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ABSTRACT

Reputations, Relationships and the Enforcement of Incomplete Contracts*

This paper discusses the literature on the enforcement of incomplete contracts. It compares legal enforcement to enforcement via relationships and reputations. A number of mechanisms, such as the repeat purchase mechanism (Klein and Leffler (1981)) and efficiency wages (Shapiro and Stiglitz (1984)), have been offered as solutions to the problem of enforcing an incomplete contract. It is shown that the efficiency of these solutions is very sensitive to the characteristics of the good or service exchanged. In general, neither the repeat purchase mechanism nor efficiency wages is the most efficient in the set of possible relational contracts. In many situations, total output may be increased through the use of performance pay and through increasing the quality of law.

JEL Classification: D86, K12, C7, O17

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A good reputation is more valuable than money.

Publilius Syrus (1st century B.C.), Roman writer of mimes.

1 Introduction

There is lively debate regarding the importance of "institutions" for economic growth.[1] Among the most important of these, as Douglas North (1981) has emphasized, are contract enforcement institutions or, to use Avner Greif (2004)'s abbreviation, CEIs. These are the various institutions, such as courts of law, reputations and community norms, that allow parties to enter into binding agreements. The enormous variety and complexity of these institutions make it rather difficult to tease out the specific mechanisms responsible for ensuring the efficient regulation and enforcement of a private agreement. This in turn makes it difficult to know the most effective CEIs, how to intervene to enhance the effectiveness of contract formation, and ultimately the impact of these interventions upon economic growth.

These issues are topical given that transition economies, such as China and Russia, are developing new commercial codes and struggling with how to most effectively introduce laws conducive to efficient markets.[2] In addition, there is a burgeoning internet market, where parties often have little recourse to formal courts of law to enforce obligations entered into via the internet.[3] The goal of this paper is to provide a synthetic review that illustrates some of the major themes in the literature on contract enforcement. In particular, I wish to show how the quality of law and of legal systems interplays with the structures of private enforcement mechanisms, and hence help us to understand how to create efficient contract enforcement institutions.

An immediate stumbling block for such a project is the vastness of literature on the economics of contract and contract law. One reason arises from the very nature of a contract, namely, it is an agreement tailored to a particular transaction, and hence as economic conditions change, parties correspondingly alter the terms of the agreement. Hence, the observed heterogeneity in economic transactions leads to heterogeneity in contract terms. The doctrines of contract law can be seen as a collection of solutions to the vast array of contractual problems that individuals face in day to day commercial transactions (see Farnsworth (1990) for an excellent review). As a consequence, contract law is often tailored to very specific kinds of transactions, rather than following from general economic principles.

In contrast, the economics of contract, as reviewed in recent books by Salanie (1997), Laffont and Maritmort (2002) and Bolton and Dewatripont (2005), provides a collection of results that relate transactions

[1] There is a growing literature on the issue including Glaeser, Johnson, and Shleifer (2001), Acemoglu, Johnson, and Robinson (2001), Rodrik, Subramanian, and Trebbi (2004),
Aghion, Howitt, and Mayer-Foulkes (2005), and
Besley and Burgess (2004).

[2] See Hay, Shleifer, and Vishny (1996) and Johnson, McMillan, and Woodruff (2002) for discussions of the problem of introducing formal enforcement institutions in transition economies.

[3] See Elfenbein and Lerner (2003) for a discussion of the role of contracts in the organization of the internet industry. Dellarocas (2003) provides a useful review of reputation and feedback mechanisms in online markets, though the legal issues are not addressed.

costs to contract form, but they often do so with little reference to the contracts observed in practice.[4] By a transactions cost, one refers to a market incompleteness that may constrain the efficiency of a relationship. This includes information hidden from one or both parties, information that courts are not able to observe, or costs associated with the planning and drafting of an agreement. Given the constraints provided by the information structure and the actions available to the agents, the theory then provides an answer to the question of how one should set the terms of the agreement to achieve the most efficient trade possible.

Hart and Holmström (1987) observe that as a consequent contract terms will likely be very sensitive to the characteristics of both the product to be exchanged and the preferences of the parties to the trade.[5] They make this observation within the context of the static principal-agent model for a principal offering a risk averse agent a revenue sharing contract. In this case, the terms of optimal contract vary with unobserved features of the agent's attitude towards risk. In repeated relationships, the situation is further complicated by the fact that parties may use a variety of different self-enforcing norms of behavior to enforce contractual obligations. Avner Greif (1994) provides some very nice historical evidence of this phenomenon in context of contracts for long distance trade during medieval times. He shows that for the same problem - ensuring that traders do not abscond with the goods that they are transporting - different groups discovered different solutions to the problem of contract enforcement: the Maghrebi traders used a community based enforcement system, while the Gevonese used a system of efficiency wages.

The question then is how best to organize this literature. The standard approach, as adopted by the recent books on contract theory, is to organize the discussion around different transactions costs - adverse selection, moral hazard, and so on. Yet, there is little agreement as to which of these transactions costs are most important to explain observed institutions. To deal with this problem, I begin with the discussion of the legal notion of a contract. Given that economists typically use only a very elemental theory of the law, this will introduce to economists how lawyers - the individuals who often write and enforce the agreements predicted by the theory - think about a contract. Secondly, given that the modern contract law is itself an institution that developed in response to contracting problems that occur in practice, it can provide insight into which transactions costs are empirically the most relevant.

The legal description of a contract is used to motivate a very specific model of trade used in the rest of the paper to show how some of the more interesting technical results in the economics literature can be used to provide insights into the form of observed contracts. The description of the basic model is followed by an outline of the rest of the review.

1.1 What is a Contract?

> "A contract is a promise or a set of promises for the breach of which the law gives a remedy, or the performance of which the law in some way recognizes as a duty."
>
> Restatement (Second) of Contracts

[4] This review does not explicitly discuss contract enforcement as it relates to the theory of the firm (see Hart (1995)). The focus of this review is upon the more basic contract enforcement issue, and not issues of governance.

[5] This is not always the case. Holmström and Milgrom (1987) provide an example of a "complex" environment where the optimal contract takes a simple, linear form.

This definition of a contract is taken from the Restatement of Contract Law produced by the American Law Institute, and it reflects the accepted legal definition of a contract. It delineates the conditions under which a court of law may intervene in a private agreement, namely whenever one party breaches an agreement. Contract law is complex for two fundamental reasons. First, when contracts are incomplete or information is imperfect, then it is not always clear if there was a breach, and who was responsible. Secondly, even when it is established that breach has occurred, the court then must determine the appropriate remedies for breach, which might include specific performance (requiring the breaching party to perform as promised) or, more typically, determining the monetary damages that the breaching party must pay to the harmed party.

In contrast, the concepts of breach and of associated remedies play no role in the economic theory of contract. Their conceptual foundations begin with the Arrow-Debreu general equilibrium model where a contract is simply a set of transfers and actions as a function of the state of nature. The choice to breach a contract is itself a state of nature, and hence for the economist a complete contract would specify the transfers (possibly random) that the court would order should breach occur.

The difference between the legal and economic approaches to a contract can be illustrated with a simple example. Suppose that a seller agrees to supply to a buyer a shipment of fresh fruit tomorrow morning at 7 am. Suppose that the fruit arrives on time, but it is substandard due to an accidental failure of the air conditioning unit in the truck that shipped the goods. Further suppose that the fruit is still saleable but at a lower price. What happens then? In this example, the seller made her best effort, but, through no fault of her own, the goods arrived in substandard condition, facts that both parties can agree upon.

As a legally binding contract, this breach can be resolved with the buyer suing the seller in court for failure to deliver satisfactory goods. In this case, the courts would normally award the buyer the difference in value between the contracted goods and the delivered goods. In the absence of any future reputation effects, the buyer would sue if and only if the damages are greater than the cost of pursuing a suit, a cost that I shall denote as a measure of the quality of the legal system.[6]

I explicitly assume that for the current discussion we are not interested in how parties play the litigation game, itself a complete literature (see for example Cooter and Rubinfeld (1989)). Rather, litigation is viewed as a costly process that determines the damages awarded to the harmed party that in the event of breach where the benefits of a suit outweigh the costs. An economist might formally model this contract as follows.

One begins with a description of two states: good, s_g, and bad, s_b.[7] Throughout our discussion, we consider two types of goods for the which the good and bad states have different interpretations and properties. We say a good is *normal* if it performs as expected most of the time, but occasionally it is defective. In this case, the bad state occurs rarely and is associated with a defective good. The *quality* of the good is higher when the probability of a defect is lower.

[6] In practice, the delivery of useable, but substandard goods, is so common that it is covered by the Uniform Commercial Code of the United States, section 2-714. It states that the seller can fulfill her obligation to the buyer by adjusting the price downwards to reflect the value of the delivered goods to the buyer. Observe that under this provision, the parties would only arrive in court if they were unable to agree upon a "fair value" for the delivered goods. We shall return briefly to the issue of standard terms in part 2 of the paper.

[7] The importance of carefully modelling the concept of a state is discussed in the influential work of Savage (1972). See Kornhauser and MacLeod (2005) for discussion of the concept of a state in the context of the law of contract.

The second class of goods is *innovative* goods. In this case, the bad outcome is the norm, and occasionally there will be a good realization. Many labor services are innovative goods. In addition to the obvious example of a researcher engaged to make new discoveries, one can view some types of sales occupations as providing an innovative good. For example, a person selling commercial real estate may have only one or two sales per year, with most of his or her time spent meeting potential clients. Individuals in the service industry also provide innovative goods - for example the waiter at a restaurant who is particularly helpful when a client has an accident at the table. (As one who dines often with children, I know that accidents can be the norm, which may explain why some restaurants specialize in serving children!). In this case, the quality of service is given by the probability of the good event, which again is assumed to increase with the quality of service. As we discuss in more detail below, the type of good affects the structure of the optimal contract when enforcement is costly.

In an abstract economic model under the assumption that the realized state is observable, one would simply associate prices p_g and p_b to the good and bad states respectively. If parties are risk neutral then, one obtains efficient trade if these prices are "enforceable". However, for the economist, enforceable simply means that when the good state s_g occurs, there is an automatic transfer from the buyer to the seller. In practice, there are many ways to make a contract "enforceable".

For this simple exchange, there are a number of different *legal instruments* that parties may use to enforce this contract. For example, the parties may agree to trade at price p. If the good is defective, the buyer will claim that the seller breached the contract, and the buyer will ask for damages d. In this case, $p_g = p$, and $p_b = p - d$. If the damages are not specified, then they need to be determined by a court, which in turn leads to an increase in costs. These costs can be decreased by specifying *liquidation damages,* in which case d is specified in the contract. In this case, the courts would address two questions. First, has there been breach, and secondly are the liquidation damages for breach of contract "reasonable"?[8]

Finally, the parties might choose to write a *complete contract.*[9] In this case, the parties explicitly agree upon two prices: the price if the goods are delivered in good condition, p_g, and the price if the goods are defective or if no delivery occurs, p_b. In contrast to the case of a fixed price contract with possibly specified damages, a breach of contract occurs when the buyer does not make good on payment appropriate for the state. As we shall see, this distinction has profound implications for enforcement costs. Each case corresponds to different notions of legal *performance.* In the first case, if the good is defective, then the buyer claims that the seller has breach. In the second case, the buyer has breached if and only if she does not make good upon the agreed upon price (or, where the price was paid in advance, if the seller does not make good upon reimbursing $p_g - p_b$). In the case of a complete contract, there is no legal obligation for the seller to provide a good that is not defective.

If the legal damages for supply of a defective good are the same as the liquidation damages $p_g - p_b$, then all contracts in theory yield the same outcome. However, if parties use informal enforcement, then the nature of the agreement has significant economic consequences for what we mean by reputation. In the first case, the seller may suffer a loss in reputation due to the defect, while in the later case her reputation is harmed

[8] See section 12.18 of Farnsworth (1999).

[9] I am grateful to Robert Scott for clarifying the difference between liquadated damages, and state contingent prices. There is a tendency in the ecoomics of contract to identify liquidated damages with state contingent prices.

only if she refuses to make a warranty payment for the good. Moreover, the goal of the contract is to ensure that the seller makes an efficient investment into quality, since in practice perfection is never possible. These different ways to describe the contractual environment require some discussion of the semantics that we will use in our review of the literature.

1.2 Semantics

In order to provide a unified discussion of the literature, we need to use terms in a consistent fashion. Unfortunately, common terms such as "quality", "performance", "trust", and "reputation" are used in a variety of senses in the literature. This is not just a matter of semantics, because, as we illustrated above for the notion of breach, the sense in which a term is used does refer to distinct ways in which parties appeal for court intervention. Therefore, it is useful to define the terms as they will be used in this review.

First, take the term "quality". This term refers to the characteristic of the good that the buyer wishes the seller to select, as opposed to the realized quality or performance of the good. Suppose that there were no transactions costs. Then the best that a buyer can do is control the actions of the seller, not the uncertain outcome due to events beyond the control of the seller. Given that variations in the characteristics of the good are inevitable, we use the term quality to refer to the probability of the good outcome; this is the choice variable of seller.

The notion of performance also has an ambiguous meaning in common language. We could have used performance to refer to the good or bad state; however, this blurs the distinction between physical and legal performance. Our concern here is the problem of contract enforcement, and hence performance is used in the strictly legal sense: *the successful completion of a contractual duty, resulting in the performer's release from any past of future liability.*[10]

Using this definition highlights the point that reputation is not necessarily linked to the physical characteristics of the good to be traded, an assumption very common in the literature. Rather, the concern of the review is with the use of relationships and reputations as substitutes for formal enforcement. When a person fails to perform a duty - be it to carry out an action to provide a certain level of service, or to make good upon a payment - then one can use the instrument of a loss of reputation rather than legal liability to punish non-performance. This idea provides a formal distinction between contract theory and game theory. The latter takes as givens the game form, and the notion of performance, while contract theory is concerned with the *design* of the performance obligation. The word "reputation" has other meaning in economics that are discussed in section 4.

