Last revision: May 2007

Consent and Exchange

Oren Bar-Gill† and Lucian Arye Bebchuk‡

Abstract

This paper considers the basic legal principle under which the consent of both parties is needed for an exchange in which an asset or a service is provided by a "seller" to a "buyer." We compare the effects of this "mutual consent" regime to those of the alternative "restitution" regime, under which a "seller" may confer a benefit on a (forced) "buyer" and thereby become entitled to receive from the buyer a payment equal to the buyer's benefit as estimated by a court. The analysis focuses on the beneficial effects that the mutual consent regime has on *ex ante* decisions. When courts are imperfectly informed about the value of an asset or service to the buyer, the restitution rule would have large *ex ante* efficiency costs *even when courts' errors are unbiased*. With such imperfectly informed courts, the restitution rule would induce excessive entry by low-quality sellers and excessive exit by low-valuation buyers. Moreover, as the court adjusts its value estimate upward to reflect the exit of low-valuation buyers and as more buyers exit in light of the increasing estimate, the market might completely unravel. The symmetric "pricing" regime, the "takings" regime, under which a "buyer" may take an asset from a (forced) "seller" provided that the buyer pay the seller's cost as estimated by a court, is dominated by the mutual consent regime for similar reasons.

JEL classification: C72, C78, D23, K10, K11, K12
Keywords: Ownership, property rights, exchange, bargaining.

† Assistant Professor of Law, NYU School of Law.
‡ William J. Friedman Professor of Law, Economics, and Finance, Harvard Law School; Research Associate, National Bureau of Economic Research. We thank Barry Adler, Michal Barzuza, Omri Ben-Shahar, Bernie Black, Hanoch Dagan, Clay Gillette, Ofer Grosskopf, Assaf Hamdani, Sharon Hannes, Oliver Hart, Louis Kaplow, Lewis Kornhauser, Roy Krytner, Shai Lavi, Paul Mahoney, Dotan Oliar, Eric Rasmusen, Alan Schwartz, Steve Shavell, Chris Snyder, Kathy Spier, Rip Verkerke, and workshop and conference participants at Harvard University, NYU, Tel-Aviv University, the University of Virginia, and the 2004 NBER Summer Institute for their helpful comments. We have benefited from the financial support of the John M. Olin Center for Law, Economics, and Business at Harvard Law School.

1 Introduction

Exchanges – transfers of value from a "seller" to a "buyer" – generally require the mutual consent of both sides to the exchange. Much work in economics takes this feature of the world for granted. But this feature is not an essential corollary of the concept of exchange. Rather, it is a product of how the legal system has chosen to regulate exchange. This paper analyzes the critical role that the mutual consent principle performs in the operation of an economy.

Specifically, we contrast the mutual consent principle with the alternative "Restitution" Rule. Under this rule, a potential "seller" may elect to confer a value on another party – say, transfer an asset or provide a service – and thereby, absent an agreement between the parties to indicate otherwise, become entitled to a payment from the other party equal to the value of the asset or service to the other party as estimated by a court. That is, under this rule, potential sellers have a "put" option allowing them to unilaterally transfer an asset or provide a service to another party and receive an exercise price equal to the court-estimated value of the asset or service to the other party. In contrast, under the Mutual Consent Rule, since potential sellers cannot unilaterally become entitled to any payment, they can be viewed as having a put option with an exercise price of zero.[1]

There are circumstances in which the legal system does impose a Restitution rule. They generally arise when there are impediments to an agreement between the parties. If B is in a comma or drowning (situations in which entering an agreement would be rather difficult) and S takes the expense to help B, S will generally become entitled to a payment by B even though B did not agree to make such a payment. Similarly, under a "common fund" doctrine, someone who makes expenditures to advance a certain interest of a class might become entitled to payments from the members of the class; under this doctrine, for example, plaintiffs in a class action might become entitled to get payments from fellow members in the event that they benefit from the litigation. However, these are exceptions. In general, a potential seller needs to get a potential buyer's consent to become entitled to any payment from the buyer. In his well-known treatise on law and economics, Posner (2003) describes the reluctance of the law to follow a Restitution Rule as follows:

> *…now suppose that a man stands under my window, playing the violin beautifully, and when he has finished knocks on my door and demands a fee for*

[1] This paper shows that the Restitution Rule, the Takings Rule, and similar pricing rules—characterized below—are inferior to the prevalent Mutual Consent Rule. This paper does not show that the Mutual Consent Rule is superior to any imaginable rule. Our defense of the Mutual Consent Rule is, therefore, limited.

his efforts. Though I enjoyed the playing I refuse to pay anything for it. The court would deny the violinist's claim for a fee -- however reasonable the fee might appear to be – on the ground that, although the violinist conferred a benefit on me (and not with the intent that it be gratuitous), he did so officiously. Translated from legal into economic terminology, this means he conferred an unbargained-for benefit in circumstances where the costs of a voluntary bargain would have been low. In such cases the law insists that the voluntary route be followed – and is on firm economic grounds in doing so." (p. 136)

We will focus in this paper on the use of the Mutual Consent Rule when bargaining is easy. As Posner states in the paragraph quoted above, those are the situations in which the case for using the Mutual Consent Rule appears to be compelling. However, while we will argue that this case is indeed strong, the case cannot be based on the conventional justification for the rule.

