "no gap" between the seller's cost and the buyer's valuation—say, in some kth state, for a given investment vector (r^s, r^b), where $c_k := [C(r^s) + \theta_k] > [V(r^b) + \phi_k] =: v_k$. This creates a breach situation, whereas in state i, as $v_i > c_i$ (i.e. $c_i := [C(r^s) + \theta_i] \leq [V(r^b) + \phi_i] =: v_i$), performance is desirable.

6.2.2 Model Analysis

In the face of two-sided ex post private information, an ex ante trading opportunity between the parties arises whenever $E(v) \geq E(c)$, i.e. whenever the buyer's expected valuation is larger than the seller's expected cost in Time 1, they may find the contracting worthwhile. Without any loss of generality, we assume here that the buyer holds the entire bargaining power and thereby he set a very low price P in such a way [so close to $E(c)$] that only the seller faces the option to breach unilaterally. (In a polar case, the buyer leaves the seller with a zero surplus from the contract.) However it is worth noting here, in this particular kind of set up, either party can contemplate breaching the contract whenever the cost of performance is higher than the value. But we restrict our analysis to unilateral breach by the seller; the analysis of breach by the buyer follows similar line.

Lemma 6.1 (The First-Best: Comparison of Efficient Reliances). *The optimum level of reliance investments under two-sided informational asymmetry must be lower when compared not only to the social optimum under complete information but also to the optimum levels of reliance under one-sided informational asymmetry.*

Proof. We provide the proof in three steps.

STEP 1: (Two-Sided Private Information and Bilateral Reliance)

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

$$\begin{aligned}\Pr[\textit{efficient performance}] &= \Pr[c \leq v] = \Pr[C(r^s) + \theta \leq V(r^b) + \phi] \\ &= \Pr[\theta - \phi \leq V(r^b) - C(r^s)] \\ &= \Pr[\xi \leq V(r^b) - C(r^s)] \\ &= H[V(r^b) - C(r^s)], \qquad (6.1)\end{aligned}$$

where $H(.)$ is the distribution function of $\xi := (\theta - \phi) \backsim h(0, \sigma_\theta^2 + \sigma_\phi^2)$, as θ and ϕ are assumed to be independent.

$$\text{And,} \qquad \Pr[\textit{efficient breach}] = 1 - H[V(r^b) - C(r^s)] \tag{6.2}$$

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

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

$$\begin{aligned}\text{i.e. } \text{EPJ} = {} & H[V(r^b) - C(r^s)].[V(r^b) - \{E(C(r^s) + \theta | C(r^s) + \theta \leq V(r^b) + \phi\}] \\ & - r^b - r^s\end{aligned}$$

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

For the buyer, we have $\text{EPJ}'(r^b) = 0$, which implies:

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

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

$$V'(r^{b**}) = \frac{1}{H[V(r^{b**}) - C(r^{s**})]} > 1, \ [\text{since } H(.) < 1] \tag{6.3}$$

For the seller, we have $\text{EPJ}'(r^s) = 0$, which implies:

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

$$i.e. \qquad H[V(r^b) - C(r^s)].C'(r^s) = -1.$$

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

$$-C'(r^{s**}) = \frac{1}{H[V(r^{b**}) - C(r^{s**})]} > 1, \text{[since } H(.) < 1] \tag{6.4}$$

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

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

STEP 2: (One-Sided Private Information and Bilateral Reliance)

Without any loss of generality, now consider that only one of the two parties holds *ex post* private information. Let the seller hold the private information θ, so that her cost is $c = C(r^s) + \theta$; and the buyer's valuation is $v = V(r^b)$ as he does not have any information. (This part is reproduced from Chap. 4.)

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

$$\begin{aligned} \text{So, Pr[perform]} &= Pr[c \leq V(r^b)] = Pr[C(r^s) + \theta \leq V(r^b)] \\ &= Pr[\theta \leq V(r^b) - C(r^s)] = F[V(r^b) - C(r^s)], \end{aligned} \tag{6.5}$$

where $F(.)$ is the distribution function of $\theta \backsim f(0, \sigma_\theta^2)$, $\because$ θ and ϕ are independent. Note that expression (6.5) involves distribution $F(.)$, whereas expression (6.1) involves $H(.)$.

Thus the expected joint pay-off would be:

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

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

For the buyer, again we have $\mathrm{EPJ}'(r^b) = 0$ which implies:

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

$$\text{i.e. } V'(r^{b*}) = \frac{1}{F[V(r^{b*}) - C(r^{s*})]} > 1, \ [\because V'(.) > 0, V''(.) < 0] \tag{6.6}$$

For the seller, similarly we have $\mathrm{EPJ}'(r^s) = 0$, which implies:

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

$$\text{i.e. } -C'(r^{s*}) = \frac{1}{F[V(r^{b*}) - C(r^{s*})]} > 1, \ [\because C'(.) < 0, C''(.) > 0] \tag{6.7}$$

STEP 3: (*No private information and unilateral reliance*).

Now coming to a set-up without any uncertainty (or private information), the efficient amounts of reliance investment simply solves the following:

The buyer solves $\max_{r^b} V(r^b) - r^b$. Let $r^b = r^b_c$ be the solution of the buyer's maximisation problem that satisfies the following first-order condition:

$$V'(r^b_c) = 1. \tag{6.8}$$

And similarly, the seller solves $\max_{r^s} C(r^s) - r^s$. Let $r^s = r^s_c$ be the solution of the seller's maximisation problem that satisfies the following first-order condition:

$$V'(r^s_c) = 1 \tag{6.9}$$

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

Comparing the expressions (6.3) with (6.6) and (6.4) with (6.7), we infer that under two-sided uncertainty the "efficient levels of investments" by the parties would be even less than under one-sided uncertainty (since $H(x) < F(x)$ for all $x[:= V(r^b) - C(r^s)] > 0$ except at the extreme).[7] The reason for this is that uncertainties at the double margin (about the buyer's valuation as well as the seller's cost) coupled with the possibility of a breach undermines the value of reliance for the parties when compared to the one-sided uncertainty case (discussed in Chap. 4). ■

6.3 Court Imposed Damages

In our model setting, there is room for a moral hazard problem as well as for opportunistic behaviour by the parties. First, we demonstrate the impact of restitution and reliance damages. Next, we move to the case of expectation damage. When it comes to the court to fix the promisee's (here the buyer's) expectation damages, the competence and the rationality of the courts become quite important. At Time 4, during the trial, the victim presents evidence to the court about his valuation—contract incompleteness coupled with asymmetry of information (within the parties and between the parties and the court) may create some room for the buyer to customise the evidence. We shall consider three distinct cases as to courts' behaviour in this scenario.

6.3.1 Restitution Damages

Restitution damages are defined as the amount of money which restores the buyer to the position he was in before the breach was made. This means that whenever 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, $D_s = 0$. In this case, restitution damages are the same as no damages. Therefore, the seller performs if $P - c \geq 0$, or if $c \leq P$; otherwise she chooses to breach.