Finally, the word "trust" often arises in discussions of contractual performance. There are even whole books, such as *Trust* by Fukuyama (1995), that discuss the virtues of trust in society. In the context of a contract, trust refers to the ability of the parties to rely upon others to perform their duties. This is distinct from the *reasons* that a person performs. In this paper, performance occurs because there are legal or reputational institutions in place that provide parties with the incentives or desire to perform. Efficient trade requires that parties perform as promised and, when there are well designed institutions in place, that the parties are able to trust each other. However, even in our simple buyer-seller examples, there are a

[10] Black's Law Dictionary, 1996.

number of ways to ensure that parties are trustworthy, and hence trust must be seen as the outcome of a complex set of underlying factors.

Therefore, we do not discuss trust explicitly. The issue of contract enforcement can be viewed as creating institutions to ensure that we can rely upon parties to abide by their agreements. We review the literature that supposes individuals perform their duties because of a legal obligation, or because of the consequence of non-performance in the future. In both cases, we describe conditions under which each party is able to "trust" that the other party will perform as agreed.

1.3 The Agenda

The agenda for the paper is as follows. The next section introduces an illustrative model used to animate many of the themes in the literature. The model is sufficiently rich to illustrate how varying the characteristics of the good can lead to predictable variations in the form of the optimal contract.

Section 3 reviews the analytics of contract enforcement. The basic features of the optimal contract with formal and informal enforcement is described. The main insight is that transactions costs imply that there must be a rent from trade and hence markets cannot be perfectly competitive. When this rent is sufficiently large, parties may use either formal enforcement or a relational contract. The basic features of relational contracts are outlined here.

Section 4 relates these results to reputational enforcement. The rent from trade can be associated formally with the reputation of one of the parties. When breach occurs, the breaching party faces a capital loss upon his or her loss of reputation. We discuss how different contract forms are associated with different types of social institutions that maintain a person's reputation. The final section reviews the results of the paper, and discusses how these results might guide future empirical research.

2 An Illustrative Model

The form of a contract, the way that parties define an obligation, and the associated notion of breach depends upon the characteristics of the good or service to be exchanged. We can illustrate many of the themes in the literature with a model of a trade for a good that is characterized by three parameters.

The first of these represents the stakes. Formal enforcement is more desirable when the stakes involved are high and when the time between the agreement and the ultimate performance is extended (as opposed to simultaneous exchange). This is parameterized by the *divisibility* of the good. This is the amount of time required to consummate a single transaction and is denoted by a real number $\Delta > 0$. Payments are assumed to occur either at the beginning or at the end of the period. A decrease in Δ corresponding to increasing the frequency of trade. To keep matters as simple as possible, we follow Abreu, Milgrom, and Pearce (1991) and suppose that the flow of benefits and costs, as well as the flow of information, remains fixed. Thus, increasing Δ increases the value of a single transaction as well as the amount of information regarding the quality of the good. Physical production of the good or service occurs each period of duration Δ. During this time, the seller selects the quality of the good, denoted by q, and normalized to be between 0 and 1.

This normalization allows one to interpret quality as a probability whenever convenient. As a matter of convention $q = 0$ denotes low quality, while $q = 1$ denotes high quality.

The final ingredient is the determination of the *performance* of the good, which is the probability that the good performs as promised. In general, performance is likely to be a continuum of possible outcomes. In the risk neutral framework that we are considering, Levin (2003) has shown that the optimal contract typically takes a bang-bang form. Namely, there is a cutoff point, above which performance is considered acceptable and below which it is unacceptable, and a punishment is applied. There is an issue as to how to determine acceptable performance; however, this is not central to the decision to use a formal or informal enforcement mechanism. Accordingly, we suppose that a good state corresponds with high performance and a bad state corresponds with low performance. The probability that the good state occurs is a function of both the quality of the good and its divisibility, denoted by $\lambda_g(q, \Delta)$.

It is assumed that the probability of the good state is increasing with quality, namely $\partial\lambda_g/\partial q > 0$. The effect of divisibility is ambiguous, and it depends upon the kind of good being purchased. Motivated by the discussion in Abreu, Milgrom, and Pearce (1991), we consider two cases. The first is the class of *normal goods.* These are goods or services that perform well, with occasional poor performance. Hence, buyers get a baseline utility denoted by v in flow terms. However, when poor performance occurs they face a capital loss L from the use of the good. This occurs with probability $\lambda_b(\Delta, q) = 1 - \lambda_g(\Delta, q)$.

Formally, it is assumed that when the good becomes very divisible ($\Delta \to 0$) the losses are a Poisson process with parameter $\gamma(q)$. This means that the probability of a loss in period Δ is approximately $\Delta\gamma(q)$. It is assumed that there is always a chance of a loss, even when the quality is high; therefore, $\gamma(1) > 0$. In order to be consistent with the assumption that quality decreases the likelihood of a loss, the parameter $\gamma(q)$ also satisfies: $\gamma'(q) < 0$.

The opposite case occurs when the good event generates a capital gain of $G > 0$. It is also approximated by a Poisson process when Δ is small. In this case, the probability of the *good* event for small Δ satisfies $\lambda_g(\Delta, q) \simeq \Delta\gamma(q)$. Thus, in contrast to the case of a normal good or service, as divisibility increases ($\Delta \to 0$), the probability of a good event goes to zero.[11] The Poisson parameter is assumed to satisfy $\gamma(q) > 0$, $\gamma'(q) > 0$ for all $q \in [0, 1]$. The likelihood of a good event increases as more time is spent on production and hence $\partial\lambda_g/\partial\Delta > 0$. The baseline productivity is again given by the flow v. An example is research and development. In that case a good event, such as a profitable discovery, is typically rare, but increases with the time spent on R&D.

In summary, the good or service is characterized by two parameters, q and Δ, which in turn determine the likelihood of a high performance, via the probability $\lambda_g(\Delta, q)$. In order to provide a unified treatment of the cases of normal and innovative groups, let the expected returns/losses be given by the flow:

$$b(\Delta, q) = \begin{cases} -rL\frac{\lambda_b(\Delta,q)}{(1-\delta)}, & \text{if the good is normal,} \\ rG\frac{\lambda_g(\Delta,q)}{(1-\delta)}, & \text{if the good is innovative,} \end{cases} \tag{1}$$

[11] Formally, we suppose that innovative goods satisfy:

1. $\frac{\partial\lambda_g(q,\Delta)}{\partial\Delta} > 0$ and $\lim_{\Delta\to 0}\lambda_g(q, \Delta) = 0$,
2. $\lim_{\Delta\to 0}\frac{\partial\lambda_g(q,\Delta)}{\partial q\partial\Delta} = \gamma > 0-$ the cross effect of divisibility and quality is assumed to be a constant.

where $\delta = e^{-r\Delta}$ is the one period discount rate.[12] In a number of applications, such as in Shapiro and Stiglitz (1984), it is assumed that the good is infinitely divisible. In that case, one can express the returns from quality as a flow in continuous time:

$$\lim_{\Delta \to 0} b(\Delta, q) = \begin{cases} -\gamma(q) L, & \text{if the good is normal,} \\ \gamma(q) G, & \text{if the good is innovative.} \end{cases} \tag{2}$$

Given the preliminary definition of returns the sequence of decisions, and associated payoffs for the buyer and seller are as follows:

1. The buyer and seller meet and agree upon the terms for the exchange. Bargaining is assumed to be efficient, and information is symmetric. At this point, there may be payments between the parties. Parties also agree upon the quality the seller is to provide and upon the payments to occur as a function of the information available to the parties.

2. The seller produces the good over the period of time $\Delta > 0$. The cost to seller per unit of time is $c(q)$, where $c(0) = c'(0) = 0$, and $c', c'' > 0$. Given the interest rate r, the total cost of production over the period is:

$$\begin{aligned} C(\Delta, q) &= \int_0^\infty c(q) e^{-rt} dt \\ &= \frac{(1-\delta)}{r} c(q), \end{aligned}$$

   where $\delta = e^{-\Delta r}$.

3. The buyer receives the goods, observes the level of performance, and makes payments to the seller under the terms of the agreement.[13] The payoff to the buyer consists of two components:

   (a) A flow payoff of v, independent of quality, corresponding to a stock payoff of $V = \frac{(1-\delta)}{r} v$ per period when there is trade.

   (b) A flow payoff of $b(\Delta, q)$ that is increasing in quality.

Payoffs are expressed in either flow or stock terms, depending upon which provides the most convenient expression. Flow terms are in lowercase, while stock terms are in upper case. Explicit dependence upon divisibility Δ is dropped when it plays no role, and it simplifies the expressions. Let p be the net *flow* transfer from the seller to the buyer, then the flow payoffs for the buyer and seller from the exchange of a good or service with divisibility Δ and quality q are:

$$\begin{aligned} u^B(\Delta, q) &= v + b(\Delta, q) - p, \text{ and} \\ u^S(\Delta, q) &= p - c(q).^{14} \end{aligned}$$

[12] In the case of a normal good, the expression follows from the identity:

$$\int_0^\Delta b(\Delta, q) e^{-rt} dt = -L\lambda_b(\Delta, q).$$

[13] In practice, the buyer may refuse to accept delivery of the goods. This strategy affects the bargaining power of the parties, but ultimately we are concerned with the enforcement of monetary transfers. To keep matters as simple as possible, let us suppose that the buyer always accepts the goods. This allows us to treat services and physical goods in the same manner.

It is assumed that the alternative payoffs of the buyer and seller are normalized to zero; therefore, trade is individually rational if and only if both parties earn at least zero. Hence, the total gain from trade is given by:

$$s(\Delta, q) = v + b(\Delta, q) - c(q). \tag{3}$$

The efficient level of quality, denoted q^*, is found by maximizing $s(\Delta, q)$ with the solution:

$$c'(q^*) \begin{cases} \leq \partial b(\Delta, q^*)/\partial q, & \text{if } q^* = 1, \\ = \partial b(\Delta, q^*)/\partial q, & \text{if } q^* \in (0,1), \end{cases} \tag{4}$$

If the marginal cost of quality is sufficiently low relative to the return, then quality is high ($q^* = 1$); otherwise, the marginal cost of quality is equal to its marginal benefit, which is increasing in G and L. The question we wish to explore is how parties should write a contract that ensures an exchange of goods produced with an efficient level of quality. The structure of the contract will depend both upon the characteristics of the good and upon the information available.

2.1 Why Write a Contract?

The paradigm case we consider in the paper follows George Akerlof (1970)'s insight that there can be a market failure when quality is not observable. In this seminal paper, he shows that when there is heterogeneity in quality, then only low quality sellers would enter the spot market for goods and services. This is because the spot market price would reflect the average quality of the goods traded, and hence sellers with above average quality exit the market. The same argument applies to the moral hazard context considered in this paper. Suppose there are no long term contracts, and the seller first chooses quality before entering the market. Quality is now an inherent feature of the good, and one can apply Akerlof's adverse selection reasoning to conclude that sellers would never choose high quality if the prices of their goods are fixed by the average quality of goods in the market.

If the seller and buyer are able to write a long term contract with price conditional upon performance, then the first best can be achieved. More formally, a contract can be specified by the vector $C = \{q, p, p_g, p_b\}$. Under this contract, the seller agrees to supply quality q (which is unobservable), and the buyer agrees to pay unconditionally a flow price p, an additional price p_g if there is good performance, and finally a price p_b (which might be negative) if there is bad performance. Assuming the contract is enforceable, the flow payoffs to the buyer and seller are:

$$u^B(C) = v + b(\Delta, q) - (p_g - p_b)\lambda_g(\Delta, q) - (p + p_b), \tag{5}$$

$$u^S(C) = (p_g - p_b)\lambda_g(\Delta, q) + p + p_b - c(q). \tag{6}$$

In order that this contract implement the trade of good with quality q, it must be the case that both parties voluntarily agree to the contract and that the seller indeed supplies the promised quality. The requirement of voluntary trade is formalized with the *individual rationality* constraints:

$$u^B(C) \geq 0, \tag{7}$$

$$u^S(C) \geq 0. \tag{8}$$

A necessary condition for the existence of an individually rational contract is a non-negative surplus $s(\Delta, q) \geq 0$. If this condition is satisfied, then one can always find a price p such that the individual rationality constraints are satisfied. Secondly, the seller will provide the agreed upon quality, if it is in her interest to do so. This is formalized using the first order conditions for the seller's optimization problem, and it is given by *incentive compatibility constraint:*[15]

$$c'(q) \begin{cases} \leq (p_g - p_b)\,\partial\lambda_g/\partial q & \text{if } q = 1, \\ = (p_g - p_b)\,\partial\lambda_g/\partial q, & \text{if } q \in (0,1). \end{cases} \tag{9}$$

Any contract that satisfies 5-9 is said to *implement* the exchange of good (Δ, q). Observe that the division of the surplus from trade can be allocated via price p, while the prices p_g and p_g can be chosen separately to ensure the incentive compatibility constraint is satisfied. Hence as long as there are sufficient gains from trade, one can implement the trade of a good with characteristics (Δ, q) :

Proposition 1 *There exists a contract $C = \{q, p, p_g, p_b\}$ implementing the exchange of (Δ, q) if and only if the surplus is non-negative ($s(\Delta, q) \geq 0$). Moreover, if this condition is satisfied, then one of the price terms (p, p_g or p_b) can be set arbitrarily. If $q < 1$, then the other price terms are uniquely determined.*

The proof of sufficiency is straightforward. Fix p at some arbitrary level. Given the quality $q \in (0,1)$, the incentive compatibility constraint uniquely determines $p_g - p_b$. Given that the gains from trade are non-negative, one simply selects $p - p_b$ in the payoffs 5 and 6 to ensure that both parties get at least their alternative. This defines two equations in two unknowns, p_g and p_b, which always have a solution. The second part follows immediately.