The standard explanation, as suggested in the Posnerian quote, is that when the parties can easily bargain we would like to force buyers and sellers to get the other side's consent to the exchange. The requirement of mutual consent is viewed as an instrument of ensuring that an exchange would take place if and only if it is efficient. Courts are bound to make mistakes and estimate imperfectly values to the buyer and seller. Only the buyer and the seller are in a position to know the value of an exchange to them. When an exchange is efficient they will find a way to carry it out so that both will benefit. And when an exchange is inefficient, requiring mutual consent would guarantee its prevention since there will be no way to carry it out so that both sides will benefit.

While this explanation appears plausible at first glance, it is hardly persuasive upon closer look. The Restitution Rule does not prevent parties from bargaining. Even when the violinist in Posner's example is backed by a Restitution Rule, he might well bargain with Posner before any playing takes place, if bargaining could produce a surplus. The presence of the Restitution Rule would just provide a different background for the bargaining – the bargaining will be conducted against a background in which, if no agreement is reached, the violinist will have a put option with an exercise price equal not to zero (as under the Mutual Consent Rule) but of the court-estimated value of the playing to Posner.

In situations in which bargaining is easy, supporters of the Mutual Consent Rule believe, this rule would generally result in an exchange taking place if and only if it is efficient. Although this is true, a Restitution Rule would also lead to an efficient outcome in this setting. If the court is expected to under-estimate or over-estimate the value of the playing to Posner in a way that would produce an inefficient outcome absent bargaining, an inefficient outcome would be prevented

because the parties would bargain around it. As Coase (1960) famously observed, when bargaining is easy the efficient outcome will obtain regardless of the legal rule. The conventional ex post argument favoring the Mutual Consent Rule over the Restitution Rule does not hold-up to scrutiny. In this paper we confirm the conventional wisdom supporting the Mutual Consent Rule. We argue, however, that the advantage of the Mutual Consent Rule is in ensuring ex ante rather than ex post efficiency.

To explain the dominance of the Mutual Consent Rule, we must fully characterize the alternative rule: the Restitution Rule. Under the Restitution Rule the buyer must pay the seller the value of the product or service exchanged. Practically, the amount to be paid will be determined by an imperfectly informed court. In particular, we assume that the court does not know the seller-specific quality of the product or service. Also, assuming that the value of the product or service to a buyer includes an idiosyncratic component, the court does not know the magnitude of this value component. Rather, the court knows only the distribution of quality levels across the class of potential sellers and the distribution of idiosyncratic values across the class of potential buyers.

The Restitution Rule reduces welfare on several dimensions. First, focusing on quality heterogeneity among sellers, we show that the Restitution Rule induces entry by low-quality sellers. Under the Mutual Consent Rule only sellers that can generate efficient exchanges will enter the market. Low-quality sellers—sellers that cannot produce a value higher than cost—will have no reason to enter the market, since they will not be able to extract any payment from buyers. Under the Restitution Rule, on the other hand, these low-quality sellers will enter the market. Since the court cannot verify seller-specific quality, it will overestimate the value provided by low-quality sellers. In particular, if no agreement is reached with the buyer, the low-quality seller might be able to impose an inefficient exchange and get a high, above-cost price from the buyer by going to court and invoking the Restitution Rule. Armed with a credible threat to impose an inefficient exchange and sue for a high price, these low-quality sellers will be able to extract bribes from buyers wishing to avoid the inefficient exchange.

Entry by low-quality sellers can severely impair the functioning of a market. The average surplus generated from a meeting between a seller and a buyer would be significantly reduced, as many buyers meet low-quality sellers—a meeting that ends without an exchange. Moreover, the proportion of low-quality sellers can be expected to be significant. While producing high-quality goods or services requires skill and investment, producing low-quality goods or services is much less demanding. And if low-quality is sufficient to extract payment from buyers, many would join the ranks of low-quality sellers.

Focusing on buyer heterogeneity reveals another, potentially critical inefficiency of the Restitution Rule. An imperfectly informed court would set damages equal to the valuation of the average buyer. Accordingly, a low-valuation buyer would expect to pay for a product or service more than the product or service is worth to her. Expecting to lose from an exchange low-valuation buyers would exit the market.

Exit by the lower half of the buyer distribution entails a significant welfare loss. And, under certain conditions, the story does not end after these low-valuation buyers exit. After the lower half of the buyer distribution exits the market courts will gradually adjust the exercise price upward to reflect the higher average valuation in the remaining group of buyers. Buyers who initially had above-average valuations will now become low-valuation buyers and exit. The exercise price will continue to rise and more buyers will exit until the entire market will collapse.