Since $P \in \{[\underline{V}, \bar{V}] \cap [\underline{c}, \bar{c}]\}$, that is the price lies in the interim of the supports of value and cost, and $\underline{c} \leq \underline{V} \leq \bar{c} \leq \bar{V}$, that is there is an overlapping of the supports of value and cost, more precisely a no-gap situation, we cannot say conclusively that the seller breaches too often when compared to the first-best level of an efficient breach, as was the case in earlier chapters. In fact, since the buyer's valuation is private information (moreover the seller cannot observe it) in some contingencies such as $v \leq P$, the seller cannot breach the contract. Thus the breach-set is actually smaller.

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

Now the buyer's expected pay-off would be:

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

The first-order condition for the buyer's pay-off maximisation can be derived as:

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

$$\text{i.e.} \qquad V'(r^b_S) = \frac{1}{F[P - C(r^s_S)]} \lesseqgtr \frac{1}{H[V(r^{b**}) - C(r^{s**})]} \tag{6.10}$$

that is the buyer will over-invest if $F[P - C(r^s_S)] > H[V(r^{b**}) - C(r^{s**})]$; and if $F[P - C(r^s_S)] < H[V(r^{b**}) - C(r^{s**})]$ then he would under-invest.

The immediate implication of this is that the investment incentive to the buyer cannot be determined conclusively! Mostly likely, he (weakly) over-invests. Note that the investment incentive is highly sensitive to the initial choice of contracted price P; it is also highly dependent on the seller's investment structure and the particular shape of the two distribution functions $F(.)$ and $H(.)$. If P is chosen sufficiently low then efficient investment or even under-investment is possible. (See Note 7 for more explanation.)

Similarly, the seller's expected pay-off would be:

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

The first-order condition for the seller's pay-off maximisation can be derived as:

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

$$\text{i.e.} \qquad -C'(r^s_S) = \frac{1}{F[P - C(r^s_S)]} \lesseqgtr \frac{1}{H[V(r^{b**}) - C(r^{s**})]}. \qquad (6.11)$$

Therefore, most likely, the seller would also over-invest in reliance. See the argument provided in the buyer's case.

Remarks. The over-investment results under restitution damage measures are in stark contrast to the conventional under-investment results obtained under single dimensional asymmetry.

The reason is as follows. Since the buyer's valuation is his private information, he in certain contingencies would receive some free performance by the seller (although this is inefficient from an economic viewpoint, as $v \leq c$). Therefore he would still obtain some private return on his specific investment, even when the separation of the parties is efficient and the investment has no social return. This is the *insurance motive*. As the buyer does not need to internalise fully all the social cost of the breach, his incentive to invest is "not" held up here, which is contrary to the results of models with one-sided private information, see Eqs. (4.4) and (4.5) in Chap. 4. However, besides this, if the contracted price is not so high, the seller anticipating this phenomenon increases her investment, with a *precautionary motive*, to the point where she has to perform under restitution damage.

6.3.2 Reliance Damages

As before, 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. Thus, the buyer's pay-off, if the contract was never signed, is "zero", while his pay-off in the event of a breach is $\{-r^b\}$. Reliance damage is the difference between these two, and turns out to be $D_r = r^b$.

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

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

Now the buyer's expected pay-off would be:

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

The first-order condition for the buyer's pay-off maximisation can be derived as:

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

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

$$\begin{aligned}V'(r_R^b) &= 1 - [V(r_R^b) - P - r_R^b].\frac{f[P + r_R^b - C(r_R^s)]}{F[P + r_R^b - C(r_R^s)]} \qquad (6.12)\\ &\leq 1 < \frac{1}{H[V(r^{b**}) - C(r^{s**})]}\end{aligned}$$

Thus the buyer will routinely over-invest compared to the first best.

Similarly, the seller's expected pay-off would be:

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

The first-order condition for the seller's pay-off maximisation can be derived as:

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

$$\text{i.e.} \qquad -C'(r_R^b) = \frac{1}{F[P + r_R^b - C(r_R^s)]} < \frac{1}{H[V(r^{b**}) - C(r^{s**})]} \qquad (6.13)$$

that is the seller will also be investing more relative to the first best.

Remarks.

1. The buyer is as usual investing excessively under reliance damage because of the separation prevention motive.
2. However, over-investment by the seller in this case stands surprisingly in contrast to the case of single dimensional asymmetry, where the seller (i.e. the breacher) under-invests compared to the then first-best level (Chap. 4). This again happens because of the precautionary motive adopted by the seller, similar to the case of restitution damage.

Worth noticing here is that the seller's equilibrium investment incentive condition (6.13) in this case is exactly the same as the condition (4.10) in the one-sided asymmetry case. So, how do we get this over-investment result? The reason is that the first-best levels are different for different dimensions of information asymmetry. The first-best optimum level of reliance under two-sided private information is lower than that under one-sided private information. (See Lemma 6.1.) Thus whenever the reliance damage is the concerned remedy, even if the seller undertakes the same amount of investment in both cases, her investment stands higher under two-sided asymmetry, whereas it falls lower under one-sided asymmetry (compared to the respective first-best levels).

6.3.3 Expectation Damage: Three Cases

Suppose D_E is the amount under the expectation damage measure. Whenever it is efficient, the seller pays the court-imposed expectation damages at Time 3 and unilaterally exits the contract. So, the seller's gain on performance is $(P - c)$ and on failure to honour the contract is $(-D_E)$. Therefore, the seller will perform whenever $P - c > -D_E$, otherwise she will breach.

Let us now conjecture that the buyer, in the face of a breach, will most likely misguide the court about his actual valuation of the performance of the contract so that his ex post pay-off increases.[8] It is worth commenting at this juncture on how his expected pay-off may vary, in the case of a breach or repudiation, depending upon how the court reacts to his claim on valuation. We can safely state that the level of strictness or even competence varies across different courts! Following the literature on *optional remedies* – such as Ayres and Balkin (1996), Ayres and Goldbart (2001), Ayres (2005), and Avraham and Liu (2006, 2009, 2012) – let us put forward three possible cases: (a) the court is naive and simply believes in the evidence produced by the promisee regarding his (inflated) valuation and grants expectation on the basis of that; (b) the court is very strict and refutes the evidence and only accepts the ex ante expected level of the promisee's valuation; and (c) the court at its discretion chooses a value in-between the expected valuation and the evidential (inflated) valuation by the promisee.

When the expectation interest of the breach victim cannot be properly verifiable in the court, either because of the uncertainty in valuations or because of hidden information, the liability for such reliance is one that is highly debated in the literature. Our special focus on these cases contributes to the legal debates on the *expectation liability for reliance* and bring out the strategic behaviour by parties under these situations. Our results are thus relevant to those cases in which liability could in principle be imposed by the courts. We also deal with the question as to whether it should be imposed by the court and, if so, to what extent. Let us now one-by-one try to show what happens in the above three different situations.