2.2 Discussion

Though this result is straightforward, a number of its implications are worth highlighting. First, it immediately illustrates that the theory will generally no provide testable hypothesis regarding the details of the optimal contract. For example, in a competitive market, we are used to thinking in terms of the market clearing price, and asking how supply and demand factors affect the equilibrium price. However, if parties are able to write enforceable contracts without additional assumptions, in general there exists a variety of contracts that would result in the same final allocation of goods and services.

The second observation is that the transaction cost of asymmetric information does not by itself create either inefficiencies nor strong implications regarding contract form. As Akerlof (1970) has shown, asymmetric information reduces trade only when combined with the impossibility of writing state contingent contracts. There is a voluminous literature exploring the structure of prices that either signal the quality of the good or screen out trades with individuals having certain characteristics.[16] The driving assumption is that the seller is unable to make price conditional upon realized performance. This is an extreme example of an

[15] We assume that it is valid to characterize the solution to the optimization problem with the first order condition. In this risk neutral setting, this is not restrictive, however this is no longer the case when the agent is risk averse, as observed by Mirrlees (1999). See Rogerson (1985) and Jewitt (1988) for some general results.

[16] See Fudenberg and Tirole (1992) for an early review of this theory. Bagwell and Wolinsky (2002) provides a more up to date review of the literature.

unenforceable contract. In the next section, the class of models that suppose parties can at a cost write an enforceable contingent contract are reviewed. The goal is to explore how different enforcement mechanisms shape the form of the optimal contract.

3 The Analytics of Contract Enforcement

In the context of our stylized exchange model, contract enforcement entails setting the terms in such a way that the seller voluntarily chooses the level of quality agreed upon. All contract enforcement institutions share the common characteristics that they either provide a reward for good performance or a penalty for poor performance. Given that performance is not a perfect signal of chosen quality, the choice of rewards versus penalties depends upon the characteristics of the good and upon the nature of the enforcement costs. This section reviews the basic analytic results for both discrete and relational enforcement mechanisms.

Discrete exchange corresponds to trade over a single period lasting Δ units of time. The contract is agreed upon at the beginning of the period, with a full settlement occurring at the end of the period. Transactions costs are introduced by supposing a fixed cost is paid when the contract is formed, and whenever a contract clause is enforced using a court of law. Section 3.1 derives the optimal contract as a function of the characteristics of the good given these enforcement costs.

Relational enforcement occurs in those situations where an individual's performance has consequences for trade in future periods. Examples of relational enforcement institutions include trust, reputation, community enforcement and brand names. All have similar analytic structures derived from repeated game theory. There are, however, two distinct approaches. The first approach, pioneered by Klein and Leffler (1981), begins with the observed behavior that individuals in the market to shun sellers who have sold low quality goods in the past, that they call the *market mechanism*. They then ask under what conditions will such behavior result in an equilibrium with sellers choosing to supply high quality. The main empirical prediction is that under such a mechanism sellers must earn above market rates of return that are dissipated via wasteful activities such as advertising.[17]

The second approach, pioneered by Telser (1980), begins with a description of the fundamentals of the market in terms of information and actions available to the buyer and seller. One then characterizes the set of possible allocations. This is reviewed in section 3.3, where it is shown that having sufficient gains from trade is both a necessary and a sufficient condition for the existence of an efficient relational contract. The structure of the contract depends upon how the gains from trade are allocated between the seller and buyer.

3.1 Formal Enforcement

Beginning with Townsend (1979) and Dye (1985), there is a literature that supposes the cost of writing an insurance contract is a function of the number of contingences. As a consequence, many risks are not included in the contract, and the contract is incomplete relative to the first best. Anderlini and Felli (1994) take a different approach and suggest that a contract can be viewed as an algorithm for computing terms for each contingency. They show that the optimal contract is not computable in the sense that contract

[17] The economics of advertising is not reviewed here. See Bagwell (2006) for a comprehensive review of the literature.

conditions can be determined using a finite number of steps. Battigalli and Maggi (2002) extend this work and construct a theory of contract formation from basic assumptions regarding the technology of contract formation. Bajari and Tadelis (2001) introduce a model in which the degree of contract completeness is modeled as an investment decision made *ex post.* Their contribution provides a formal bridge between the costly state verification literature and the literature on holdup.

In Dye (1985) and in Bajari and Tadelis (2001) it is assumed that costs are paid *ex ante,* while Townsend (1979) supposes that verification costs are paid *ex post* at the time the event occurs. Using this model Gale and Hellwig (1985) provide conditions under which the use of debt contracts is optimal. Recently, Krasa and Villamil (2000) have shown that the costly state verification model can be viewed as a special case of a model with endogenous enforcement.

All these models assume that once information is publicly known, then the courts can enforce the contract as written. There is also a literature that explores the role of the courts in reaching a settlement when there is asymmetric information. Cooter and Rubinfeld (1989) provide a review of the earlier literature, with Spier (1992), Daughety and Reinganum (1993) and Daughety and Reinganum (1995) providing more recent contributions. The question is how one should design the rules to encourage efficient settlement rather than litigation. These rules can be viewed as part of the more general problem of increasing the *quality* of the law.

Djankov, La Porta, Lopez-de Silanes, and Shleifer (2003) provide evidence regarding how the quality of law can vary by country and legal system. They find that the cost of litigating a simple contract (in their case a lease agreement) varied widely from country to country. From the literature on cost state verification, one can model this variation in litigation costs as a simple fixed cost. These costs are borne both *ex ante* and *ex post.*

At the *ex ante* stage, enforcement by the courts typically, though not always, requires the parties to write the salient features of their agreement in a contract.[18] In addition, if the contract requires payments as a function of quality measures, then the parties may need to invest in explicit monitoring systems. Let these costs be given by $K_A(Q)$, where Q denotes the quality of the law. It is assumed that these costs fall with Q. We also assume that the parties bear these costs equally - any asymmetries in bargaining power would allow these costs to be reallocated via the contract price.

Once these costs have been sunk, then by definition the events that determine the quality of the good are observed. However, this still does not mean that one has an enforceable contract. Suppose that the contract requires the seller to compensate the buyer for a \$100 defect. The cost of using the courts to collect such an amount is very high, and hence we would not expect such a payment to be enforced. However, if the defect results in a loss of \$10,000, then it is likely to be worthwhile pursing the seller if she refuses to pay. This can be modelled by supposing that the *ex post* expected cost of recovering is a function of the quality of law, denoted by $K_P(Q)$. This cost has the following interpretation. If an event requires the buyer to pay the seller P, then the buyer incurs a cost $K_P(Q)$ of collection, which implies that the seller pays P while the buyer nets in flow terms $P - K_P(Q)$.

[18] Courts will enforce oral agreements, however such enforcement requires evidence regarding the terms of the agreement, something that is more easily achieved with a written agreement.

The situation is reversed if the seller is required to pay the buyer. For example, suppose that the seller provides a warranty for her goods and agrees to pay the buyer D whenever the good is defective. Now, when a defect occurs, the buyer must spend time and effort to collect the amount D. The value of $K_P(Q)$ represents this cost. Observe that, if $K_B(Q) > D$, then the buyer would never bother to collect the warranty. This implies the following definition of a legally enforceable contract term.

Definition 2 *A contract that calls for a payment P_E from i to j if event E occurs is* legally enforceable *if and only if the writing costs $K_A(Q)$ have been sunk into contract formation, and $P_E \geq K_P(Q)$.*

Given these costs, parties have two ways to structure a contract. They could use a *bonus contract,* namely the buyer pays a fixed price P and then promises to pay a bonus B if the good signal occurs. Alternatively, the seller can can offer a warranty and pay the buyer an amount W whenever the good is defective.

Consider first the case of a normal good, where there is a potential loss of L if the bad event occurs. Suppose parties agree that the quality should be q, and they divide equally the fixed cost of writing a contract.[19] Under a bonus contract $\psi = \{q, P, B\}$, the payoffs to the buyer and seller in stock terms are:

$$\begin{aligned} U^S(\Delta, q, \psi) &= P + (B - K_P(Q))\lambda_g(\Delta, q) - C(\Delta, q) - K_A(Q)/2 \\ U^B(\Delta, q, \psi) &= V(\Delta) - P - B\lambda_g(\Delta, q) - L\lambda_b(\Delta, q) - K_A(Q)/2. \end{aligned}$$

Here, we have supposed that the seller pays half of the fixed costs of writing a contract. In this case, the total gains from trade do not depend upon the bonus B, and hence it can ensure that seller chooses the agreed upon quality, with the total gain from trade given by:

$$S^{bonus}(\Delta, q, \psi) = V(\Delta) - K_P(Q)\lambda_g(\Delta, q) - L\lambda_b(\Delta, q) - C(\Delta, q) - K_A(Q) \tag{10}$$

Now suppose that the parties instead use a warranty contract, $\psi = \{q, P, W\}$, where W is paid by the seller to the buyer if the good is defective. The payoffs to the buyer and seller in stock terms are:

$$\begin{aligned} U^S(\Delta, q, \psi) &= P - W \cdot \lambda_b(\Delta, q) - C(\Delta, q) - K_A(Q)/2 \\ U^B(\Delta, q, \psi) &= V(\Delta) - P + (W - L - K_P(Q))\lambda_b(\Delta, q) - K_A(Q)/2. \end{aligned}$$

In this case the total gain from trade is:

$$S^{warrantee}(\Delta, q, \psi) = V(\Delta) - (L + K_P(Q))\lambda_b(\Delta, q) - C(\Delta, q) - K_A(Q) \tag{11}$$

The maintained hypothesis for normal goods is that the bad events are rare, that is $\lambda_g > \lambda_b$, implying $K_P(Q)\lambda_g(\Delta, q) > K_P(Q)\lambda_g(\Delta, q)$, from which we conclude that the warranty contract is more efficient.

The warranty is set to ensure that the seller chooses the desired level of quality, and hence satisfies the first order conditions for quality:

$$C'(\Delta, q) = -W\frac{\partial \lambda_b(\Delta, q)}{\partial q}. \tag{12}$$

[19] The rule for dividing the contracting costs does not affect the results since the relative power of the parties determines the overall division of the gains from trade via the contract price P.

From (11) it follows that the first best entails $W = (L + K_P(Q))$. The optimal warranty is equal to cost of the lost plus the fixed cost of recovery. In this case, transactions costs raise the warranty payment and associated quality above what it would be in the absence of enforcement costs. An increase in the quality of law, holding all else fixed, will result in a *decrease* in the quality of goods traded, because the marginal cost of using the law falls, reducing marginal enforcement costs. While this result may seem a bit counter intuitive, the effect is similar to the one observed in US tort law, where it is claimed that excessive medical malpractice awards has led to too much defensive medicine by doctors (see Kessler and McClellan (1996)).

Moreover, it does not imply that *average* quality falls with the quality of the law. The effect of the law on quality applies only to those goods with an enforceable warranty term. There is also a selection effect. When the quality of law is low, fewer firms use enforceable contract terms, and hence in those cases the quality of the delivered good is at the lowest possible level. An average we are likely to see low quality law associated with low quality goods.

The result for innovative goods and services is similar. In that case, the good event is relatively rare, and hence the optimal contract with enforcement costs is a bonus contract that pays the seller an amount B whenever there is a good outcome, denoted by $\psi = \{q, P, B\}$. The payoffs to the buyer and seller are respectively:

$$\begin{aligned} U^S(\Delta, q, \psi) &= P + (B - K_P(Q))\lambda_g(\Delta, q) - C(\Delta, q) - K_A(Q)/2, \\ U^B(\Delta, q, \psi) &= V(\Delta) - P + (R - B)\lambda_g(\Delta, q) - K_A(Q)/2. \end{aligned}$$

The corresponding social surplus is:

$$S^{bonus}(\Delta, q, \psi) = V(\Delta) + (R - K_P(Q))\lambda_g(\Delta, q) - C(\Delta, q) - K_A(Q) \tag{13}$$

In this case, since the seller must sue the buyer to get recovery, the incentive constraint incorporates the fixed enforcement costs, and we have:

$$C'(\Delta, q) = (B - K_P(Q))\frac{\partial \lambda_g(\Delta, q)}{\partial q}. \tag{14}$$

Thus, in order to maximize the surplus (13) the bonus pay, B, is set equal to the reward R, and does not vary with the quality of law. Since the quality of law does affects the first order conditions, one has the optimal quality of delivered goods falls when the quality of law falls. When the reward R is close in magnitude to $K_P(Q)$ the first order conditions imply that the optimal q^* is close to zero. Given the fixed costs of contract formation, $K_A(Q)$, parties would not use a formal contract. When it is profitable to use a contract, observe that the marginal return to quality, $(B - K_P(Q))\frac{\partial \lambda_g(\Delta, q)}{\partial q}$, is increasing in Q, and hence an increase in the quality of law results in an increase in the quality of the good supplied.

In either case, when the *ex ante* fixed costs of writing a contract outweigh the benefits, then there will be no contract. In this case, the cost of using a contingent contracts leads to lower quality goods on sale, or in the extreme case a complete breakdown in trade, as illustrated by Akerlof (1970).

In summary, the basic model of transactions costs arising from the cost of writing contingent contracts makes the following predictions regarding how an increase in the quality of law affects economic performance, holding all else constant:

1. For normal goods it is optimal to use a warranty contract. The quality of goods traded with warranties *falls* with an increase in the quality of law, though the total volume of trade (and number of warranty contracts) is expected to increase.