This is not the first paper questioning the desirability of the Restitution Rule. Saul Levmore (1985) also argued that the Restitution Rule would impede the workings of the market. Under such a rule, Levmore observed, sellers would have an incentive to unilaterally confer benefits on buyers rather than compete for buyers' business in the market. And this is welfare reducing because, absent market-based competition, there is no guarantee that a buyer will be served by the seller who is best-suited for the job, i.e., can perform at the lowest cost. Levmore further observes that "[t]o the extent that benefits are overvalued, overencouraged providers may intermeddle." (p. 70)

Our analysis focuses on the related risk that low-quality sellers would flood the market. Importantly, we show that this risk exists even when benefits are not systematically overvalued. Low-quality sellers will enter the market even when an imperfectly-informed court commits unbiased errors by setting a price equal to the average benefit. We also demonstrate that the Restitution Rule can significantly distort buyers' incentives—to the point that the demand side of the market will completely collapse. And this too might occur even when court errors are unbiased. More generally, a main theme of our analysis is that unbiased errors can have a real effect on behavior.

This paper focuses on the Restitution Rule, which stands as a real-world alternative to the Mutual Consent Rule, at least under certain conditions. The Restitution Rule, however, is only one example of a pricing rule, i.e., a rule that gives the seller a put option to force the sale of a good or service at a court-determined price. Under the Restitution Rule the option's exercise price equals the (average) benefit to the buyer. But rules setting different exercise prices can be easily imagined. A pricing rule with a court-determined price above the buyer's valuation produces the same adverse results as the Restitution Rule. These are reduced under

a pricing rule with a court-determined price that is below the buyer's valuation, but are not completely eliminated until the price is so low that the Restitution Rule effectively converges to the Mutual Consent Rule.

While we focus on the Restitution Rule, our analysis applies also to the symmetric "Takings" Rule. Under this rule, a potential buyer would be entitled to take an asset from a seller and become thereby only required to pay, absent an agreement between the parties to indicate otherwise, an amount equal to the value of the asset to the seller. (Using the influential taxonomy proposed by Calabresi and Melamed 1972, the Takings Rule provides liability rule, rather than property right, protection to the seller.) In the case of a new asset, the interpretation of the Takings Rule would imply giving a potential buyer the right to elect to have the seller produce the asset in return for the seller's cost of providing the asset as estimated by a court. That is, under this rule, potential buyers have a "call" option giving them the right to get an asset for an exercise price equal to the cost to the potential seller of giving up the asset or producing it (as the case might be). In contrast, under the Mutual Consent Rule, potential buyers can be viewed as having a (worthless) call option with an exercise price of infinity.[2]

Under the Restitution Rule low-quality buyers would exit the market. Correspondingly, under the Takings Rule high-cost sellers would exit the market. And, if exit is prohibitively costly, the Takings Rule effectively converges to the Mutual Consent Rule as damages are set equal to the cost of the product or service to the seller with the highest cost. Louis Kaplow and Steve Shavell (1996), in an important article, identified adverse incentive effects of the Takings Rule similar to those we identify in the costless exit case (and these, in turn, are similar to adverse ex ante effects of theft – as noted by Kaplow and Shavell).[3] We formalize and extend Kaplow and Shavell's observations regarding these ex ante costs of the Takings Rule.

---

[2] The law does impose a Takings Rule in exceptional situations in which high (or infinite) transaction costs make the acquisition of consent impossible or impractical. Thus, because of holdout problems, government has an eminent domain power. And one has the right to moor one's boat at another's dock in a storm, even without the dock owner's consent, provided only that one pay afterwards the resulting costs to the dock's owner. However, these deviations from the Mutual Consent Rule are again exceptions. Generally, a potential buyer may get a benefit from a potential seller in exchange for a payment only upon obtaining the seller's consent to the exchange.

[3] Kaplow and Shavell (1996) identify additional inefficiencies associated with the Takings Rule. Specifically, they discuss the problem of reciprocal takings. A symmetric problem of reciprocal givings is present under the Restitution Rule. The problems of reciprocal takings/givings are unique to exchanges of goods, and do not apply to exchanges of services. Also, the reciprocal takings/givings problem is mitigated when the court-determined price is sensitive to information about whether this is an initial taking/giving, a second-round taking/giving, or an *n*-round taking/giving.

Our main contributions, however, are (1) in identifying and analyzing the ex ante costs of the Restitution Rule (which is not studied in Kaplow and Shavell 1996),[4] (2) in providing a general framework for comparing the Mutual Consent Rule with alternative pricing rules, and (3) in demonstrating that both the Restitution Rule and the Takings Rule effectively converge to the Mutual Consent Rule when exit is costly.

The remainder of the paper is organized as follows. Section 2 describes the formal model's framework of analysis. Section 3 solves the model and derives the ex ante costs of the Restitution Rule. Section 4 considers three extensions: costly exit, general pricing rules and the Takings Rule. Section 5 offers concluding remarks.