Case 1: The Court Is Naive

The court is naive in the sense that it adopts a *subjective measure* of the damage that either requires information revelation by the parties or permits the discovery of firm-specific information during trials. The court may straightaway accept the evidence put before it by the promisee (buyer) and grant him recovery of D_E, the expectation damage measure based on the buyer's reported valuation, denoted by $\hat{V}$, to the court. Thus $D_E = \hat{V} - P$. Given the buyer's reported value, the seller would breach whenever $c > \hat{V}$, otherwise she would perform. Now we compute the probabilities of performance and breach as follows:

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

Thus, the buyer's expected pay-off would be:

$$\begin{aligned}\text{EPB}_E &= F[\hat{V} - C(r^s)].[E(v) - P - r^b] + [1 - F(\hat{V} - C(r^s))].[D_E - r^b] \\ &= F[\hat{V} - C(r^s)].[V(r^b) - P - r^b] \\ &\quad + [1 - F(\hat{V} - C(r^s))].[\hat{V} - P - r^b] \\ &= F[\hat{V} - C(r^s)].V(r^b) + \hat{V} - F[\hat{V} - C(r^s)].\hat{V} - P - r^b \qquad (6.14)\end{aligned}$$

Similarly, the seller's expected pay-off would be:

$$\begin{aligned}\text{EPS}_E &= F[\hat{V} - C(r^s)].[P - r^s - E(c|c \leq \hat{V})] \\ &\quad + [1 - F[\hat{V} - C(r^s)]].[-D_E - r^s] \\ &= P - r^s - F[.].E[C(r^s) + \theta | C(r^s) + \theta \leq \hat{V}] \qquad (6.15) \\ &\quad -\hat{V} + \{1 - F[.]\}.\hat{V}\end{aligned}$$

To check the investment incentives for the parties we derive the following lemma:

Lemma 6.2 (Reliance Incentives).
To check whether the buyer and the seller make an efficient investment or not, we one-by-one maximise the buyer's expected pay-off in Eq. (6.14) with respect to r^b and the seller's expected pay-off in Eq. (6.15) with respect to r^s:

$$\mathrm{EPB}'_E(r^b) = F[\hat{V} - C(r^s)].V'(r^b) - 1 = 0$$

$$\text{i.e.} \qquad F[\hat{V} - C(r^s)].V'(r^b) = 1$$

$$\text{i.e.} \quad V'(r_E^b) = \frac{1}{F[\hat{V} - C(r_E^s)]} \lesseqgtr \frac{1}{H[V(r^{b**}) - C(r^{s**})]} = V'(r^{b**}) \tag{6.16}$$

From the previous expression we cannot conclusively decide the investment incentive of the buyer if he were to over-invest or efficiently invest in this case compared to the first-best level. Further evidence on $\hat{V}$ is required to be able to compare the values of $F(.)$ on the two sides of inequality ($\lesseqgtr$) in the expression (6.16). Let us hold on for this until the next lemma, and derive the incentives for the seller.

The seller's expected pay-off maximisation gives us the following:

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

$$\text{i.e.} \quad -C'(r_E^s) = \frac{1}{F[\hat{V} - C(r_E^s)]} \lesseqgtr \frac{1}{H[V(r^{b**}) - C(r^{s**})]} = -C'(r^{s**}) \tag{6.17}$$

Similar to the buyer's case, we again cannot conclusively derive the level of investment by the seller compared to first best. We draw our inference on the investment incentive for the parties in Observation 6, following the lemma below. ■

Now, when the buyer tries to maximise his expected pay-off by choosing $\hat{V}$, we get the following condition:

$$f[\hat{V} - C(r^s)].1.V(r^b) + 1 - f[\hat{V} - C(r^s)].\hat{V} - F[\hat{V} - C(r^s)].1 = 0 \qquad (6.18)$$

We derive the following lemma:

Lemma 6.3 (Equilibrium Outcomes).

$$\hat{V}^E = E(v) + \frac{1 - F[\hat{V} - C(r^s_E)]}{f[\hat{V} - C(r^s_E)]}, \qquad \text{where } E(v) = V(r^b) \qquad (6.19)$$

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

Proof. $\hat{V}^E$ is directly derived from *Eq. (6.18)*. We call this $\hat{V}^E$ the agent's virtual valuation under expectation damage.[9] Other conditions are calculated by substituting the first order condition value in the relevant places. ■

Observations.

1. From Eq. (6.19), we can see that the buyer tends to inflate his valuation ($\hat{V}^E$) by the amount $\{\frac{1-F[\hat{V}-C(r^s_E)]}{f[\hat{V}-C(r^s_E)]}\}$ over his expected valuation ($E(v)$). This confirms our suspicion that the buyer would try to fetch more than his expected valuation during litigation by misguiding the court.
2. However, there are two sides to this mis-reporting by the buyer. As the buyer's $E(v)$ increases, his reported value $\hat{V}^E$ also increases, but the exaggeration factor (i.e. $\frac{1-F[\hat{V}-C(r^s_E)]}{f[\hat{V}-C(r^s_E)]}$) decreases. This can be directly derived from the monotone hazard property we ascribed to $f(.)$.
3. There is an ambivalence, that the buyer faces, in terms of options of (mis)reporting his anticipated value to the court: when the seller's actual

cost is high enough (with probability $[1 - F(\hat{V} - C(r^s))]$), if the buyer inflates his valuation in the face of a breach by the seller, the buyer wins higher damages. However, a higher reported valuation, and hence a higher damage payment, will discourage the seller from breaching, in which case the buyer only gets $E(v)$ instead of a higher $\hat{V}^E$. Therefore, he has to balance these two countervailing incentives when choosing his evidence.

4. We assumed here that the buyer's uncertainty has not been realised fully when the breach occurs and so he has to report an anticipated valuation. However, even if his valuation is fully realised, it is his dominant strategy under trial to report such a valuation so long as his actual valuation $v < \hat{V}^E$. It is to be noted here that in case the buyer's actual valuation $v > \hat{V}^E$, then he may even insist on a "specific performance remedy" in the court. Both are strategic types of behaviour of the victim to obtain something extra.
5. Further, note that there is an inefficient breach from both the ex ante as well as the ex post perspectives. As the seller breaches whenever $c > \hat{V}^E$ $(\neq v)$, clearly, there is an under-breach if $v < \hat{V}^E$ and there is an over-breach whenever $v > \hat{V}^E$.
6. Therefore in the light of the previous point, we can now conclusively say that in the expressions (6.16) and (6.17) only strict inequality holds good (since for $x > 0$, $F(x) > H(x)$; refer to Note 7), and thus both parties will over-invest in reliance compared to the individual first-best levels under this case. However, the buyer's investment choice is tempered by his desire to inflate his valuation. We may intuit a reason for this phenomenon. When a naive court accepts the buyer's reported value in establishing the expectation compensation, the buyer then does not stretch his reliance too much but rather tries to customise his report so as to maximise his gain. We mean to say that while the insurance motive is still present in the mind of the buyer, the separation prevention motive is absent here (as against Case 2 below, see the intuition of Remark 3 following Lemma 6.4).

Remarks. It is important to note that, in the special case where $F[\hat{V} - C(r^s)] = H[V(r^b) - C(r^s)]$ (refer to Note 7), both buyer and seller would undertake efficient levels of investment as under the first best.

This is striking and has an important bearing on court-decisions to uphold efficiency (at least in terms of efficient reliance when ex post efficient breach is very unlikely). In case the parties foresee this particular possibility, they may at the time of contracting (under the provision of liquidated damage) fix a *high penalty* (according to $F(.) = H(.)$) as a default option in case of dispute, which will effectively ensure efficient reliance for both parties.