2. It is optimal to use a bonus contract for the exchange of innovative goods. In this case, an increase in the quality of law increases both the quality and volume of trade.

3.2 The Repeat Purchase Institution - Enforcement with Reciprocal Norms

In a seminal paper, Klein and Leffler (1981) observe that parties can avoid the costs of using the legal system if market participants refuse to buy from firms that breach upon their implicit promise to supply high quality goods. They show that a sufficient condition for the existence of an equilibrium is the existence of an above market clearing price. Shapiro and Stiglitz (1984) make a similar point in the context of the employment relation when effort is not contractible, and they show that firms can solve this problem by offering an "efficiency wage", namely a wage set higher than the market clearing rate, combined with the threat of dismissal for workers who shirk.

These papers were revolutionary because they introduced new ways to think about economic institutions. At the time these papers appeared, the general equilibrium model provided the standard approach to economic modeling, as succinctly presented in Debreu's *Theory of Value.* In general equilibrium theory, one begins with a complete description of the environment and the set of feasible allocations. One then asks which of these allocations are efficient, and if they are supported by a competitive equilibrium. In a brilliant paper (based upon his Ph.D. thesis), Oliver Hart (1975) showed that in general with markets are incomplete the welfare theorems of general equilibrium theory no longer apply. Hence, one cannot rely upon competitive markets alone to allocate resources efficiently.

An alternative approach begins by exploring the properties of institutions that mediate trade between parties when markets are incomplete. In the case of Klein and Leffler (1981), they explore the properties of the "repeat purchase institution". This is the decision by buyers to shun firms that have produced low quality goods in the past. We call this an "institution" because it is not a direct implication of competitive theory. In a competitive market, price reflects quality, and a rational buyer would not shun a firm because of poor performance in the past. Rather, the purchase decision depends upon the relationship between the current price and quality - past performance enters only via the buyer's beliefs regarding quality.

Avner Greif (2004) coined the term "contract enforcement institution," or *CEI,* to denote the behaviors and expectations of individuals, such as the market mechanism, that ensure that private parties abide by their contractual obligations. These institutions have a common structure based upon the theory of repeated games. This section reviews the basic analytics of repeated games used in the theory of CEIs, provides necessary conditions under which the market mechanism supports trade of high quality goods.

The behaviors described by the "repeat purchase institution" can be viewed as strategies for a repeated game, formally defined as follows. Fix the divisibility of the good at Δ, and suppose that each period the buyer and seller play the following *trade game:*

1. The seller fixes her price P at the beginning of the period.
2. The buyer agrees to purchase or not at price P.
3. The seller chooses quality and produces the good.
4. Trade occurs during the period. High or low performance is observed by buyer after the price P has been paid.
5. At the end of the period, the buyer decides whether or not to continue the relationship.

If trade does not occur, we have assumed that each party earns zero. When trade does occur, the payoffs are exactly as described in the one period case. The difference now is that the buyer and seller maximize their discounted payoff, where the discount rate is given by $\delta = e^{-r\Delta}$.

A *strategy* is a description of the actions that the buyer and seller select for every possible situation, or information set. Such a strategy is a subgame perfect Nash equilibrium (SPNE) if, for each situation or information set, the actions described from agents following that period form a Nash equilibrium. A contract is *self-enforcing* if there exist strategies constrained by the enforceable terms of the contract that form a SPNE.[20] This concept of a self-enforcing contract has it origins in the work of Luce and Raiffa (1957) in their discussion of the prisoner's dilemma, while Telser (1980) was the first to provide an explicit link between repeated games and contract theory.

Consider first the static equilibrium that is the result of playing the trade game once. Once the buyer has the good and pays the seller, there are no further transfers between the parties. Therefore, the seller's choice of quality has no effect upon her compensation, and it is optimal for her to choose $q = 0$. If $s(\Delta, 0) > 0$, then it is in both parties' interests to trade, and consequently the *unique* SPNE entails the seller charging a price to make the buyer indifferent between buying a good with "zero" quality and not buying at all, with the buyer purchasing. Even for this simple game, beliefs play a role in determining the outcome. It could not be an equilibrium to have the buyer plan not to purchase the good; otherwise, the seller would simply lower the price slightly so that the buyer is strictly better off. Of course, any price that makes the buyer slightly better off can be raised, and hence the unique SPNE entails the seller making the buyer exactly indifferent between buying and not buying.

In this case, it is never rational for the parties not to trade, and hence the threat inherent in the repeat purchase institution is credible only in the case where it is not efficient to trade with the seller when quality is zero. As we shall see, this problem can be resolved with the use of a *relational contract* where the buyer and seller continue to trade, but the terms of their contract may change over time.

[20] Subgame perfection is not the only equilbrium concept used. For the purposes of the current dicussion, we do not highlight the implications of different solution concepts, except to note that the requirement of *self-enforcement* can be viewed as a necessary, but not always a sufficient condition for rational play. See Selten (1975) for a discussion of this point.

Let us now suppose that $s(\Delta, 0) < 0$, while at the efficient level of quality one has $s(\Delta, q^*) > 0$. Thus, the buyer will reject any price that makes production of a zero quality good profitable for the seller. Here, we have the phenomenon corresponding to Akerlof's famous market for lemons: even though the production of high quality is efficient, the market breaks down completely because of the insensitivity of price to quality.

If the buyer and seller can potentially meet every period, the repeated game no-trade is still an equilibrium. It is based upon the following set of self-enforcing beliefs. Regardless of the price charged by the seller, the buyer expects that the seller will choose low quality. In order that this be a SPNE, it must be true even if the buyer has agreed to buy the good at some price P. In that case, the seller chooses to provide low quality because she has the expectation that the buyer will not come again, and hence, she will not gain from choosing high quality.

The high quality equilibrium in the repeated relationship is constructed by bootstrapping from the no-trade equilibrium. Each period, the seller offers the buyer a contract $\{P, q\}$, which the seller accepts. It entails the buyer continuing to purchase from the seller until bad performance is observed. When this occurs, both the buyer and seller now believe that the relationship is tainted, and they no longer trade with each other under the mutually self-enforcing belief that the seller will supply zero quality in the future.

The question becomes whether or not the seller will choose to supply quality $q > 0$. Her payoff from the contract under the repeat purchase institution, denoted $U^S(P, q)$, solves the following dynamic programming equation (for simplicity we suppress dependence upon Δ):

$$U^S(P, q) = P - C(q) + \delta \lambda_g(q) U^S(P, q).$$

The seller's payoff is the current period payoff, plus the discounted value of future trade. Since the buyer cannot observe quality directly, the seller will choose quality to maximize her payoff, taking into account the effect of quality upon the probability that the relationship continues, to get the following first order conditions for quality:

$$C'(q) = \delta \frac{\partial \lambda_g(q)}{\partial q} U^S(P, q) \tag{15}$$

$$= \delta \frac{\partial \lambda_g(q)}{\partial q} \frac{(P - C(q))}{(1 - \delta \lambda_g(q))}. \tag{16}$$

This relationship has a number of implications. First, given the price, the level of quality is determinate. Hence, the repeat purchase institution does not allow for a flexible determination of price and quality terms. Secondly, an increase in the price paid results in an increase in quality. In particular, in order to have a strictly positive quality supplied the price must exceed the cost ($p > C(q)$), and hence the repeat purchase institution is not consistent with perfect competition.

Under the assumption that the buyer accepts any price that gives him non-negative utility, the seller is able to appropriate all the gains from trade, and hence 15 can be rewritten as:

$$C'(q) = \delta \frac{\partial \lambda_g(q)}{\partial q} S(q). \tag{17}$$

Observe that it is efficient to trade if and only if $S(q) \geq 0$. However, this expression shows that the repeat purchase institution can implement positive quality only if the gains from trade are strictly positive:

$S(q) > 0$. In particular, if at the efficient level of of quality, $q^* > 0$, the market is perfect competitive then $S(q^*) = 0$, and the repeat purchase institution would not be able to implement any exchange.

Klein and Leffler (1981) discuss this issue explicitly, and they argue that the high price charged by the seller can be viewed as a reputational rent. A competitive equilibrium exists as long as the firms are able to dissipate the reputational rent in a public way, such as with wasteful advertising, or with selling their products in extravagantly expensive retail stores. The efficiency wage model of Shapiro and Stiglitz (1984) provides another example of rent dissipation with the repeat purchase institution. In that case the seller is a worker who is paid a high wage, with performance incentives provided by the threat of dismissal by the firm (buyer) should performance be substandard.

Shapiro and Stiglitz (1984) apply the idea of Klein and Leffler (1981) to labor markets. They begin with the idea that the strategy of paying a high wage and dismissing poor performers is a solution to the problem of incomplete employment contracts. Then they predict that in markets where employee performance is difficult to measure there will be high wages combined with high unemployment. This view proves to be controversial for two reasons. First, as Carmichael (1985) observes, it is not all clear that this institution is consistent with the existence of a free entry equilibrium. This issue is discussed in detail in section 4 on contract enforcement institutions. Secondly, Levin (2003) has shown that the repeat purchase institution is not in general efficient and therefore should not be widely observed in a competitive market. The next section addresses this concern.

3.2.1 The Efficiency of the Repeat Purchase Mechanism

In both Klein and Leffler (1981) and Shapiro and Stiglitz (1984), it is assumed if the seller (worker) supplies the agreed upon quality then she will never be dismissed. In practice, this is an extreme assumption. One would expect low performance to sometimes occur, even if the seller has not shirked. Since the repeat purchase institution would call for separation whenever there is poor performance, this results in inefficient turnover.

If the probability of error is very low, then turnover costs are minimal, and the repeat purchase institution can approach the first best. Moreover, the intuition suggested by Klein and Leffer (1981) leads one to believe that not only can the repeat purchase institution lead to generally higher quality than the simple competitive market, but that as the divisibility of the goods increases one gets more frequent monitoring of performance and hence a more efficient outcome. Building upon the insights of Abreu, Milgrom, and Pearce (1991), one can show that in the case of innovative goods neither of these statements is correct.

To see this, consider the dynamic equation for total surplus in the case of an innovative good:

$$S^{RP}(q, \Delta) = (V(\Delta) + \lambda_g(\Delta, q) G - C(\Delta, q)) + \delta \lambda_g(\Delta, q) S^{RP}(q, \Delta).$$

from which we get the expression:

$$S^{RP}(q, \Delta) = \frac{(V(\Delta) + \lambda_g(\Delta, q) G - C(q))}{1 - \delta \lambda_g(\Delta, q)}.$$

The first order condition for quality under the repeat purchase condition as the good becomes perfectly

divisible can be written as:

$$\begin{aligned} c'(q) &= \gamma'(q) \cdot \lim_{\Delta \to 0} S(\Delta, q) \\ &= \gamma'(q) \cdot 0 = 0. \end{aligned}$$

In other words, the repeat purchase institution provides zero incentives for quality in the case of an innovative good.

The reason is quite intuitive, as Abreu, Milgrom, and Pearce (1991) discuss. When the good is very divisible, the probability of a good signal is very low, and hence the probability of severing the relationship is very high. Consequently, the future gain approaches zero. This result illustrates that the scope of the repeat purchase institution and the ability of high prices or wages to enforce quality depend upon the characteristics of the good being traded. It also suggests that in practice one should see quite a bit of heterogeneity in compensation form. This is indeed the case, as documented by Brown (1992), Krueger (1991), Rebitzer (1995) and MacLeod and Parent (1999).

Hence, the fact that the repeat purchase institution may incentivize sellers to enhance the quality of their goods does imply that this is the most efficient way to achieve this goal. Moreover, from the fact that one observes a particular CEI in a market, one cannot conclude that it is the best or only solution to the problem of enforcing an incomplete contract. The next section outlines the theory of *relational contracts* that include the repeat purchase institution as a special case.

3.3 Relational Contracts

In practice, sellers are not restricted to the law of one price. Sellers often promise to exchange defective goods, or to provide monetary compensation so that the buyer may have the good repaired. Similarly, employers often reward employees with bonuses for good past performance. This section reviews the economic theory of relational contracts. The goal is to begin with a precisely specified incomplete contract environment in which the buyer and seller meet and trade repeatedly over time. We then ask what set of allocations can be supported by some *relational contract.* Formally, by a relational contract, we mean a complete description of the behavior and pattern of payments between a buyer and seller.

A relational contract consists of two elements. The first element is the set of possible *explicit* terms. These include the price of the good and any other term conditioned upon observed events and enforced by the courts. The second element is the *implicit* terms that refer to the expectations regarding how each party will *behave* as the relationship evolves. This behavior corresponds formally to strategies in a dynamic game. We continue to define a contract as *self-enforcing* if the combination of explicit and implicit terms form a SPNE for the appropriately defined repeated game.[21]

The repeat purchase institution is an example of a relational contract. However, it is a special case in two regards. First, one may implicit payments between parties. For example, it is common in North America to

[21] See MacLeod and Malcomson (1989) for a formal description of a relational contract. There is a great deal of legal scholarship on the issue, beginning with the work of MacNeil (1974); however in that literature there is no accepted definition of a relational contract.

leave a tip for dinner service. This condition is often excluded from the bill, but it is implicitly understood to be part of the compensation contract of the waiter.

Second, the threat of separation is used to provide direct performance incentives. When one allows side-payments, they can take on the role of providing performance incentives. In that case, the threat of separation can be used to enforce the side-payments themselves, rather than performance. As we shall see, this allows relational contracts to achieve the first under a much wider set of conditions than the repeat purchase institution.