2 Framework of Analysis

2.1 Sequence of Events

The model focuses on two groups of economic actors (individuals or firms): potential buyers, Bs, and potential sellers, Ss. Buyers and sellers are assumed to be risk neutral with a discount rate of zero. The sequence of events in the model, which is illustrated in Figure 1 below, is as follows:

T = 0: Buyers and sellers decide whether to enter the market.

T = 1: Random matching generates buyer-seller pairs. In any B-S pair, S might transfer an existing asset, or produce and transfer a new asset, to B.

T = 2: Payoffs materialize.

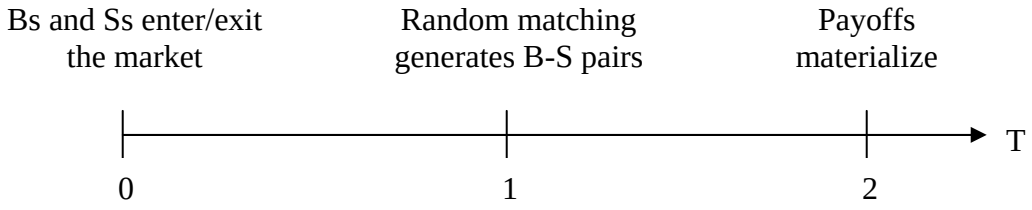

Fig. 1: The Sequence of Events

[4] As a terminological note, our Restitution Rule controls in situations where a seller forces a trade on a buyer. The literature has sometimes referred to a restitution *remedy* that a seller may be entitled to when a trade is forced by a buyer (as under our Takings Rule). The restitution remedy may include disgorgement of any profits that the buyer made as a result of the taking. For example, Schankerman and Scotchmer (2001) study the restitution remedy in the intellectual property context, adopting an ex ante approach similar to the one used in this paper.

2.2 Two Cases

The formulation used is sufficiently general to cover two cases. The term exchange will be used to indicate one of two cases – (i) S transfers an existing asset to B in return for a payment, or (ii) S produces a new asset and transfers it to B in exchange for a payment. In both cases, if an exchange takes place, S gives up a value of C, where in the existing asset case, C denotes the use-value of the asset to S, and in the new asset case, C denotes the cost to S of producing the asset. Also, in both cases, if an exchange takes place, B obtains the asset. Let V denote the value of the asset to B. The surplus, which can be either positive or negative, is: $W = V - C$.

We shall now turn to specify the assumptions regarding each of the three stages.

2.3 T = 0: Entering the Market

At T = 0, buyers and sellers decide whether to enter the market. We assume that buyers and sellers can costlessly enter (or exit) the market, and will do so if and only if they expect a strictly positive payoff. We also discuss the alternative assumptions that entry or exit is costly (see section 6.1).[5] The idea of entry into a market is clear in the context of well-defined marketplaces, such as a farmers' market or a commodity exchange. Decisions to enter a market are also well-studied in the industrial organization and antitrust contexts. But our analysis also applies to more mundane scenarios where a person decides, for example, whether to start offering goods or services door-to-door or via the mail or the internet.

Since buyers and sellers do not know each other at T = 0, when they make their entry/exit decisions, they cannot contract at T = 0, neither regarding their entry/exit decisions nor regarding the rules that will govern their future negotiations should they meet at T = 1.

2.4 T = 1: Random Matching

There are M sellers and N buyers. N is normalized to 1. Sellers and buyers meet through a random matching process. Specifically, each buyer is randomly assigned to one seller. (When $N>M$ a seller can meet more than one buyer.) This

[5] Our ex ante analysis focuses on participation – entry and exit – decisions. Similar effects obtain when other ex ante decisions/investments (e.g., investments in search or in hiding / self-help, and investments in enhancing the value of a potential transaction) are considered.

assumption covers all markets where each buyer demands (at most) one unit of the good or service and sellers have no capacity constraint. While our analysis assumes that each buyer is matched with a seller only once, all of our results hold when a buyer can be matched with several sellers sequentially.

The cost to a seller of producing the asset or parting with the asset is C. The value of the asset to a buyer is $V = q + \mu$, where $q \in [0,1]$ represents the seller's type and the corresponding quality of the asset and $\mu \in [0,1]$ represents the buyer's type and the corresponding idiosyncratic preferences that affect the value of the asset to the specific buyer.

We assume that the distribution of seller types is characterized by the probability density function, $k(q)$, and the corresponding cumulative distribution function, $K(q)$. Let $\bar{q}$ denote the average quality, i.e., $\bar{q} = \int_0^1 qk(q)dq$.

We assume that the distribution of buyer types is characterized by the probability density function, $f(\mu)$, and the corresponding cumulative distribution function, $F(\mu)$. Let $\bar{\mu}$ denote the average buyer-specific value, i.e., $\bar{\mu} = \int_0^1 \mu f(\mu)d\mu$.