This penalty may often be higher than the *actual expectation damage* (in the case where it is verified, it could be lower as well, but certainly higher than the *expected expectation damage* (vide Eq. (6.19)) at the time of dispute settlement depending on the realisation of the buyer's valuation.

Note that this finding stands in stark contrast to the result by Stole (1991), which suggests that liquidated damages could not be higher than the buyer's expected valuation. In fact, his analysis was motivated by social welfare maximisation, whereas our result arises from the parties' interest to induce efficient reliance when an efficient breach is difficult to detect. But it is noted in the literature that the courts routinely refute these stipulated penalties in the case of disputes and only allow non-penalty liquidated damages.

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

Case 2: The Court Is Strict

A strict court may adopt measures that neither require the aggrieved party to reveal, nor permit the breaching party to discover, any firm-specific information. The court then completely overlooks all the evidence produced by the promisee regarding his ex post valuation and only accepts $E(v)$, which is perhaps observable (through initial contract terms) and easier to calculate and also may be due to the promisor's routine refutation of the promisee's valuation. This is thus an "objective damage" measure, and in the jargon is called *Expected Expectation Damage*. Thereby, the court sets expectation damage $D_e = E(v) - P$ and allows the breach victim to recover this amount when trade is inefficient. Given D_e, the seller performs iff $P - c \geq -D_e = -\{E(v) - P\}$, or if $c \leq E(v)$; otherwise she breaches.

$$\begin{aligned}\Pr[\text{performance}] &= \Pr[c \leq E(v)] = \Pr[C(r^s) + \theta \leq E(v)] \\ &= \Pr[\theta \leq E(v) - C(r^s)] = F[V(r^b) - C(r^s)]. \quad (6.20)\end{aligned}$$

Now the expected pay-off for the buyer would be:

$$\begin{aligned}\text{EPB}_e &= F[V(r^b) - C(r^s)].\{E(v) - P - r^b\} \\ &\quad + \{1 - F[V(r^b) - C(r^s)]\}.\{D_e - r^b\} \\ &= V(r^b) - P - r^b\,. \quad (6.21)\end{aligned}$$

And the expected pay-off for the seller would be:

$$\begin{aligned}\text{EPS}_e &= F[V(r^b) - C(r^s)].\{P - r^s - E(c|c \leq E(v))\} \\ &\quad + \{1 - F[V(r^b) - C(r^s)]\}.\{-D_e - r^b\} \\ &= P - r^s - F[V(r^b) - C(r^s)].E(C(r^s) + \theta|C(r^s) + \theta \leq V(r^b)) \\ &\quad - V(r^b) + F[V(r^b) - C(r^s)].V(r^b)\,. \quad (6.22)\end{aligned}$$

Lemma 6.4 (Investment Incentives).
To check if parties make an efficient investment or not, we maximise the buyer's expected pay-off in Eq. (6.21) with respect to r^b and the seller's expected pay-off in Eq. (6.22) with respect to r^s:

$$\mathrm{EPB}_e'(r^b) = 0 \Rightarrow V'(r_e^b) = 1 < \frac{1}{H[V(r^{b**}) - C(r^{s**})]} = V'(r^{b**}) \tag{6.23}$$

Thus the buyer will (severely) over-invest in reliance relative to the first-best level.

$$\begin{aligned} &\text{Now for the seller,} \quad \mathrm{EPS}_e'(r^s) = 0 \\ &\textit{i.e.} \quad -1 - f[V(r^b) - C(r^s)].[-C'(r^s)].V(r^b) \\ &\qquad -F[V(r^b) - C(r^s)].C'(r^s) \\ &\qquad\quad +f[V(r^b) - C(r^s)].[-C'(r^s)].V(r^b) = 0 \end{aligned}$$

$$\textit{i.e.} \quad -C'(r_e^s) = \frac{1}{F[V(r_e^b) - C(r_e^s)]} < \frac{1}{H[V(r^{b**}) - C(r^{s**})]} \tag{6.24}$$

that is the seller will also over-invest compared to the first-best level. ■

Remarks.

1. Observe that the level of reliance investments both by the buyer and the seller in this case is equivalent to that in the model of the previous chapter where there is only one-sided uncertainty pertinent to the seller's cost of performance. This result is not very surprising as the breach decision is unilateral in both cases and is exercised by the seller.
2. However, note that the breach condition here is not exactly the same for an efficient breach; we observe that the seller breaches whenever $c > E(v)$. This is inefficient in some states of the world when $E(v) > v$. Therefore, importantly, there is over-breach from the ex ante perspective. Also worth noting, from the ex post perspective, is that there is under-breach whenever $E(v) > v$ and there is over-breach if $E(v) < v$.

3. By comparing the expressions (6.23) with (6.16), we can conclude that the investment incentives to the buyer under case 2 is far higher than under case 1. The reason is twofold: first, there is an insurance motive (which is a common argument for expectation damages); second, additionally, a *separation prevention motive* is also operating here (contrary to the view of Sloof et al. (2006); they say that this motive only works under reliance damage measures) as the buyer's expected valuation is directly dependent on his investment choice (by construction, in our model). In this case the buyer is better off when the parties trade than when they efficiently separate; he may therefore have an incentive to invest at least so much such that the valuation within the relationship reaches the highest possible one.
4. For the seller, comparing the expressions (6.24) with (6.17), we can infer that the investment incentives to the seller under case 2 is somewhat higher than under case 1. The reason for this is that when the buyer invests excessively due to a separation prevention motive and forces the seller to perform, the seller so as to cope with this extra burden of performance is also induced to undertake excess investment that will further reduce her cost of performance. This is just the precautionary/insurance motive.

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

In general terms, objective remedies tend to do a relatively good job of protecting the aggrieved party's "secrecy interest" but will often fail to protect her compensatory interest because they do not take transaction-specific elements of value into account. In contrast, subjective remedies seriously jeopardize the aggrieved party's "secrecy interest", and may also jeopardize her compensatory interest, once the interplay between the "secrecy interest" and the "compensatory interest" is taken into account. Although subjective remedies like the expectation measure (case 1) may appear to be well-suited to the goal of full compensation, since they are closely tailored to the actual losses of a particular aggrieved party, an aggrieved party who is concerned with keeping information private may be reluctant even to file a suit seeking a subjective damage measure. Such a party may rationally prefer to forego her compensatory interest because pursuing a subjective remedy would give the defendant the right to obtain her valuable private information through discovery. Moreover, in situations where the existence of the potential aggrieved party's "secrecy interest" is known to a promisor contemplating a breach, the would-be aggrieved party's threat to sue in the event of a breach may lose its credibility, thereby increasing the likelihood of a breach and further jeopardizing her compensatory interest.

Thus we summarise our observations from the two cases above as follows.