It is worth emphasizing that explicit terms distinguish the theory of relational contracts from standard repeated game theory. This distinction provides the theory with some additional empirical content. In a repeated game, the game form and the actions available to the players are assumed to be exogenous, and hence the theory tends to focus ones attention upon what constitutes an efficient *norm of behavior*.[22] In contrast, the explicit terms in a relational contract focus attention upon the performance expectation, and upon the conditions under which one party can claim that breach as occurred. Hence, as Richard Posner (2003) observes, even with informal enforcement, one may wish to have an explicit contract with clear terms.[23] In this case, the role of the contract is to clarify the conditions under which it is legitimate for one party to terminate a relationship or to impose informal sanctions.

Such contracts also determine *who* holds a reputation. For example, under an efficiency wage contract, if a separation occurs, then others in the market would conclude that the worker did not perform. However, if the firm promises to reward a worker with a bonus if she performance well, then if a separation is observed the market should conclude that the firm has not performed as promised (see Bull (1987)). These issues can be explored with a modification of the trade game introduced above:

1. The seller/buyer agree to a contract $\omega = \{P, B, W, q\}$, where P is the price, B is a bonus payment, W a warranty payments and q the agreed upon quality.

2. The seller chooses quality and produces the good.

3. Trade occurs, and P is paid.

4. The quality $s \in \{b, g\}$ is realized and observed by the buyer and seller (but not by the courts or any third party).

5. The buyer chooses to pay the seller a bonus B if the good state occurs, or the seller chooses to make a warranty payment W if the bad state occurs.

6. The buyer and seller simultaneously decide to continue the relationship given the events that have occurred in stages 1-5.

The contract ω is self-enforcing if SPNE strategies result in trade of a good of quality q each period. A necessary condition for the existence of a self-enforcing contract is non-negative gains from trade, $s(\Delta, q) \geq 0$. The gains also define the size of the maximum punishment that can be imposed on a party. However, if the

[22] See in particular the theory of social norms developed by Axelrod (1981).
[23] See page 94, Posner (2003).

gains from trade are sufficient, then there always exists some self-enforcing contract to implement trade each period.

Proposition 3 *There exists a self-enforcing relational contract, resulting in trade of quality q each period if and only if:*

$$c'(q) \leq \delta \frac{\partial \lambda_g(\Delta, q)}{\partial q} s(\Delta, q). \tag{18}$$

In order that there be trade every period it must be the case that the seller's incentive to perform arises from the implications of low performance on her income. In particular, the transfer must satisfy:

$$c'(q) = \frac{\partial \lambda_g(\Delta, q)}{\partial q} \frac{r(B+W)}{(1-\delta)}. \tag{19}$$

In equilibrium, both parties make good on their promised payments, and hence separation occurs if and only if there is cheating upon an agreed payment. The maximal punishment in that case is separation; hence, the incentive constraints for the seller and buyer to make good upon payments at stage 5 in the trade game are:

$$\begin{aligned} -B + \delta U^B(\omega, \Delta, q) &\geq 0, \\ -W + \delta U^S(\omega, \Delta, q) &\geq 0, \end{aligned} \tag{20}$$

where $U^S(\omega, \Delta, q)$ and $U^B(\omega, \Delta, q)$ are the payoffs under the relational contract. If we add these inequalities together, one has:

$$B + W \leq \delta S(\Delta, q) = \delta s(\Delta, q) \frac{(1-\delta)}{r},$$

from which get expression 18. Conversely, if expression 18 is satisfied one can always construct a contract to satisfy 19 and 20.

Observe that underlying these inequalities are self-enforcing reciprocal norms at which the buyer and seller believe that after cheating has occurred once, both parties will continue to cheat upon each other in any future agreements. In particular, notice that relational contracts of this type are *not* consistent with the Coasian presumption that parties will always enter into efficient agreements. For example, if the buyer does not follow through on a bonus payment, this is a sunk decision with no implication for future payoffs. Hence, if trade at high quality was part of equilibrium play in the past, it should be part of equilibrium play in the future. However, if accepted, this would undermine the incentives (threat of termination) needed to support the equilibrium in the first place.

Therefore, self-enforcing contracts are not *renegotiation proof*. See for example Bernheim, Peleg, and Whinston (1987), Farrell and Maskin (1989), and in particular the review in Pearce (1992). These papers suggest a number of possible solutions, though as Bernheim and Ray (1989) show, there is no widely accepted solution that ensures the existence of an equilibrium in all cases. Bergin and MacLeod (1993) provide an synthetic model of the various concepts of renegotiation in repeated games, and they conclude that there is a fundamental conflict within the requirement that agreements be self-enforcing *and* efficient in every possible contingency.[24]

[24] van Damme (1989) shows the existence of a strongly renegotiation-proof equilibrium for the finitely repeated prisoner's dilemma game. However, this is very much a special case.

The fundamental issue is how to create a set of self-enforcing norms with the property that, should one party breach an agreement, the other party has an incentive to follow through upon the punishment, and not renegotiate the agreement. MacLeod and Malcomson (1989) adapt the solution proposed by Pearce (1987) to select renegotiation proof self-enforcing contracts. They all have the feature that one party - either the buyer or the seller - is always indifferent between accepting or rejecting the equilibrium contract. In the context of the model here, this criterion greatly restricts the class of self-enforcing contracts to two types.

The first type would require the seller to be indifferent between accepting or rejecting the contract. In that case, the renegotiation proof equilibrium consists of a bonus contract, with the seller leaving the relationship whenever the buyer reneges upon paying the bonus where there is high performance. This is renegotiation proof with the belief that, should the buyer offer a contract with a higher price, then he will renege in the future. Therefore the seller rationally rejects any such contract. Since she is indifferent between staying and leaving at the equilibrium contract, it is credible to quit the relationship if and only if the buyer breaches upon the agreement.

The second type is the reverse situation. The buyer is indifferent between trade and no-trade. The seller offers a warranty contract, and the buyer quits the relationship if and only if the seller breaches upon her agreement to make payment when there is low performance. In this case, should the seller offer a lower price, the buyer believes that this deal is "too good to be true," and hence rejects all such contracts.

In particular, repeat purchase institution is renegotiation proof only in the extreme case for which the efficient level of quality entails high performance with probability one. In all other cases, the repeat purchase institution is dominated by either a bonus contract or warranty contracts. Hence, even though the theory of relational contract entails multiple equilibria, the addition of this version of renegotiation proofness leads to some testable implications - namely that we should observe bonus or warranty contracts in the market place. This point is discussed in more detail below.

The End Game Problem and the Empirical Validity of the Model Hart and Holmström (1987) observe that infinitely repeated game theory may not be an appropriate vehicle for the study of relational contracts. It supposes that contracting parties live forever, a clearly false hypothesis. For this class of models, it is typically assumed that there is a unique Nash equilibrium for the one period trade game. Hence, in the last period, there would be a unique outcome, which makes it impossible to support cooperation in the next to last period. One applies this argument recursively to show that, if agents are finitely lived, then the unique sub-game perfect equilibrium is not to cooperate in any period.

There have been many experiments with human subjects playing repeated prisoner's dilemma games.[25] They consistently find that individuals cooperate at the beginning of the game, and they begin to defect near the end. Hence, these results show that sub-game perfection when applied to repeated games is rejected by the data.

There have been several proposed solutions to this problem. The most famous of these is in the paper by Kreps, Milgrom, Roberts, and Wilson (1982) who introduce the idea that some individuals are cooperative by nature. However, one does not know a player's type at the beginning of the game. Since all players

[25] See Camerer (2003) for a comprehensive review of behavioral game theory.

prefer cooperation to no cooperation, they may signal that they are cooperative by mimicking the play of the cooperative type early in the game. Hence, when doing a Bayesian updating, one cannot exclude the hypothesis that one's opponent is cooperative.

Kreps, Milgrom, Roberts and Wilson show that even if the probability of a cooperative type is very small, in a long, but finitely repeated game there is a unique perfect Bayesian equilibrium that entails all individuals cooperating at the beginning of the game. Of course this model is also clearly false since it supposes that there is a single cooperative type, and that all players have the same *ex ante* beliefs regarding the likelihood of facing a cooperative type. However, it does produce the prediction that most people will start defecting near the end of the game, consistent with the empirical evidence.

The Kreps, Milgrom, Roberts and Wilson model highlights the important role that expectations regarding the other person's behavior play in supporting an equilibrium. The key ingredient is how individuals will play in the future. Ariel Rubinstein (1991) argues explicitly that infinitely repeated game theory is really a parable for the way that individuals think about strategic situations. The key ingredient is the trade off between current gain and future returns from the relationship.

There is quite a bit of experimental evidence demonstrating that individuals do behave in ways consistent with this trade off. In addition, Fehr, Gächter, and Kirchsteiger (1997) provide experimental evidence showing that individuals who cheat in a relationship will face retaliation from their trading partner. Hence, the repeated game model provides a convenient shortcut to modelling behavior while a relationship is active, and from the individual's perspective it will continue almost "indefinitely".[26]

3.4 Legal versus Informal Enforcement

The classical study by Macaulay (1963) shows that even when there is a well functioning legal system, relational contracts can enhance the level and quality of exchange. What is much less clear is how the quality of legal enforcement interacts with relational contracts to affect the over-all output in an economy. Blanchard and Kremer (1997) observe that disorganization during transition made it difficult for new relationships to form, which in turn contributed to economic decline in the short run. They point out that the problem is most severe with complex goods, where legal enforcement is more difficult. Roland and Verdier (1999) argue that the rapid changes in Eastern Europe made it difficult for new relationships to form, resulting in a initial decline in output. Johnson, McMillan, and Woodruff (2002) present some evidence on how firms respond to the problems of incomplete contracts in transition economies. They find that relational contracts are important, and that they can be enhanced in some cases by having increased access to courts. Johnson, McMillan, and Woodruff (2002) find that when the quality of law is low, there is a greater reliance upon informal or relational contracts. However, their work does not explicitly address the trade-off between legal and informal enforcement.[27].

[26] See also Crémer (1986) who shows that with finitely lived, but overlapping generations of players one can support cooperative equilibria. His model suggests that families and firms can "rationally" act as infinitely lived agents, even though their members have finite lifespans. See also Ben-Porath (1980) on the role of families and firms in supporting exchange.

[27] Bakos and Dellarocas (2003) explicitly explore the trade-off between legally enforceable contracts and relational contracts. They find that relational contracts are preferred when litigation costs are high and the discount rate is low. They do not explicitly discuss the impact of the quality of law upon the efficiency of trade.

In general, these results suggest a positive complementarity between legal enforcement and the efficacy of relational contracts, and they illustrate the central role that relational contracts play in enhancing trade. In contrast, there is also a literature that highlights the costs of legal enforcement and the potential benefits of using reciprocity to enforce incomplete contracts. Akerlof (1982) suggests that one can view +above market clearing wages as a form of gift exchange with workers who agree to supply high quality effort in return. Kranton (1996) studies a situation in which individuals can move between a market setting with enforceable contracts and a network setting where trade is enforced via a reciprocity norm. She illustrates that, when the two coexist, the outcome may not be efficient. In particular, if goods in the market are poor substitutes for each other, then there may be only reciprocal relations, even though market exchange is more efficient. Conversely, there is a range of substitutability for the goods traded under which it is efficient to use reciprocal exchange, yet the market may crowd out such exchange.

Prendergast and Stole (2001) make a similar point in the context of organizational design. They argue that reciprocal relationships within an organization can enhance performance. However, since markets may crowd out such behavior, this can explain why organizations often ban the use of monetary exchange within the organization. Baker, Gibbons, and Murphy (2002) build upon these ideas to construct a theory of the firm based upon the creation and enforcement of relational contracts.

This section illustrates the interplay between relational and legal enforcement of contract that underlie these arguments and how they affect the *quality* and *quantity* of trade as a function of the *quality* of law. These effects can be illustrated with our simple model of exchange developed above. The key ingredient for efficient trade using either formal or informal enforcement is the total gains from trade. We can explore the interplay between formal and informal enforcement by supposing that there is a large number of goods for which the effect of quality is the same, but the total gain from trade can vary.

More formally, parameterize the flow returns v so the flow gains from trade defined in (3) can be rewritten as:

$$s(\Delta, q, v) = v - s^* + b(\Delta, q) - c(q), \tag{21}$$

where $s^* = \max_{q \geq 0} b(\Delta, q) - c(q)$ is the flow gains from trade at the efficient level of quality. Suppose that v is the only source of heterogeneity among goods, and let $V(v)$ denote the quantity of goods with value v or greater. This function is assumed to be continuous and decreasing in v. In the absence of transactions costs, it is efficient to trade whenever $v \geq 0$, with a corresponding efficient volume of trade: $V^* = V(0)$.

Now, consider the effect of costly enforcement with formal contracts. Let the quality of the law be parameterized by tc, the expected fixed cost in flow terms of writing and of enforcing a contract.[28] If good is normal, then the warranty payment enforcing the efficient level of quality is assumed to be larger than the enforcement cost. Hence, when parties trade they will always agree to have the efficient level of quality produced.

Under these conditions, trade at high quality occurs if and only if the gains from trade are greater than

[28] Formally $tc = K_A(q) + \rho K_P(Q)$, where ρ is the probability that a contract clause is enforced. For simplicity of exposition suppose that ρ does not depend upon v, and hence tc can be viewed as an independent parameter representing the quality of law.

the cost of enforcement:

$$s(\Delta, q, v) \geq tc. \tag{22}$$

The interplay between the quality of law and its effect on the level and the quality of trade is illustrated in figure 1. When the quality of law is low, illustrated by $tc^L > s^*$, the law has no effect upon either the level or quality of trade. In this case only low quality goods with $v \geq s^*$ are traded, generating a volume of trade is $V(s^*)$.

Now suppose that the quality of law increases, and the resulting contract formation and enforcement cost now falls to $tc^H < s^* < tc^L$. In that case, goods with valuation v satisfying:

$$v \geq tc^H \tag{23}$$

will be traded. These trades will have bonus or warranty terms that ensure high quality and result in a total volume of trade $V\left(tc^H\right) > V(s^*)$. Thus, an increase in the quality of law would result in an increase in both the quality of goods and the volume of trade.