We assume that $\bar{q} + \bar{\mu} > C$, namely, that the average benefit to a buyer is greater than the cost to a seller. It would seem that this condition is satisfied in well-functioning markets. More importantly, as will be made clear below, this assumption is necessary for a meaningful distinction between the Mutual Consent Rule and the Restitution Rule.

At T = 1 the buyer and the seller observe $V = q + \mu$. The court knows the distributions $k(q)$ and $f(\mu)$, but does not observe the specific realizations of q and μ. In other words, the value of the asset to the buyer is observable to the parties but not verifiable to a court.[6]

The assumption that C and V are both common knowledge, together with the assumption we make that transaction costs are zero, ensure that the outcome will be ex post efficient under the two rules to be considered. That is, an exchange will take place *if and only if* $W > 0$ – that is, if and only if $V > C$. While the outcome will be ex

[6] The no verification assumption can be relaxed. As long as verification is costly the court's value estimate will be imperfect (though unbiased), and our main results will hold. Our results depend on the assumed information structure, and specifically on the informational advantage that parties enjoy vis-a-vis the court. We recognize, however, that such an informational advantage does not always exist. It is not always the case that courts estimate the benefit to the buyer based on a known distribution of types, when the parties know the exact type. Rather, courts, attempting to ascertain the benefit to the specific buyer, might make unbiased errors, e.g., based on evidentiary uncertainty, that are not anticipated by the parties. Our results do not hold in such cases. It should be emphasized, however, that these two categories of imperfect information – one where parties know more than courts and the other when both parties and courts are similarly uninformed – are not mutually exclusive. Our results hold as long as some imperfect information of the former category is present.

post efficient under both rules, the rules will affect how the surplus (if any) will be divided and therefore in turn will affect ex ante decisions and ex ante efficiency. Two different legal regimes will be considered:

(i) Mutual Consent Rule (MC): This is the familiar rule under which an asset will be transferred, or produced and transferred, in exchange for a payment by B, *if and only if* both parties agree for this to happen. To enforce this rule courts need to be able to verify only whether transfer and payments occur and whether mutual consent was given. We assume that courts have the requisite information.

Under the Mutual Consent rule, if the parties meet, and a positive surplus W exists, it will be assumed that S will make an expected gain of θW and B will make an expected gain of $(1-\theta)W$ with $\theta \in [0,1]$. This corresponds to the standard assumption that S can make a take-it-or-leave-it offer with probability θ and B can make such an offer with a probability $1-\theta$.

(ii) Restitution Rule (R): Under the Restitution Rule, S may give the existing asset to B, or produce the asset and give it to B, and thereby become entitled (without B's consent being required) to the court-estimated value of V. Let $\hat{V}$ denote the court's estimate. Given our assumption that q and μ are non verifiable, $\hat{V} = \frac{1}{\Pr(q \in \Omega_S)} \int_{\Omega_S} qk(q)dq + \frac{1}{\Pr(\mu \in \Omega_B)} \int_{\Omega_B} \mu f(\mu)d\mu$, where Ω_S and Ω_B are the sub-groups of sellers and buyers, respectively, that come before the court.

With imperfect information, there will be sometimes reason for the parties to bargain. Having a "pricing" rule does not prohibit bargaining, it only gives one of the parties an option to act unilaterally. In the event that bargaining takes place, it will be assumed, as before, that S makes a take-it-or-leave-it offer with probability θ and B makes a take-it-or-leave-it-offer with probability $1-\theta$. The presence of the unilateral option, however, will affect what will happen if bargaining fails and thus will shape the outcome. Specifically, when the party without the option, B, makes the take-it-or-leave-it offer, the position of the party with the option, S, is improved by the existence of the option. On the other hand, when the party with the option, S, makes the take-it-or-leave-it offer the existence of the option may either improve or worsen the position of the party with the option, S, if that party cannot commit to give up the option. We will assume that such a commitment is impossible to make. The alternative assumption leads to results, which are qualitatively similar and quantitatively more supportive of the superiority of the Mutual Consent Rule.

In the event that an exchange takes place, B will pay S a price π and obtain the asset. In the event that an exchange does not take place, B might still be forced to "bribe" S not to impose an inefficient exchange. Let π denote the amount of the bribe.

2.5 T = 2: Final Payoffs

If an exchange took place at T = 1, then B will use the asset at T = 2 and obtain V. B's payoff will be $W_B = V - \pi$. Correspondingly, S's payoff will be $W_S = \pi - C$.

If, on the other hand, an exchange does not take place at T = 1, then in the existing asset case S will use the asset at T = 2 and obtain C, and in the new asset case S will not produce the asset and thus save C. B does not receive an asset (and does not make any payment), and thus his payoff remains unchanged. For convenience, we normalize these payoffs to zero. As mentioned above, even when an exchange does not take place B might be forced to make a payment π to S. Accordingly, B's payoff will be $W_B = -\pi$, and S's payoff will be $W_S = \pi$.

Of course, W_B and W_S must add up to W – the total social surplus (if any) from the exchange both when an exchange takes place ($W > 0$, $W_B + W_S = W > 0$) and when an exchange does not take place ($W < 0$, $W_B + W_S = 0$).