Proposition 6.1. *Under a fixed price incomplete contract that has bilateral investments and two-dimensional asymmetry, any variant of expectation damage remedy results neither in an ex ante efficient relation-specific investment nor in an ex post efficient breach; although Expected Expectation Damage (case 2) optimises expected social welfare and High Expectation damage (case 1) may induce efficient reliance.*

Case 3: The Court's Nature and Behaviour Are Uncertain

The level of naivety or strictness of every court is not the same: it varies widely. To highlight this point, we assume that the courts may determine the amount of expectation damages in such a way that it may lie somewhere in-between the thresholds of the two above cases. Thus, the court is assumed to hear the buyer's report and, knowing that the buyer has an incentive to mis-report the loss, the judge will also use his or her discretion to make some (downward) adjustments. Specifically, we assume that the damages will be a linear combination of the buyer's report ($\hat{V}$) and the buyer's (observed/expressed) expected value $E(v)$, that is the new measure of damage will be

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

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

We suppress the calculations at this stage since it will proceed in the same way as in case 1 and the results would be pretty much similar. The only difference that arises here is that the buyer would be less aggressive in exaggerating his reported value.

When the Promisee's Ex Post Valuation Is Verifiable to the Court

We have assumed all through that the seller's costs and the buyer's valuation are private information and non-observable to the other party in the course of the entire transaction. Now for dispositional purposes we can think that the buyer's damages are verifiable ex post (only) in court through some discovery process, but not while the seller is making a decision on performance or a breach. We assume that there are no costs associated with the verification of the buyer's ex post valuation (or there could be some reasonable cost for verification; under common laws this cost is borne by the seller/promisor whereas under US laws this cost accrues to the buyer/promisee). As the buyer's valuation is verifiable to the court, then the court is capable of awarding actual damages. However, there is a catch: the buyer in this case would file a lawsuit only when his ex post actual valuation is larger than the contracted price; otherwise the buyer might end up paying damages. Thus, the seller does not, in fact, face the entire distribution of the buyer's valuations under actual damages remedy. Instead, he faces a truncated distribution which has a higher mean than the ex ante expectation damages he would pay under the fixed ex ante expectation damages remedy. As a result, the seller breaches too little. Therefore, joint welfare in an actual damages award regime is reduced relative to a fixed expected expectation damages regime. We suppress the calculations for the analysis of incentives to investment and breach, as it is again expected to be inefficient just as in the previous cases we discussed before.

6.4 Party Designed Liquidated Damages

The setting and analysis. In our present setting of two-sided asymmetric information with bilateral reliance, we can derive the analysis of party designed damage remedy in the same ethos as in the case of one-sided informational asymmetry that was dealt with in Chap. 4 (Sect. 4.4). Moreover, since the parties are risk neutral (under both one and two-sided information asymmetry cases) and go by the estimates rather than the actual values, if the buyer is designing this contract, then it is going to be exactly the same as in Chap. 4. Therefore, we hereby suppress the analysis and associated derivations and refer the reader to the analysis of liquidated measure in Chap. 4 (the calculations are exactly the same). However, we still draw some remarks.

Observations and Remarks.

1. Note that under liquidated damage $p + D_L = V(r^b) = E(v)$. This is just the same condition that induces an efficient breach under expectation damage in the one-sided uncertainty model.
2. Further, under liquidated measure $p + D_L = V(r^b) = E(v)$ means that this damage is equal to the EED (case 2) when the court is strict.

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

   Thus the levels of investment undertaken by the said parties are still inefficient compared to the first-best level (the buyer over-invests and the seller under-invests), but the buyer invests less and the seller invests less and that is exactly equal to the level in case 2.
4. Note from the ex ante perspective that there is an efficient breach but ex post there could be an inefficient breach whenever $c > E(v)$. To put it starkly, inefficiency arises in both the cases when $v > c > E(v)$ and when $v < c < E(v)$.

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

6.4.1 Parties Appoint a Mediator

As discussed in Chap. 4, the parties may, instead of writing the terms of the contract under liquidated damages, appoint an uninformed broker or mediator who may design a contract that maximises the joint surplus from trade between the parties. In that case, the mediator acts as the principal who proposes the contract. We now study the impact of this remedy.

Sequence of Events The mediator proposes to parties at Time 1 a contract and specifies the fixed delivery price P_M and the liquidated damage payment, D_M → 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_M and D_M → At Time 2, both buyer and seller observe the respective cost and valuation of production → Given P_M and D_M, either party may unilaterally decide to breach. However, let us consider, as usual, that the seller decides whether to perform the contract or to breach it → If the seller breaches, the buyer files a suit and the court awards him the liquidated damages D_M at Time 3. (Analysis of the buyer's decision of breach and its consequences can be assessed in a similar way.)

The seller's breach decision is subject to her realised cost, and is contractually agreed price P_M and damage D_L. The seller will perform only when:

$$P_M - c \geq -D_M \quad \text{or if:} \quad c \leq P_M + D_M.$$

For further reference, it is useful to define T_M as the sum of the price and the liquidated damage clause $T_M \equiv P_M + D_M$. We refer to this T_M as the promisor's *total breach cost* when leaving the existing contract consisting of his opportunity costs P_M and the damage D_M.

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

$$\begin{aligned}\Pr[C(r^s) + \theta \leq P_M + D_M] &= \Pr[\theta \leq P_M + D_M - C(r^s)] \\ &= F[P_M + D_M - C(r^s)]\ .\end{aligned}$$

Given the probability performance, the buyer's expected pay-off is:

$$\begin{aligned}\mathrm{EP}_M^b = {} & F[P_M + D_M - C(r^s)].[V(r^b) - P_M] \\ & +\{1 - F[P_M + D_M - C(r^s)]\}.D_M - r^b\ ,\end{aligned}$$

and the seller's expected pay-off is:

$$\begin{aligned}\mathrm{EP}_M^s &= F[P_M + D_M - C(r^s)].[P_M - E(c|c \leq P_M + D_M)] \\ &\quad +\{1 - F[P_M + D_M - C(r^s)]\}.(-D_M) - r^s \\ &= F[.].(P_M + D_M) - F[.].E(C(r^s) + \theta|C(r^s) + \theta \leq P_M + D_M) \\ &\quad -D_M - r^s.\end{aligned}$$

$$\begin{aligned}\text{So,}\quad \mathrm{EP}_M^b + \mathrm{EP}_M^s = {} & F(.)\{V(r^b) - E(C(r^s) + \theta|C(r^s) + \theta \leq T_M)\} \\ & -r^b - r^s.\end{aligned}$$

We obtain the following lemma:

Lemma 6.5. *For any given $T_M \equiv P_M + D_M$ and $P_M > 0$:*

(a) *The buyer can always be made strictly better off by increasing D_M and decreasing P_M by the same amount, thereby keeping T_M constant.*
(b) *However, the seller can be made strictly better off by decreasing D_M and increasing P_M by the same amount, thereby keeping T_M constant.*

Proof. Note that the buyer's expected pay-off can also be written as:

$$\mathrm{EP}_M^b = F[T_M - C(r^s)].V(r^b) - F[T_M - C(r^s)]\}.T_M + D_M - r^b,$$

which is strictly increasing in D_M. The lemma implies that, for given T_M, the buyer prefers to accept the offer price P_M from the mediator as low as possible. Although P_M and D_M are prefect substitutes from the standpoint of contract performance, the buyer prefers to accept a higher damage payment D_M rather than paying a higher price P_M. Clearly, there is a limit to lowering P_M due to the non-negativity constraint and the seller's participation requirement.