Relational contracts are potentially superior to formal contracts because they allow parties to avoid the cost of using the legal system. However, in order to be self-enforcing, there must be sufficient surplus to satisfy the incentive constraint 18. Suppose that parties wish to use relational contracts to support the trade of a good at an efficient level of quality. Suppose that the surplus needed, s^R, is less than the total potential surplus in the market, s^*.[29] If the quality of law is sufficiently poor ($tc \geq s^*$), then in the absence of any relational contracts only goods with characteristics $v \geq s^*$ will trade at quality $q = 0$. Since $s^R < s^*$ this implies that for goods with characteristics $v \geq s^R$ can be traded using a relational contract that enforces the efficient level of quality q^*, as illustrated in Figure 2.

Now suppose that $s^* \geq tc \geq s^R$. In that case, for any $v \geq tc$, parties prefer trade with a formal contract enforcing high quality to not trade or to trade with a low quality good. Should a relational contract breakdown, this implies that the default is trade with a legally enforceable contract, rather than not to trade. But since $tc \geq s^R$ the deadweight loss from a legally enforceable contract is greater than the surplus needed to enforce the relational contract, and hence the relational contracts is self-enforcing in this case. This is illustrated in the upper right corner region of figure 2.

This also corresponds to the case discussed by Johnson, McMillan, and Woodruff (2002). In this region, firms that are uncertain whether or not their partner might perform could begin with legal sanctions and then move to a relational contract. This might be particularly helpful in situations where firms have lost partners due to one party reneging upon an agreement. They could then revert to the use of legal sanctions, and later regain their reputation.

Now, suppose that enforcement costs are less than s^R, i.e. tc^H as illustrated in figure 2. In that case, the surplus from a relational contract is less than s^R, and hence there do not exist any self-enforcing contracts because the threat to use a legally enforceable contract undermines the surplus needed to satisfy the incentive constraint 18. Even though relational contracts are strictly preferred to formal contracts, the existence of

[29] From 18 one can compute the surplus:

$$s^R = \frac{c'(q^*)}{\delta \frac{\partial \lambda_g(\Delta, q^*)}{\partial q}}.$$

legally enforceable contracts can undermine the sustainability of relational contracts. This possibility was first observed by Schmidt and Schnitzer (1995).

These effects are not necessarily unidirectional. Relational contracts require the existence of sufficient gains from trade in order to be self-enforcing. When the parties have a choice between making a term relational or formal, then increasing the quality of law can crowd out efficient relational contracts. More generally, when there are multiple terms in a contract, it may be possible to have some terms enforced using a relational contract and others enforced with legally binding terms. In this case, as Baker, Gibbons, and Murphy (1994) show, increasing the quality of law to allow some terms to be legally binding may lead to enhanced efficiency. Bernheim and Whinston (1998) generalize this point and show that parties may choose to make some terms legally unenforceable in order to increase the gains from trade, and hence allow for the use of more efficient relational contracts. Scott (2003) provides some nice evidence of actual court cases showing that indeed this occurs in practice.

3.5 Subjective Evaluation

The model of relational contract discussed thus far supposes that performance can be observed by both the buyer and the seller. This hypothesis is consistent with the early literature on relational contract (Klein and Leffler (1981), MacLeod and Malcomson (1989) and Baker, Gibbons, and Murphy (1994)). In many situations, the buyer's evaluation of performance is *subjective.* Formally, this means that the buyer's evaluation is private information that no other party can observe. The theory of contracts with subjective evaluation is developed by Levin (2003) and MacLeod (2003), and it builds upon the theory of repeated games with asymmetric information developed by Kandori and Matsushima (1998) and by Compte (1998).

This introduces a number of complications into the model, but also provides some interesting new insights. Suppose that the performance of the good is observed only by the buyer, while the seller observes her quality choice. This is now a model of two sided asymmetric information. An immediate implication of this, as first shown by Myerson and Satterthwaite (1983), is that it is no longer possible to implement the efficient allocation (see also section IV of Levin (2003) and proposition 2 of MacLeod (2003)). Hence, in equilibrium, disputes are an inevitable consequence of using subjective evaluation.

However, it is nevertheless possible to construct self-enforcing contracts with subjective evaluations that are superior to static contracts. This requires that the contract be structured in order that the buyer reveal his private information. If the information revealed by the buyer affects his payoff, then he will always claim the outcome that gives him the highest return; typically, he would like to claim that the good is defective. Thus, in order for him to be truthful his report must be *independent* of his payoff. This places some strong restrictions on the form of the contract that imply that contracts take one of two forms:

1. Efficiency wage contract: Suppose that the contract entails a fixed price by the buyer to the seller. Then, the only punishment is the threat of separation should the good be defective. In order that this threat be credible the buyer must be *indifferent* between continuing the relationship and leaving. The optimal strategy in this case is a fixed price P with the property that the buyer gets zero. The buyer then continues the relationship if the good is of high quality and leaves with positive probability if it

is of low quality. Then the probability of termination and the price P jointly determine the quality of the good. A higher price P or higher probability of termination lead to higher quality.

2. Bonus pay contract: Suppose that there is a bonus payment from the buyer to the seller whenever performance is good. In order that the buyer be indifferent between paying the bonus or not the seller must threaten to quit the relationship should the buyer not pay a bonus. In this case, the seller must be indifferent between continuing or leaving the relationship. Given this, the quality chosen by the seller is determined by the bonus, while the size of the incentive compatible bonus depends upon the gains to the buyer from continuing the relationship.

Levin (2003) shows that, for this risk neutral case, these two contract forms are optimal and equivalent for a wide class of repeated moral hazard problems with subjective evaluation. In contrast to the relational contract case in the previous section, the introduction of side payments does not enhance efficiency. It is interesting to observe that the renegotiation proof equilibria of the previous section yield contracts of the form 1 or 2. The difference is that under a relational contract there is never termination, while here there is termination with strictly positive probability. This is necessary due to the two sided asymmetric information.

The next question is the effect of divisibility upon the structure of the optimal contract with subjective evaluation. In the case of normal goods, increasing divisibility has no effect upon the structure of the contract; the contract is of form 1 or 2. However, in the case of an innovative good, the optimal contract does not have this form. We face the same problem as in the case of the repeat purchase institution; when the good is highly divisible, the probability of a good signal is very low. Hence the probability of termination approaches one, and it is impossible to support a positive level of quality. Levin (2003) observes that the model of Kandori and Matsushima (1998) provides a solution to this problem that has a particularly nice empirical interpretation.

In order to increase the probability of a good signal, it is optimal for the buyer to review the performance of the seller for several periods before making a decision. Hence, optimal contracts for innovative goods when evaluations are subjective entail the use of reviews less frequent than the frequency at which one receives performance information.

Secondly, at the time of evaluation, the buyer must report his information to the seller. This ensures that, at the beginning of the next period, the seller and buyer will act upon the same information. In contrast, if this were not required, then at the beginning of the next period, the buyer might condition future actions upon his private information. The seller would then be in the position of trying to decode the meaning of the buyer's actions. This creates an extremely complex Bayesian game which at the moment has no known solution. This requirement that the buyer report his observations to the seller is rather intuitive, and it is consistent with the advice of management texts encouraging managers to provide feedback to employees regarding how their performances are perceived (see for example Milkovich and Newman (1996)).

Finally, there is the issue of the form of the optimal contract. The analysis of Levin (2003) supposes risk neutral parties, then he shows that the optimal contract always takes the form of a simple step function. When the signal or performance falls below a threshold a punishment is applied - either the termination of the relationship or the non-payment of a bonus. The form of the optimal contract is therefore the same

under both subjective and objective signals of performance. The main difference is that the optimal contract with subjective information necessarily entails some losses and must be structured so that the individual who applies the punishment is indifferent between the choices available so that she is willing to reveal her private information.

MacLeod (2003) extends these results to the case of a risk averse agent. In the case of the classic principal agent model, as reviewed by Hart and Holmström (1987), the extent to which pay depends upon measured performance is a function of the quality of the signal, an intuition not easily captured in the risk neutral case, where typically there are many optimal contracts. Extending the analysis to the risk averse case in a repeated game setting is in principal very difficult.[30] One avoids this difficulty by recognizing that the role of the repeated game is to provide a way for parties to credibly destroy resources.

Thus formally, one can derive the optimal contract with subject evaluation using a static principal agent model with two modifications. One captures the relational aspect of the contract by requiring the amount that the Principal pays is greater than or equal than the agent's receipts. This formally allows parties to destroy resources as part of the contract. This is necessary in order to provide incentives for both parties to reveal their private information. Second, one adds incentive constraints to the optimization problem that requires parties to truthfully reveal their private information. As we know from the revelation principle, these constraints suffice to capture the costs imposed by asymmetric information. MacLeod (2003) characterizes the optimal contract with subjective evaluation with two ingredients.

When there is complete agreement in the assessments of the principal and agent, then the use of subjective evaluation equals the case of relational contracts above. As long as there are sufficient gains from trade, one can implement the efficient contract. However, if the beliefs of the principal and of the agent are not perfectly correlated, then one faces a trade-off between more pay for performance and conflict. This explains why firms often compress performance ratings of employees. In the extreme case when the beliefs of the principal and agent are uncorrelated, the optimal contract consists of a single wage combined with the threat to fire the worker should the principal believe that performance falls below a given threshold.

4 Reputation

Let us now explicitly consider the role of reputations in ensuring contractual performance. There is a large informal literature, beginning with Friedman (1962) and Akerlof (1980), illustrating that in competitive markets, sellers can develop "reputations" for quality that can ensure that buyers obtain the quality that they expect. This section reviews the literature on reputations and on contract enforcement and how the results we have derived above can help us better understand the structure of contract enforcement institutions, and the precise roles of reputation effects. The first issue is to decide exactly what one means by a "reputation"? One can roughly divide the literature into three distinct types of reputational models: reputation for ability, reputation for integrity and reputation for performance.[31]

[30] See Pearce and Stacchetti (1998) for some progress on this problem.

[31] I have discussed this issue with a number of researchers in the area. Unfortunately, there is no a consensus regarding the terms and their interpretation. The choices made here owe much to my discussions with my fellow colleague, Kyle Bagwell.

The classic paper on reputation for ability is Holmström (1992) who introduces a model of career concerns. In his model, a seller (manager of a firm) of uncertain ability supplies labor to a buyer (shareholders in a firm) in a competitive labor market.[32] The seller, the buyer and the market all share the same information regarding the ability of the seller. In addition to ability, the agent can affect performance via her choice of quality (or effort), a choice unobserved by both the market and the principal.

It is assumed that each period the seller is paid a price equal to the expected value of her output, taking into account the rule she uses to set quality. By working hard, the seller can increase measured performance, which causes the buyer to bias upward his estimate of the seller's ability. The buyer understands that the seller is doing this, but given that quality is not observable, in equilibrium the seller's quality choice will increase with the level of uncertainty regarding her ability. This has a number of novel implications:

1. A concern for one's reputation, as measured by the beliefs regarding ability, does motivate the seller to supply higher quality than she might otherwise.

2. However, quality is related to the uncertainty of beliefs, not to the marginal benefit of quality, and hence this reputation mechanism does not in general result in efficient trade. Holmström (1992) thus concludes that reputations, as modelled by Fama (1980), cannot be relied upon to ensure efficiency in a competitive market.

Gibbons and Murphy (1992) test some of the empirical implications of the model using data on compensation for CEOs in large American corporations. Reputation can be viewed as a "career concern": one works hard to affect the beliefs that employers attach later to ability. Gibbons and Murphy show that in order to offset the weakened incentives to CEOs approaching retirement, companies supplement their pays with explicit performance incentives. From this literature we can conclude that by itself, a concern for ones reputation for ability in a competitive market cannot ensure efficient trade.[33] Rather, concerns for the market's evaluation of one's ability does affect behavior, but in order to achieve efficient exchange it is necessary to introduce additional contractual instruments.

The second class of models are those whose parties have reputations for "integrity". The classic contribution in this case is Kreps, Milgrom, Roberts, and Wilson (1982) who consider the potential to support cooperation in a finitely repeated prisoner's dilemma.[34] One needs only a small number of individuals in society with "integrity" to support cooperation. In the context of a prisoner's dilemma, a person with integrity is one who has a "taste" abiding by her agreements. If she agrees to select the cooperative strategy, then she continues to select this strategy regardless of how other player behaves. We shall follow the Oxford dictionary and call this a person of upright character or type.

In a repeated prisoner's dilemma game it is optimal for individuals with no integrity to mimic the individuals with integrity early in the game. As long as a person does not cheat, her partner believes

[32] Constent with our example developed above, we view quality as a choice variable, while ability determines the probability of good performance given quality. The greater the ability of a seller, the greater the realized performance given a fixed quality choice.

[33] Recent additions to the career concern literature include Meyer and Vickers (1997) and Dewatripont, Jewitt, and Tirole (1999).