3 Heterogeneous Buyers

The framework described in Section 3 incorporates both buyer heterogeneity and seller heterogeneity. We begin, however, in Section 4 with the case of homogeneous sellers in order to focus on the implications of buyer heterogeneity. We will reintroduce seller heterogeneity in Section 5. We normalize the quality of the homogeneous sellers to zero, i.e., $q = 0$. To focus on buyers' entry/exit decisions, we assume that the homogeneous sellers enter the market.[7]

3.1 The Mutual Consent Rule

The parties' entry decisions under the Mutual Consent Rule are characterized in the following proposition.

Proposition 1: Under the Mutual Consent Rule –
(i) Buyers enter the market if and only if $\mu > C$.
(ii) Social welfare is: $W^{MC} = \int_C^1 (\mu - C) f(\mu) d\mu$.

Proof: Immediate from the definition of the Mutual Consent Rule.

[7] In terms of the model's parameters, we are assuming that $C < 1$. This assumption guarantees that even sellers with $q = 0$ have a chance to generate a positive surplus ($q + \mu > C$) – a chance that would materialize when they meet a buyer with $\mu = 1$.

3.2 The Restitution Rule

Under the Restitution Rule, low-valuation buyers expect to lose from an exchange and thus do not enter the market, leading to a welfare loss. Moreover, in the long-run, as courts adjust their value estimate to the shrinking pool of remaining buyers, all buyers will exit and the market will collapse.

The short-run behavior distortions under the Restitution Rule and the resulting welfare loss are stated in the following proposition.

Proposition 2: Under the Restitution Rule, in the short-run –

(i) Only high-valuation buyers, i.e., buyers with $\mu > \overline{\mu}$, enter the market.

(ii) The welfare loss, as compared to the Mutual Consent Rule, is

$$\Delta W = W^{MC} - W^{R} = \int_{C}^{1} (\mu - C) f(\mu) d\mu - \int_{\overline{\mu}}^{1} (\mu - C) f(\mu) d\mu = \int_{C}^{\overline{\mu}} (\mu - C) f(\mu) d\mu .$$

Proof:

(i) We show that only buyers with $\mu > \overline{\mu}$ earn a positive payoff. Given the assumption that $\overline{\mu} > C$, there are three cases:

Case I: $\mu < C < \overline{\mu}$. In this case,

$$W_B = -\left[(1-\theta)\cdot(\overline{\mu} - C) + \theta \cdot (\overline{\mu} - \mu)\right] = -\left[(1-\theta)\cdot W - (\mu - \overline{\mu})\right] =$$
$$= -\left[(1-\theta)\cdot(\mu - C) - (\mu - \overline{\mu})\right] < 0$$

$[\hat{V} = \overline{\mu} > C \rightarrow (\mu - C) - (\mu - \overline{\mu}) > 0 \rightarrow (1-\theta)\cdot(\mu - C) - (\mu - \overline{\mu}) > 0$ (since $\mu < C$)].

Note that $\frac{\partial W_B}{\partial \mu} = \theta > 0$, and $W_B(\mu = C) = C - \overline{\mu} < 0$.

Case II: $C < \mu < \overline{\mu}$. In this case, $W_B = \mu - \overline{\mu} < 0$. Note that $\frac{\partial W_B}{\partial \mu} = 1 > 0$, $W_B(\mu = C) = C - \overline{\mu} < 0$, and $W_B(\mu = \overline{\mu}) = 0$.

Case III: $C < \overline{\mu} < \mu$. In this case, $W_B = \mu - \overline{\mu} > 0$. Note that $\frac{\partial W_B}{\partial \mu} = 1 > 0$, and $W_B(\mu = \overline{\mu}) = 0$.

(ii) Since only buyers with $\mu > \overline{\mu}$ enter the market, social, welfare equals $W^{R} = \int_{\overline{\mu}}^{1} (\mu - C) f(\mu) d\mu$. The welfare loss is:

$$\Delta W = W^{MC} - W^{R} = \int_{C}^{1} (\mu - C) f(\mu) d\mu - \int_{\overline{\mu}}^{1} (\mu - C) f(\mu) d\mu = \int_{C}^{\overline{\mu}} (\mu - C) f(\mu) d\mu$$

QED

The long-run behavior distortions under the Restitution Rule and the resulting welfare loss are stated in the following proposition.

Proposition 3: Under the Restitution Rule, in the long-run –
(i) No buyers enter and the market collapses completely.
(ii) The welfare loss, as compared to the Mutual Consent Rule, is $\Delta W = W^{MC} - W^{R} = W^{MC} = \int_{C}^{1} (\mu - C) f(\mu) d\mu$.