But for the seller, her expected pay-off can be written as:

$$\mathrm{EP}_M^s = F[.].T_M - F[.].E(C(r^s) + \theta | C(r^s) + \theta \leq T_M) - D_M - r^s,$$

which is strictly decreasing in D_M; therefore, for given T_M, the seller prefers to accept the offer price P_M from the mediator as high as possible. Although P_M and D_M are prefect substitutes from the standpoint of contract performance, the seller prefers to accept a lower damage payment D_M rather than conceding a lower price P_M. Clearly, there is a limit to lowering D_M due to the non-negativity constraint and the buyer's participation requirement.

So the mediator would consider both prospects while proposing the contract that may allow a breach by the seller. In fact, there may be two different contract proposals to deal separately with the two cases of breach—one by the seller, another by the buyer. We are here dealing with the case of the seller's breach. ■

The mediator typically determines P_M and D_M to maximise the expected social pay-off. Under asymmetric information, the principal (the mediator) cannot observe the agent's (either parties') effort. Thus the mediator's programme is then to offer both parties a contract (P_M, D_M) (in the case of the seller's breach) that will maximise their expected social pay-off subject to the participation constraints (IRs) of both, so that both agents receive non-negative utility, and the incentive constraints (ICs) for both, so that they are incentivised to take an efficient level of reliance. Note that we now have two sets of ICs and IRs which was not the case in the maximisation problem (4.16) in Chap. 4, as there the buyer was proposing the contract. We assume that neither party has all the bargaining power in contracting. When the mediator makes a take-it-or-leave-it offer to the parties simultaneously, either can accept or reject the contract. If they reject, the outcome is $(q, P_M) = (0, 0)$. This then becomes both parties' reservation bundle, so their reservation utilities are $c = 0$ and $v = 0$, as there is no market alternative.

Thus we have the following optimisation problem:

$$\max_{P_M, D_M, r^b, r^s} \mathrm{EPJ}_M^b(P_M, D_M, r^b, r^s) = \mathrm{EP}_M^S + \mathrm{EP}_M^B$$

$$\begin{aligned} \text{subject to} \quad &(i) \quad \mathrm{EP}_M^S \geq 0 && [\mathrm{IR}_S] \\ &(ii) \quad \mathrm{EP}_M^B \geq 0 && [\mathrm{IR}_B] \\ &(iii) \quad \max_{r^s} \mathrm{EP}_M^S && [\mathrm{IC}_S] \\ &(iv) \quad \max_{r^s} \mathrm{EP}_M^S && [\mathrm{IC}_B] \end{aligned}$$

Now this is a substantially more complicated programme, which can be tackled in the same way as in Chap. 4, Sect. 4.4. We leave this to interested readers to solve and draw conclusions. We are hopeful that this programme will give better results than the party-designed liquidated damage, though incentive issues still remain.

6.5 Conclusion

As stated above, the majority of the literature on the analysis of contract remedies for a breach does not account for the non-breaching party's option of not suing for damages. The typical way of analysing the efficiency of various contract remedies presumes that any breach of the contract would lead to litigation. However, analysis in this chapter shows that the breach victim might refrain from suing for remedy if the expected pay-off from the lawsuit is negative (given the contractual terms and her private information about her loss from a breach). Further, it is established that this option of acquiescing to a breach as well as the non-observability of the parties' valuations and reliances together have important implications for the parties' incentives to both breach and reliance and thereby the efficacy of different damage remedies. Notably, it is also pointed out that when actual expectation damages of the breach victim (although not directly observable to the breacher) can be verified ex post (at a cost) during trial in court, it will induce an under-breach from the ex ante perspective.

As to the court's optimal choice of damages under the case of non-verifiable damages, where the parties engage in a strategic signalling game of trying to present evidence strategically to influence the court's damages award, our results have twofold implications. First, when the parties do not specify any particular damage measure in their initial contract, the courts should adopt the *expected expectation damage* as this will augment the ex ante social surplus and to some extent curb the strategic behaviour of the parties, although this does not lead to efficient investments by the parties. Second, if the parties themselves come up with any mutually agreed upon liquidated damage provision in their contract, even if the amount is very high, the court should implement the same unequivocally, as the parties might be designing this damage provision either from the perspective of maximising the joint pay-off or from the perspective of implementing efficient levels of bilateral reliance investments.

Notes

1. The model analysis in this chapter is based on ideas originally published in my article “On Breach Remedies: Contracting with Bilateral Selfish Investment and Two-Sided Private Information” (Bag, 2015).
2. The ex post revelation of information that is required by subjective damage measures and the rules of discovery may also reduce parties’ incentives either to acquire deliberately certain types of information or to invest in the types of innovation and activities whose profitability is dependent on keeping information private. Consider a manufacturer who invents a low cost production process. If she brings a suit for damages against a supplier of a component, she will have to reveal her cost of production, which will induce her competitors to try to obtain information about her production process. Firstly, protecting this type of information from revelation in such a suit would have the beneficial effect of preserving or enhancing parties’ incentive to devise such innovations. Secondly, there are many contracting contexts in which protecting private information ex post is likely to create more efficient ex ante incentives to gather and use information.
3. It has already been noted that most articles that use fixed-price contracts require the assumption of costless renegotiation to be able to achieve the first-best outcome, an outcome which the contingent-contract literature has been able to achieve without assuming costless renegotiation.

   A renegotiation game is in reality never costless ex post and hard to design ex ante. It is thus questionable whether writing a fixed-term contract and designing a renegotiation game (which itself should be renegotiation proof) is indeed simpler than writing a contingent contract (Schmitz, 2001). It is therefore also questionable whether costless renegotiation is a more plausible assumption to make than the one we make here.

   Besides that, throughout the analysis it is our maintained assumption that the parties’ valuation(s) are not observable even at the stage when parties decide to perform or breach, thus under this kind of asymmetric participation the renegotiation is probably more costly than when parties’ valuations are observable. Indeed, models, which account for renegotiation, typically assume that parties’ valuations at the trade-or-renegotiate stage are observable. Although making renegotiation less costly, the observability assumption (which we do not make) is quite restrictive (see, Chung, 1992; Edlin & Reichelstein, 1996; Hart & Moore, 1988; Nöldeke & Schmidt, 1998; Spier & Whinston, 1995). Third, some have argued that the parties may find ways to commit to not renegotiating or at least to finding ways to significantly raise the costs of renegotiation. Maskin and Tirole (1999) analyse several ways that the parties can commit not to renegotiate (but see, Hart & Moore, 1999). Thus, our model also captures situations where the parties were able to commit to not renegotiating. As Hart and Moore (1999) noted, the degree of the parties' ability to committing not to renegotiate "is something about which reasonable people can disagree". Thus, they argue, both the cases where the parties can and cannot commit not to renegotiate are worthy of study. Lastly, even if renegotiation were simple and costless, our forthcoming result shows that there is no room for it under two-sided asymmetry.