[34] Rosenthal and Landau (1979) introduced the idea that reputations can be modelled via unknown agent characteristics. See Mailath and Samuelson (2006) for an up to date review of this literature.

there is a chance that she has integrity and she continues to cooperate. The moment that a person cheats, it becomes common knowledge that the person lacks integrity, and hence there is no cooperation for the rest of the game.[35] Kreps (1990) has shown how one can use this model to study the notion of corporate culture. Fudenberg (1989) extend this result to the case of a long run player facing a sequence of short lived individuals, and finds that in many cases the long run player is able to select her most preferred outcome.[36]

From a practical point of view, the uniqueness of the equilibrium is not particularly helpful because the detailed structure of the equilibrium depends upon the assumed distribution of upright types, something difficult to measure and to interpret in practice. In terms of large scale behavior, the structure of the equilibria early in the game is given by the punishment that results when a seller is categorized as having no integrity. The implications for contract form early on therefore depend upon payoffs in two continuation equilibria and not upon the types per se. This structure is conveniently analyzed using the less complex structure of repeated game theory.[37]

More recently, Ely and Valimaki (2003) have shown that in the models of reputation for integrity it may not be possible for parties to acquire good reputations. In their model, a good mechanic who correctly advises clients regarding a car repair cannot effectively prove to his client that he is in fact competent. Bad mechanics can recommend costly repairs that after the fact result in the same outcome: a functioning car. This problem is similar to the difficulty of supporting efficient equilibria in the case of innovative goods, as we showed above in the context of the Abreu, Milgrom, and Pearce (1991) model: the signal of good quality is simply not strong enough to consistently reward good performance. The solution is for parties to use more complex contracts that allow one to design the performance standard in order to support a *reputation for performance.*

4.1 Reputation for Performance

A reputation for performance, in the words of Colin Camerer (2003), is defined as follows:

> " a player's reputation is crisply defined as the probability that she .....will take a certain action."[38]

In this case, reputation only has meaning as part of a system of self-enforcing norms of behavior.[39] For example, in the context of the Klein and Leffler (1981) model, the firm acquires a good reputation by making a sunk investment in advertising.[40] The firm then sells the product for a high price to cover the cost of this investment. If at any point the firm offers a product with low performance, then she loses her "reputation for performance", and customers refuse to continue buying at the high price. As we showed above, if quality and performance are highly correlated, then this behavior can support a nearly efficient level of quality. Unlike reputations for quality or for integrity, the reputation for performance only has meaning in the context of

[35] See Wilson (1985) for a review of the early literature.

[36] See Fudenberg (1992) for a review of this literature.

[37] In this regards see the comments by Rubinstein (1991).

[38] Page 445. He also allows for reputation to represent the probability of being a certain type, which we have called the reputation for integrity.

[39] See Carmichael (1984) and Kornhauser (1983) for early non-strategive reputation models.

[40] See also the recent clever paper by Tadelis (1999) in which firms can acquire a reputation by purchasing a brand name.

a system of self-enforcing norms. The nature of these self-enforcing norms is a function of the environment and in many cases can be related to observed economics institutions.

The theory of self-enforcing relational contracts demonstrates a variety of ways to structure the contract between the buyer and the seller. Each contract form corresponds to different ways to define breach of contract. Economists are typically not very attentive to legal notions of breach; however, the notion of a reputation is intimately tied to the concept of breach. A party loses its reputation for performance or for trustworthiness whenever they breach an agreement. A relational contract plays an important role in setting the performance standard, and hence which party *should* hold the reputation for performance. In the simple buyer-seller example we have been studying, there are a number of ways to achieve this:

1. Seller holds the reputation - breach if there is a defect or no innovation.

2. Seller holds reputation - breach if the seller does not remediate a defect or if there is a lack of innovation.

3. Buyer holds reputation - breach if the buyer does not reward high output by the seller.

Each of these contract forms is associated with a particular set of self-enforcing norms of behavior. Much of the game theoretic literature is built upon variations of the prisoner's dilemma model where the notion of breach of trust is mechanically linked to the "cheat" strategy. This has been very useful to animate the structure of self-enforcing behaviors, but it tends to overlook that fact that in practice buyers and sellers use a variety of institutions to enforce agreements, and that one of the important parameters is the locus of the breach decision. Thus, reputation for performance can be associated with at least three distinct notions of performance: output, remediation and reward. The first two notions of performance are enforced via a seller's reputation for performance, while the latter case corresponds with having the buyer act to protect his reputation. These cases are considered in turn.

4.2 Seller Reputation

By far the largest literature explores the case where the seller holds a reputation. This includes the literature on price ensuring quality, such as Klein and Leffler (1981) and Shapiro and Stiglitz (1984).[41] In these models, the seller is penalized for low output by a termination of the relationship. As we have shown above, if there are sufficient gains from trade and if the seller can ensure high output with a sufficiently high probability, then there is a price at which the threat by the buyer to terminate the relationship can provide adequate incentives for the seller to perform.

Carmichael (1985) observes in the case of efficiency wages models, these conditions are necessary, but not sufficient for high performance. There must also exist a set of self-enforcing norms in the market that create a "reputation" for performance. Klein and Leffler (1981) explicitly address this issue, and they argue that the existence of an equilibrium requires the firm to invest in non-salvageable investments, such as advertising or expensive store fronts. For their argument to work these investments must cue the following set of beliefs by buyers:

[41] See also Shapiro (1983) and Rogerson (1983) for extension of the Klein and Leffler model.

1. If the buyer does not observe advertising or an expensive store front, then he/she concludes that the seller is of low quality.

2. If a buyer observes these investments, he/she initially believes that the firm is of high quality until he/she experiences a defect, at which point he/she refuses to purchase from the firm again.

Under the appropriate set of conditions, this set of beliefs is self-enforcing, and it ensures that the sellers supply high quality until the buyers observe low performance. From that point on, the sellers select low quality. In the case of efficiency wage models, the buyer (firm) pays the seller (worker) an above market clearing wage, and subsequently terminates the relationship should the seller (worker) be caught cheating. In this case, the fired worker loses her "reputation," and she must spend a period of time unemployed.

In the original efficiency wage models, all workers are identical, and hence it is not clear why other firms do not immediately hire laid off workers. There is evidence that workers who separate from a firm for unknown reasons face a lower probability of rehire than those for whom the separation decision had nothing to do with their job performance (see Jacobson, LaLonde, and Sullivan (1993)). However, as Carmichael (1985) shows, logically there is no reason that firms cannot pay a low starting wage to compensate for the higher wage they will receive in the future. All that the efficiency wage model requires is that the worker not shirk because of the consequence for *future* earnings; current earnings are irrelevant to this decision.

There are a number of responses to the issue. First, MacLeod and Malcomson (1989) show that indeed, contrary to Carmichael's claim, it is possible for an equilibrium to exist in this market. However, it explicitly requires that there be a social norm and that the firm pay high wages. If a firm attempts to offer a wage less than the accepted norm, then workers conclude that the firm will not treat them fairly and hence will shirk, which in turn becomes a self-enforcing prophesy. MacLeod and Malcomson (1998) are more explicit on this point, and they show that in the absence of a long term contract, one also needs a social norm that the firm will not cut the wage. If they do so, then again the workers will shirk. This observation may explain the observation going back to Keynes that worker resist wage cuts recommended by firms.[42]

There are other ways to create the rent that is needed to enforce the contract. In many cases the rents are created naturally through on the job training that make it expensive to replace a work (see Mincer (1962)).[43] Murphy and Topel (1990) links the point explicitly to the efficiency wage model, and suggests that during the initial period of training that provides the bond necessary to enforce the contract. Akerlof and Katz (1989) suggest that rising wages might serve a similar role. MacLeod and Malcomson (1988) observe that job titles in a firm are associated with worker quality, and hence can also be used as a reputational bonding mechanism.[44]

Related to the Klein-Leffler idea on wasteful investment in store fronts, Carmichael and MacLeod (1997) show that some form of up-front wasteful expenditures is not only a necessary condition for constrained efficiency, but it is also the unique outcome in an evolutionary model of trade where the wasteful expenditure

[42] See Bils (1985), Blinder and Choi (1990), and Altonji and Devreux (1999) for some evidence on wage stickiness. See also Fehr and Falk (1999) for some experimental evidence on wage stickiness.

[43] Williamson, Wachter, and Harris (1975) also make the point that there are large relationship specific investments in the employment relationship. They discuss how internal labor markets are designed to efficiently manage employees.

[44] See Waldman (1984) for a seminal discussion of the signalling role of job titles.

is interpreted as a costly gift.[45]

These results are based upon the problem of enforcing a *bilateral* contract. Matters are quite different if one allows for third parties.[46] Milgrom, North, and Weingast (1990) show that private law merchants in medieval times tracked the reputations of traders, and hence made possible for a higher level of trade than would be possible otherwise. Greif (1989) documents the case of the Maghribi traders who keep track of the business transactions of group members, which in turn ensures that they all behavior in a trustworthy fashion. Taylor (2000) explores a model of the old-boy network. Gilson (2003) discusses the market for venture capitalists, and how their ability build a reputation allows them to exert more efficient control over new ventures than they could otherwise.

The structure of the equilibria that support such trade is analyzed in detail by Kandori (1992) and by Ellison (1994), building upon the seminal contribution of Rosenthal (1979).[47] Again, these equilibria depend upon a social norm with the feature that when an individual has breached an agreement, then all members of the community believe that breach is likely again in the future. These papers show it is not strictly necessary, as assumed in Klein and Leffler (1981), for all members of the community to observe who breaches. They that cooperation can be supported under a number of assumptions on information flows. In the simplest version, each individual in the community is labelled as trustworthy. Should an individual breach upon an agreement, then other members of the community are informed of this breach. They now expect the individual to breach again in the future; therefore they rationally avoid trading with or trusting the individual.

The problem with such a mechanism is that it is very costly for individuals to observe the outcomes of specific transactions. A solution to this is to provide explicit information regarding seller performance. A number of examples of such institutions have been studied in economics. Dranove, Kessler, McClellan, and Satterthwaite (2003) explore the impact of health "Report Cards" on the quality of medical care. A difficulty, as they point out, is that if the information is not perfectly correlated with performance, then one will get adverse selection. Jin and Leslie (2003) explores the effect of requiring restaurants in Los Angeles county to display the ratings from regular health inspections. This study is particularly interesting because it illustrates the interplay between regulation and reputation effects. All restaurants in Los Angeles as a matter of course are inspected and will be shut down if they do not meet minimum standards. The new law did not change in the procedure used to evaluate restaurants, rather it simply required restaurants to post the results of the health inspection in a prominent place. Even at the best restaurants, diners could see if the establishment earned an A, B or C. In a short period of time, diners made decisions based upon these ratings, which in turn caused restaurants to pay more attention to maintaining sanitary conditions in their restaurants. Jin and Leslie (2003) find, as a consequence, there was a significant decline in hospitalizations due to food borne illnesses.

A similar idea motivates the rating system used for internet trading.[48]. Many internet retailers - especially

[45] See Camerer (1988) for a theory of gifts as a signal of quality. Ghosh and Ray (1996) and Watson (1999) use the Kreps, Milgrom, Roberts, and Wilson (1982) approach to model *building* a reputation for integrity.

[46] See Moore (1992) for an excellent discussion of this issue from an abstract mechanism design approach.

[47] See also Okuno-Fujiwara and Postlewaite (1995).

[48] See Bajari and Hortacsu (2004) and Dellarocas (2003) for recent reviews of the literature.

eBay - allow buyers to report their experiences with the seller, to create a quality rating of the seller. The early work of Resnick and Zeckhauser (2002) finds little relationship between price and a seller's reputation. Cabral and Hortacsu (2004) find some evidence in this regard; however, the reputation mechanism itself appears quite complex. There is evidence that sellers buy a reputation by making purchases online, - a phenomenon that is reminiscent of Tadelis (1999)'s model where firms without good reputations can acquire such a reputation by purchasing a brand name.

A lacuna in this literature is the focus upon a version of the repeat purchase institution of Klein and Leffler where breach is associated with the seller delivering a defective good. As shown in section 3.2.1, when the probability of a defect is significant or when one trades an innovative good, the repeat purchase institution is not in general efficient. In this case, parties would prefer to use a relational contract where breach is associated with the non-payment of a warranty or bonus.

4.2.1 Warranties

If a seller agrees to supply a good of a specified quality, as a matter of law this does not imply that the seller must supply the good or else face inordinate penalties. It is required that the seller make adjustments to the price to compensate the buyer for his/her lost.[49] Hence, breach occurs if and only if the seller supplies substandard quality *and* fails to compensate the buyer adequately. When the likelihood of failure is significant, then it is efficient for a seller's reputation to be associated with this lack of remedial payment, rather than with the defect in the good per se.

While there is a large literature on the optimal structure of warranties, there is little work that explores the enforcement of warranties as part of a relational contract.[50] Beginning with the seminal work of Heal (1977), Spence (1977), and Grossman (1981), the literature has for the most part assumed that one can write an enforceable contract, and hence the issue is a question of how to structure the warranty contract to signal product quality. In the context of the internet market, clearly there needs to be more work exploring how sellers can affect the quality of their goods via the services provided after the good is delivered. The importance of this may explain why the empirical link between a seller's online reputation and a price charged can be very weak, as Resnick and Zeckhauser (2002) find.

The recent work of Banerjee and Duflo (2000) provides some evidence that sellers may develop a reputation for remediation of services rather than for quality per se. They find that in the Indian software industry when firms are in a long term relationship they use contracts with the feature that each party is responsible for its own errors, which it is expected to correct. Their reputation is therefore associated with the extent to which they remediate errors rather than with quality per se.[51] An interesting area for future research would be to explore more systematically the role that reputations play in regulating seller behavior after point of sale.

However, as we have shown in above, warranty contracts suit normal goods where the likelihood of a defect is low, but they may not be the most efficient solution ensure the supply of high quality innovative

[49] This is codified in section 2 of the Uniform Commercial Code of the United States.

[50] See Murthy and Djamaludin (2002) for a recent survey of the literature.

[51] Banerjee and Duflo (2000) use a "reputation for integrity" model to animate their results. As discussed above, this is partly a matter of taste. One could as easily have used a "reputation for performance" model, with similar qualitative results.

goods. In this case, bonus pay contracts may be more appropriate.