Proof:
(i) Part (i) of proposition 2 showed that in the short-run only the upper part of the buyer-value distribution, $\mu > \overline{\mu}$, remains. Eventually, the court will realize that it is facing a new distribution, $f_1(\mu)$, over the $(\overline{\mu}, \mu_{\max}]$ range, and will adjust its value estimate upward to $\overline{\mu}_1 > \overline{\mu}$. With the new distribution and new estimate, only the upper part of the new buyer-value distribution, $\mu > \overline{\mu}_1$, will enter the market. This adjustment process will continue, and in the long-run $\lim_{t \to \infty} \overline{\mu}_t = \mu_{\max}$, implying the complete collapse of the market.
(ii) Since the market completely collapses under the Restitution Rule, the welfare loss as compared to the Mutual Consent Rule equals the social welfare under the Mutual Consent Rule.
QED

4 Heterogeneous Buyers and Sellers

We now reintroduce seller heterogeneity, in addition to buyer heterogeneity, and demonstrate the inefficiency of the Restitution Rule in this more general setting.

4.1 The Mutual Consent Rule

The parties' entry decisions under the Mutual Consent Rule are characterized in the following proposition.

Proposition 4: Under the Mutual Consent Rule –
(i) Buyers enter the market if and only if $\mu > \mu_{\min} = \max(C - 1, 0)$
(ii) Sellers enter the market if and only if $q > q_{\min} = \max(C - 1, 0)$.
(iii) Social welfare is: $W^{MC} = \frac{1}{1 - K(q_{\min})} \cdot \int_{q_{\min}}^{1} \int_{\mu_{\min}}^{1} (q + \mu - C) f(\mu) k(q) d\mu dq$.

Proof:
Under the Mutual Consent Rule, when $V > C$ and the exchange is efficient the seller obtains a payoff of $\theta(V-C) > 0$ and the buyer obtains a payoff of $(1-\theta)(V-C) > 0$. And when $V \le C$ and the exchange is (weakly) inefficient both parties obtain a zero payoff. Parties are assumed to enter the market if and only if they expect a strictly positive payoff. Only buyers with $\mu > \mu_{\min} = \max(C-1,0)$ and sellers with $q > q_{\min} = \max(C-1,0)$ face a positive probability of participating in an efficient exchange, i.e., of meeting a trading partner such that $V = q + \mu > C$. This also implies that $W^{MC} = \frac{1}{1-K(q_{\min})} \cdot \int_{q_{\min}}^{1} \int_{\mu_{\min}}^{1} (q+\mu-C) f(\mu) k(q) d\mu dq$.

QED

4.2 The Restitution Rule

Allowing for heterogeneous sellers exposes a supply-side inefficiency, in addition to the demand-side inefficiency identified in Section 4. Under the Restitution Rule low-quality sellers are able to extract bribes from buyers by threatening an inefficient exchange. This leads to excessive entry by low-quality sellers and to a corresponding welfare loss.[8]

The short-run behavior distortions under the Restitution Rule and the resulting welfare loss are stated in the following proposition.

Proposition 5: Under the Restitution Rule, in the short-run –
(i) Only high-valuation buyers, i.e., buyers with $\mu > \hat{\mu}$, will enter the market, where $\hat{\mu}$ is defined by $\hat{\mu} = \bar{\mu} + \Pr(q < C - \hat{\mu}) \cdot E\left[(1-\theta) \cdot (q + \hat{\mu} - C) \middle| q < C - \hat{\mu}\right]$ and satisfies $\hat{\mu} \le \bar{\mu}$.
(ii) All sellers will enter the market.
(iii) The welfare loss, as compared to the Mutual Consent Rule, is $\Delta W = W^{MC} - W^{R} = \Delta W_1 + \Delta W_2$, where:

$$\Delta W_1 = \int_{q_{\min}}^{1} \int_{\mu_{\min}}^{1} \max(q+\mu-C,0) f(\mu) \frac{k(q)}{1-K(q_{\min})} d\mu dq - \int_{0}^{1} \int_{\mu_{\min}}^{1} \max(q+\mu-C,0) f(\mu) k(q) d\mu dq$$

represents the welfare loss from inclusion of low-quality sellers, and

[8] Legal doctrine tries to minimize this problem by imposing implied warranties on sellers. An implied warranty can be viewed as a minimal quality, $\underline{q}$, that sellers must provide. Such a rule presumes, however, that courts can verify quality or, at least, verify that quality is below the $\underline{q}$ threshold. We assume that quality is not verifiable. Alternatively, if courts can verify that quality is below the $\underline{q}$ threshold but cannot verify the exact quality level above the threshold, then our results apply in the $\lfloor \underline{q}, 1 \rfloor$ range.

$$\Delta W_2 = \int_0^1 \int_{\mu_{\min}}^1 \max(q+\mu-C,0) f(\mu) k(q) d\mu dq - \int_0^1 \int_{\hat{\mu}}^1 \max(q+\mu-C,0) f(\mu) k(q) d\mu dq$$

represents the welfare loss from exit by low-valuation buyers.