4. Additionally, parties may take into account the price and the incentives to breach that reflect the anticipated ex post costs of verifying the buyer's valuation. They may also consider the English rule of loser pays or the American rule of shared costs applies.
5. Assuming a firm to be risk-neutral but wealth-constrained is also consistent with the modern contract-theoretic formulation of the Shapiro and Stiglitz (1984) efficiency wage model, see e.g. Tirole (1999) or Laffont and Martimort (2001).
6. This is a substantial departure from notions immanent in the existing models in the literature that deal with incomplete contracts. At Time 1, the parties only observe each other's distributions and their estimates, and do not even know their individual (ex post) valuations. Thus in this sense the valuations are symmetrically uninformed ex ante. This is the only similarity with other models in the literature. Hidden action exists in the form of self-investments by each party. At Time 3 asymmetry of information is introduced. Parties learn their individual valuations but still cannot observe (and definitely cannot verify) the other's valuation and finally the court knows nothing but the estimates.
7. Let us describe the situation conceptually instead of using a figure. Suppose in the horizontal axis we have a variable x, where $x = V(.) - C(.) \lesseqgtr 0$. (See expressions (6.1) and (6.5).) The vertical axis represents the values of distribution functions $F(.)$ and $H(.)$. Further, let us assume that $F(x)$ follows a normal distribution with variance 25 and mean 0 (corresponding to θ), whereas $H(x)[:= F(x) + G(x)]$ follows a normal distribution function with variance 100 and mean 0 (corresponding to $\xi := (\theta - \phi)$). As per this assumption, the representative curve for distribution $F(x)$ always lies above that of $H(x)$ on the right of the mean of x (i.e. $x = 0$) (except for the extreme right); whereas on the left of $x = 0$ the case is reversed. The area on the left

of the horizontal mark 0, which is the mean of both distributions, according to our assumption, represents the "breach set" ($x := V(.) - C(.) < 0$), that is "no contract" is feasible as the argument takes a negative value. Thus the relevant performance set of the contract is the right-hand side of the $x = 0$ mark. In this zone, for any $x' > 0$, we have $F(x') > H(x')$. Moreover, to have equality of $F()$ and $H()$, we need $\widehat{x} > x'$, so that $F(x') = H(\widehat{x})$, where, say, $x' = V(r_k^b) - C(r_k^s)$ and $\widehat{x} = \widehat{V} - C(r_k^s)$. Therefore $\widehat{V} > V(r_k^b)$ for any given $C(r_k^s)$.

8. When the breach is occurring, the value of performance to the promisee, a part of which is a function of non-verifiable reliance, will not have materialised, so there's nothing for the court except the initial estimate from which it can infer the exact value. The court either has to believe the reported value or go by the estimate or arbitrarily decide the level from the available set of information.
9. The "virtual valuation/cost" (see Myerson, 1983) appears in many related models where agents have private information about their willingness-to-pay. See also Bulow and Roberts (1989) for an interesting economic interpretation of "virtual valuations" and "virtual costs".

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7

Concluding Notes

The economic analysis of contract law is a vast subject that synchronises the theory of contract and legal premises. In this book we have attempted to cover a limited sphere that deals with incomplete contracting under asymmetric information. Let us now sum up the work.

We began the economic analysis of contract law by reviewing the role of contracts in promoting efficient exchange. Using the competitive market as the paradigm for reviewing the elements of a valid (enforceable) contract, we interpreted the economic reasons for forming contracts as responses to various forms of market modes. We summarised the economic theory developed to describe how contracts not only serve as a means for economic exchange but also provide incentives to invest in reliance that enhances the value of contracting. We also showed the type of incentives that contracts can provide under different circumstances.

Without contractual commitment, under-investment is likely to occur because of a hold-up (see, Klein, Crawford, & Alchian, 1978; Williamson, 1985). A hold-up entails that, after reliance expenditures are made, the other party may behave opportunistically by threatening to terminate the relationship. Such a threat permits this party to obtain better terms of trade than were initially agreed upon and thereby capture some of the

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returns on the specific investment made by the other party. Anticipating that she may be unable to reap the full return, the investor will invest less than the efficient level. Breach remedies can be used to overcome this hold-up under-investment problem, because they effectively protect the investor against appropriation of the return on the investment by the trading party.

While contract law provides the legal means by which economic agents enforce promises to one another, agents, who enter into a legally binding contract, may often legally break it (that is "breach" of contract is quite common). When a party to a contract fails to honour the contract terms or perform as promised, the victim suffers an economic loss and may ask the court for a remedy. Economic analysis of contract law must adhere to two basic premises: What promises should be enforced? What should be the remedy for breaking an enforceable promise? If the contract is judged to be enforceable, then the court must decide on a remedy. How should the breach victim be compensated? What penalty should be adequate to make good for the loss?

This leads us to the design of remedies for breach of contract. Breach remedies play an important role in protecting (non-contractible) relationship-specific investments. They also allow parties to cancel the agreement if the exchange is rendered inefficient due to a rise in production costs or a fall in consumption value. The analysis hinges on two key questions: When is it efficient to breach an enforceable contract? What legal remedies encourage a breach only in those circumstances? Legal remedies, under common or civil laws, fall into two general types: court designed breach remedies and party-designed remedies. Among the breach remedies, there are a set of court-imposed damages and a specific performance remedy. Party-designed remedies are embedded in the contract which stipulates a remedy when it contains explicit terms prescribing what to do if someone breaches. Different legal systems in different countries disagree about the preferred remedy; however, both common law and civil law traditions tend to specify an efficient remedy for breach of contract. Out of all the remedies, three (i.e. liquidated, reliance and expectation) specify a sum of money that the breacher has to pay to the innocent party. This expresses a *liability rule*, which is common under Anglo-American common law but uncommon in civil law systems.

In contrast, a specific performance remedy corresponds to a *property rule*. This is common in civil law systems but rare in common law systems (Ulen, 1998).

Different remedies create different incentives for the parties to a contract. We have developed economic models to compare the incentive effects of different remedies on investment in performance and reliance under three particular circumstances of information asymmetry that can prevail in most pragmatic contracting situations. The main thrust of our analysis has been in designing an efficient remedy for the breach of enforceable contracts. An efficient remedy for breach should give contracting parties efficient incentives to breach and reliance.

The theoretical literature predicts that breach remedies typically provide too much protection, thereby causing over-reliance. Two distinct motives drive such over-investment—insurance and separation prevention motives. Most of the existing literature in this domain assumes symmetric information between the parties and the inability to verify on the part of the courts. Instead, in our models we have included private information by the parties (which is again not verifiable by the court) and dealt with all the legal remedies in the case of selfish investments.

Our analysis is premised on the argument that a breach of contract is efficient in those cases where the cost of performance turns out to exceed the benefit of performance. However, under asymmetric information this often fails to happen. We have considered two different situations: first, when there is single-dimensional asymmetry pertinent to the promisor's cost and, second, when there is two-way asymmetry related to the valuations of both the promisor and the promisee. In these situations, we examined the effects of different legal remedies (without ex post renegotiation)—the incentives that breach remedies create for parties to make investments in preparation for performance and the role of breach remedies in preventing contractors from over-relying on performance. We also considered the role of breach remedies in assigning the risk of breach in an optimal way. In the course of examining the above point, we focussed primarily on money damages since that is the standard remedy employed by courts. However, we also examined specific performance, a remedy that is used less often, and high penalty measures that are akin to specific performance. Once we begin to examine the institutional details of contracting and the effects of breach remedies on contracting behaviour, some surprising conclusions emerge. We argued that courts should be more open to use specific performance and party designed liquidated damage remedies more often.