4.3 Buyer Reputation and Bonus Pay

Under a bonus pay contract the buyer pays the seller a reward whenever performance is high. This type of contract characterizes many employment relationships where the employee receives rewards on an irregular basis. In this case, the reputation is held by the buyer (firm) rather than by the seller (worker). Bull (1987) is the first paper to explicitly link bonus pay to firm reputation. He makes the point that the party should hold the reputation for good performance is a function of the information available in the market. If it is easier to observe firm behavior, then the firm should hold the reputation for performance. In this case, the optimal relational contract entails pay for performance.

In labor economics, one typically supposes that workers earn a fixed wage, but as a matter of fact bonus or "merit" pay is very common (see Brown (1990) and MacLeod and Parent (1999)). In an important paper, Baker, Gibbons, and Murphy (1994) explore the trade-off between formal contracts and the provision of bonus pay supported by a reputation for performance. They show that where there are good verifiable measures of performance, these measures can crowd out the use of subjective measures, even though the subjective measures may more accurately measure performance.

This result mirrors the result discussed above where legal contracts can crowd out more efficient relational contracts. Bernheim and Whinston (1998) show that in these case parties may optimally design contract with fewer contingencies in order to enhance the power of implicit incentives. In other cases the use of verifiable measures can increase the total gains from trade relative to a default of no trade. In these cases explicit and implicit incentives can act as complements.

The evidence on whether explicit and implicit incentives are complements or substitutes is mixed. Poppo and Zenger (2002) using survey evidence, find that objective and subjective measures act as complements. In contrast, Scott (2003) finds in a review of litigated contract cases that parties would leave important terms open in order to increase the gains from continued cooperation, relative to the losses that they would suffer from defection. It is still an open question regarding the optimal allocation of responsibility for breach, namely who should hold the reputation for good performance, and the trade-off between the use of subjective and objective performance measures.

5 Concluding Discussion[52]

It is well appreciated that for transactions of modest value, parties may rely upon informal reputational mechanisms for enforcement rather than the legal system. One of the lessons of the current review is that a complete theory of contract that bridges the gap between contract law and contract economics needs to be attentive to the breach decision and the contractual instruments that parties use to enforce performance. This section briefly reviews these results, and discusses future research directions.

[52] This conclusion benefited greatly from discussions with Louis Kornhauser. The notion of a contractual instrument discussed here is based upon our joint research.

The choice of contractual instrument is summarized in table 1. Each box in the table corresponds to a different contractual instrument for the enforcement of trade between a buyer and seller. The contractual instruments described in this review have two dimensions. The first is whether or not one uses formal or informal enforcement. Second, the instrument should specify the event that triggers breach, as well as the damages that such a breach implies. Each entry in the table summarizes the contractual environment for which the specified instrument is likely to be efficient.

Type of Enforcement	**Penalty Clause**		
	Fixed Price	Warranty Contract	Bonus Contract
Formal Enforcement	Defects are unlikely, quality of law is high.	Normal Goods, high quality law or high value exchange.	Innovative Goods, high quality law, or high value exchange.
Informal Enforcement	Defects unlikely and efficient for seller to hold reputation. Quality of law is low.	Efficient for Seller to hold Reputation, quality of law low or value of trade low.	Efficient for Buyer to hold Reputation, quality of law low or value of trade low.

Table 1: Conditions for Optimal Choice of Contractual Instrument

The paradigm instrument in a simple buyer-seller contract is the agreement deliver a good of a specified quality in exchange for an agreed upon price. In this case, breach occurs if the quality of the good is unacceptable. Formal enforcement of this contract entails the buyer filing suit, and claiming damages for the harm caused by the delivery of a low quality good. This instrument is efficient when seller is able to control the quality of the good at a low cost, and hence the likelihood of breach is low. If the cost of court enforcement is high, then firms may rely upon the repeat purchase institution introduced by Klein and Leffler (1981) and Shapiro and Stiglitz (1984).

The repeat purchase institution is the market consequence of no legal enforcement *and* no explicit penalty clause. Formally, the repeat purchase institution specifies a set of self-enforcing norms with the feature that buyers refuse to deal again with a seller who has breached upon the agreement to supply high quality goods and services. This is efficient only if the seller can easily control performance. If perfect performance cannot be attained then the repeat purchase institution is not efficient.

Efficiency can be enhanced using a clause that specifies payments as a function of the quality of the good. Under a warranty clause the seller agrees in advance to compensate the buyer should the good supplied be defective. In this case breach occurs not in the event of that there is a defect, but in the event that the seller does not make good upon the warranty payment. When the quality of law is high and the promised warranty payment is higher than the cost of a court case, then parties may choose formal enforcement of the contract. In the case of most consumer goods the cost of a court case, even in small claims courts, is likely to be much larger than the value of the good. An open question is whether firms honor these warranty claims because of the fear of harming their reputation, or because of the threat of class action suit?

Alternatively, the buyer may promise a bonus when performance is high. When contracts are enforced through the legal system, bonus contracts are optimal for the exchange of innovative goods. These are

services for which high performance is a relatively rare event. Examples include research provided by a scientist, or the sale of large, complex goods such a military weapons systems or commercial real estate. There many examples of contracts for which such bonus pay enforced by the courts. In particular, the doctrine of "good faith" behavior in labor contracts precludes employers from dismissing employees to avoid paying out a large bonus payment.[53]

It is also very common for bonus pay to be voluntary. This includes tips to waiters and discretionary end of the year bonuses to employees. As MacLeod and Parent (1999) document, these payments are very common, and are associated with jobs for which the evaluation of performance is likely to be partly subjective. We still do not understand the extent to which these payments are part of a relational contract, nor how employee performance varies with the size and frequency of such bonus pay.

With the exception of Banerjee and Duflo (2000), the empirical research on reputation in markets has focused upon the repeat purchase institution, corresponding to the upper left box in table 1. There are lots of examples of contracts corresponding to the other contractual instruments in this table. However, we do not know for the economy as a whole how often these different instruments are used in practice, nor how they affect the efficiency of trade relative to the alternatives. Such an exercise would help guide policy makers on how best to modify commercial law, particularly in developing economies, to support an increase in both the quantity and the quality of traded goods and services.

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[53] See Rothstein and Liebman (2003), chapter 10.

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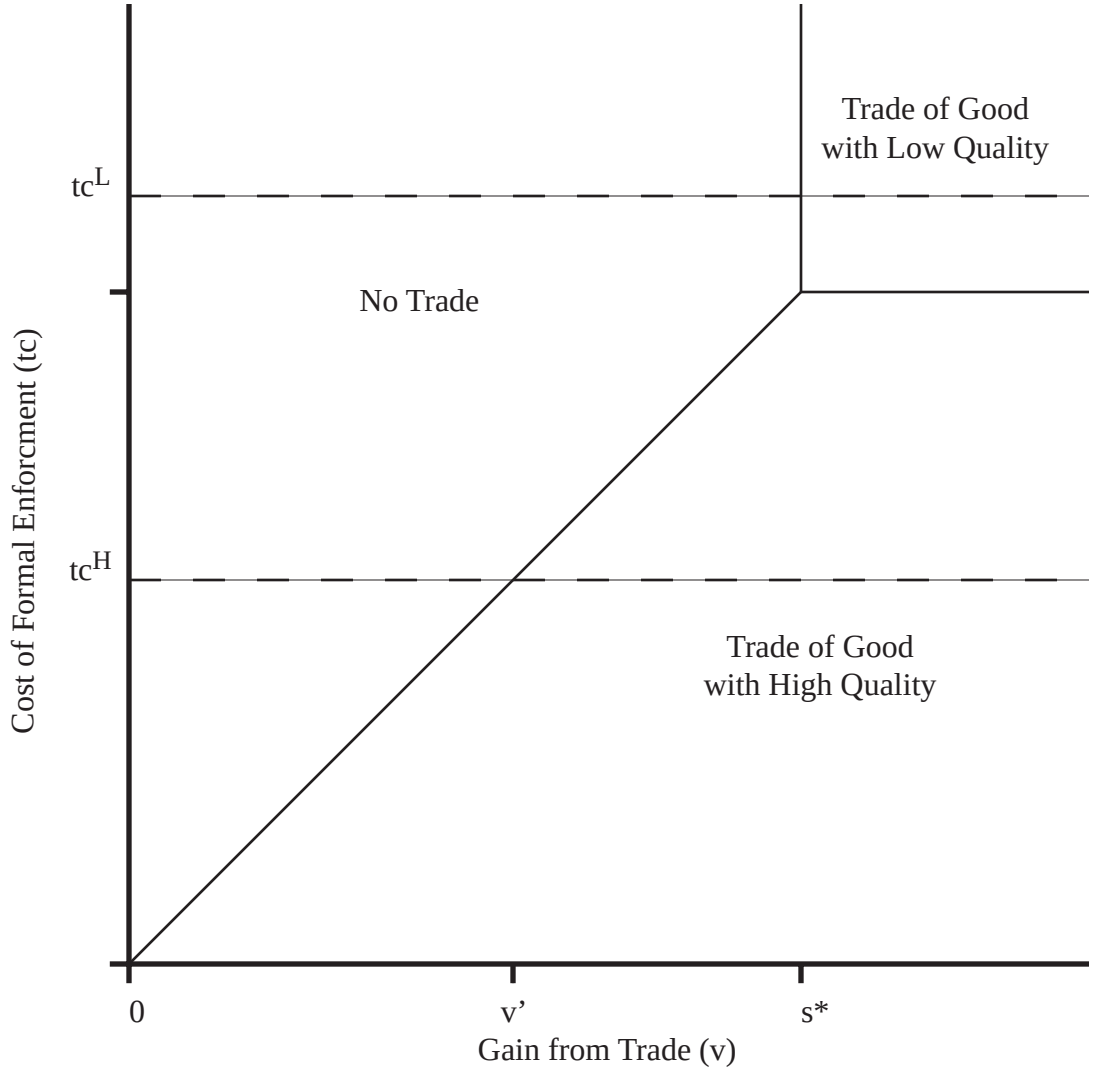
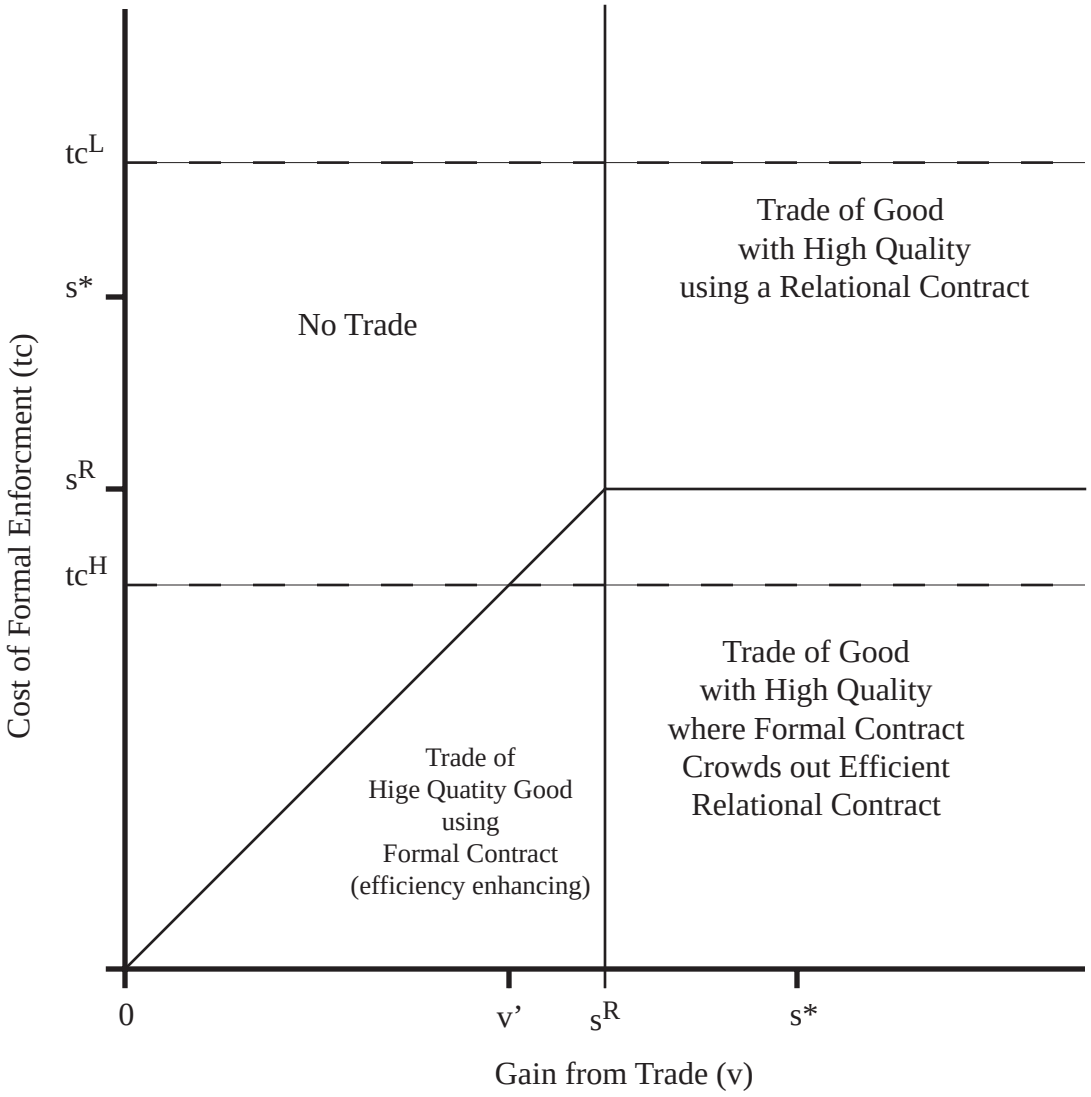


Effect of Transactions Cost on Trade with Formal Contracts

Figure 1



Effect of Transactions Cost on Trade with Formal and Relational Contracts

Figure 2