We found that, irrespective of the dimension of asymmetry when agent(s) undertake reliance, both the reliance and the restitution remedies lead to inefficient outcomes (both in breach and in reliance) for fixed-price incomplete contracts. Under the single-dimensional asymmetry case, in a fixed-price contract with no explicit damage measure in operation, each party undertakes a level of reliance that is less than the first-best level. However, a contractually chosen price is very crucial to these inefficiency results: a higher price increases the reliances by both the parties. But in a two-sided private information case, restitution damage may lead to a reversal of the under-investment case just mentioned above. Depending upon the initially chosen contract (sufficiently low) price, again under-investment or even efficient investment is possible for each party.

When reliance damage is the concern, the general result is that it leads the promisee to over-rely because of his *separation prevention motive*. (In this case the investor is better off when the parties trade than when they efficiently separate. He may therefore have an incentive to invest at least so much such that the valuation within the relationship exceeds the highest possible valuation of an outside party.) But the promisor's incentive to rely under this damage measure changes significantly with the dimensions of asymmetry. Under one-sided asymmetry, she invests less compared to the first-best level, as she does not have to bear the total loss from the breach; rather she would bear only a fraction of it. But over-investment by the seller under two-sided asymmetry stands in surprising contrast to the single dimensional asymmetry case. This happens due to the *insurance (precautionary) motive* on the part of the seller, similar to the case of restitution damage.

The possible justifications of the above results for both remedies under different dimension(s) of informational asymmetry stems from an inefficient breach by the promisor in different situations. Under one-sided asymmetry (when she observes the buyer's valuation) she breaches too frequently compared to the first-best level. Our results are very much consistent with the existing literature on an incomplete contract for this case. But under two-sided asymmetry (when she does not observe the other party's valuation) her performance is to some extent higher than the optimal level (the breach set is somewhat smaller than the efficient one). The (possible) over-investment result for both parties under both reliance and restitution damages is new and distinct from the existing literature.

Most of the recent literature on hold-up analysis concentrates on the efficacy of expectation damage, since the pioneering work of Shavell (1980) in which he establishes the general superiority of expectation damage over the others. Contemporary literature, most notably Edlin and Reichelstein (1996), suggests that under an ex post symmetric information framework expectation damage performs poorly when both parties undertake reliance in specific assets, often implying that no fixed-price incomplete contract is efficient but that a specific performance remedy (with efficient costless renegotiation) achieves efficient reliance for both parties; and when only one of the two parties undertakes a reliance investment he observes that the expectation damage remedy works perfectly fine when the parties renegotiate with an appropriately chosen *initial intermediate quantity*. As the above results were obtained under a symmetric information framework, our analyses incorporating private information stand quite differently. In Edlin's analysis, while renegotiation (with the help of a suitably chosen intermediate contractual quantity) paves the way for the efficiency of expectation damages under a unilateral investment situation, in a bilateral investment set-up the same creates a problem for the proper working of expectation damage. The efficacy of both expectation damage and specific performance remedy (irrespective of unilateral or bilateral investment set-up) is under question in our set-up as the parties' private information may render post-breach renegotiation costly and anything but efficient.

Our assessment of the court imposed expectation damage remedy shows that:

- Under single-dimensional asymmetry stemming from the promisor's cost, first, it ensures performance when the buyer's valuation is higher than the seller's cost; second, it induces efficient reliance for the breaching promisor (if only she invests), but leads both parties to over-invest (in case both rely); third, when both parties rely, the seller has to perform more than the first-best level. Also to be noted here, in case the uninformed party (buyer) chooses to breach the contract, his decision is ex post state-contingent. The court cannot monitor the informed party's (seller's) expectation interest properly, thus ex post efficient performance as well as ex ante efficient reliance are not attained.

- Under two-sided asymmetry, expectation damage remedy leads to a contract breach which is never (neither ex ante nor ex post) efficient as against the one-sided asymmetry case. Besides that, it poses some great challenges for the court because of the non-verifiability of the promisee's valuation. The courts face immense difficulty in establishing a reasonable level of the promisee's expectation. When they try to enforce *expected expectation damage* (a low damage, case 2 in Sect. 6.3) driven by the goal of social pay-off optimisation, not only is some efficient performance sacrificed but also efficient reliance is compromised. In another case, when the court arbitrarily fixes the damage at a medium level (case 3 in the same section), it simply accentuates the inefficiency. Contemporary literature contends that in the presence of asymmetric information the court should avoid imposing very high damage. But here we have found that in the case where the court employs a high damage (by believing in the promisee's opportunistically inflated claim on his valuation, or an even higher one), which could implicitly serve as a substitute for specific performance, then it can restore efficiency of reliance undertaken by both parties (see, Chap. 6, Sect. 6.3.3, Case 1); however, we accept that this leads to over-performance by the promisor (despite the fact that this measure does not altogether eliminate the opportunity of a viable breach for the promisor, it definitely helps to shrink the scope of doing so).

Finally, we found that the party designed liquidated damage measure is superior to all court-imposed remedies in all circumstances under consideration: it performs the best by securing ex post efficient performance and ex ante optimal reliance in either cases of unilateral or bilateral self-investment when there is one-sided asymmetry; but when dual-sided asymmetry is present it can only achieve an ex ante efficient breach and cannot prevent inefficient reliance (the buyer over-relies whereas the seller under-relies).

To focus on the distortion of incentives to both breach and rely and the efficiency of contract remedies, we demonstrated these points using very simple models. In the future we plan to explore further this line of research by studying models with continuous quantity choice and allowing a non-dichotomous approach to the observability constraints to investments and valuations.

For the most of the literature in law or in economics, both the verifiability and the observability constraints (of reliance and valuation) have been treated as an either/or proposition: the contracting parties/the courts either can or cannot observe/verify a potential contracting variable. While this distinction has been useful in contract theory, at least in terms of analytical convenience, it must be recognised as overly stark. Our analysis is in the same vein. Verifiability is a matter of degree, and not a dichotomy; the same is true for observability (for the parties). The dichotomous verifiability approach to contract enforcement is somewhat surprising in light of the extensive literature examining the implications of the varying degrees of imperfection in the enforcement of tort and criminal law. In the incomplete contracting context, courts will display varying degrees of competence as they are more or less able to deduce efficient *gap-filling* terms. So a game theoretically rich model for judicial competence is an important future research agenda.

Lastly, traditionally, the literature on contract remedies has considered only single-remedy contracts where the non-breaching party (or the court) applied a pre-determined exclusive remedy. In contrast, of late there have been a series of studies on *optional remedies,* such as Ayres and Balkin (1996), Ayres and Goldbart (2001), Ayres (2005), and Avraham and Liu (2006, 2012), that analyse the efficiency of contracts with optional remedies, that is contracts where the non-breaching party has an ex post option to choose a remedy from a predetermined menu of remedies. We strongly feel that this orientation of analyses has some important bearing on the issues of the court's choice of remedy when a breach victim's expectation interest is difficult to assess properly.

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