Proof:

(i) We show that a buyer's expected payoff from an exchange is monotonically increasing in μ, and that there exists a threshold buyer type $\hat{\mu} < \overline{\mu}$ such that high-valuation buyers, i.e., buyers with $\mu > \hat{\mu}$ gain from an exchange: $E[W_B | \mu > \hat{\mu}] > 0$, buyers with $\mu = \hat{\mu}$ break even: $E[W_B | \mu = \hat{\mu}] = 0$, and low-valuation buyers, i.e., buyers with $\mu < \hat{\mu}$, lose from an exchange: $E[W_B | \mu < \hat{\mu}] < 0$.

Given the assumption that $\overline{q} + \overline{\mu} > C$, there are three cases depending on the relative magnitudes of the actual exchange value, $q + \mu$, the court's estimate of the exchange value $\hat{V} = \overline{q} + \overline{\mu}$,[9] and the cost of production (or transfer) to the seller, C:

Case I: $q + \mu < C < \overline{q} + \overline{\mu}$ (or $q < C - \mu$). In this case,

$$W_B = -[(1-\theta)\cdot(\overline{q}+\overline{\mu}-C) + \theta\cdot(\overline{q}+\overline{\mu}-q-\mu)] = -[(1-\theta)\cdot W - (q+\mu-\overline{q}-\overline{\mu})] =$$
$$= -[(1-\theta)\cdot(q+\mu-C) - (q+\mu-\overline{q}-\overline{\mu})] < 0$$

$[\hat{V} = \overline{q} + \overline{\mu} > C \quad \rightarrow \quad (q+\mu-C) - (q+\mu-\overline{q}-\overline{\mu}) > 0 \quad \rightarrow$
$(1-\theta)\cdot(q+\mu-C) - (q+\mu-\overline{q}-\overline{\mu}) > 0$ (since $q + \mu < C$)].

Note that $\frac{\partial W_B}{\partial \mu} = \theta > 0$, and $W_B(q+\mu=C) = C - \overline{q} - \overline{\mu} < 0$.

Case II: $C < q + \mu < \overline{q} + \overline{\mu}$ (or $C - \mu < q < \overline{q} + \overline{\mu} - \mu$). In this case, $W_B = q + \mu - \overline{q} - \overline{\mu} < 0$.

Note that $\frac{\partial W_B}{\partial \mu} = 1 > 0$, $W_B(q+\mu=C) = C - \overline{q} - \overline{\mu} < 0$, and $W_B(q+\mu=\overline{q}+\overline{\mu}) = 0$.

Case III: $C < \overline{q} + \overline{\mu} < q + \mu$ (or $q > \overline{q} + \overline{\mu} - \mu$). In this case, $W_B = q + \mu - \overline{q} - \overline{\mu} > 0$. Note that $\frac{\partial W_B}{\partial \mu} = 1 > 0$, and $W_B(q+\mu=\overline{q}+\overline{\mu}) = 0$.

The expected payoff of a type-μ buyer is:

$$E[W_B|\mu] = \Pr(q < C-\mu)\cdot E[-[(1-\theta)\cdot(q+\mu-C) - (q+\mu-\overline{q}-\overline{\mu})] | q < C-\mu] +$$
$$+ \Pr(q > C-\mu)\cdot E[q+\mu-\overline{q}-\overline{\mu} | q > C-\mu] =$$
$$= E[q+\mu-\overline{q}-\overline{\mu}] + \Pr(q < C-\mu)\cdot E[-(1-\theta)\cdot(q+\mu-C) | q < C-\mu] =$$
$$= \mu - \overline{\mu} + \Pr(q < C-\mu)\cdot E[-(1-\theta)\cdot(q+\mu-C) | q < C-\mu]$$

Define $\hat{\mu}$ such that $E[W_B|\mu=\hat{\mu}] = 0$ or $\hat{\mu} = \overline{\mu} + \Pr(q < C-\hat{\mu})\cdot E[(1-\theta)\cdot(q+\hat{\mu}-C) | q < C-\hat{\mu}]$.

[9] The naïve court looks at the entire distribution of values, not considering entry and exit decisions, but see proposition 6.

Since $\frac{\partial E[W_B|\mu]}{\partial \mu} > 0$, we have: $E[W_B|\mu < \hat{\mu}] < 0$ and $E[W_B|\mu > \hat{\mu}] > 0$.

Note that $\hat{\mu} \le \overline{\mu}$.

(ii) An uninformed court will set damages equal to $\hat{V} = \overline{q} + \overline{\mu}$. As in part (i) of the proof, there are three cases:

Case I: $q + \mu < C < \overline{q} + \overline{\mu}$ (or $\mu < C - q$). In this case,

$$W_S = (1-\theta)\cdot(\overline{q} + \overline{\mu} - C) + \theta \cdot (\overline{q} + \overline{\mu} - q - \mu) = (1-\theta)\cdot W - (q + \mu - \overline{q} - \overline{\mu}) =$$
$$= (1-\theta)\cdot(q + \mu - C) - (q + \mu - \overline{q} - \overline{\mu}) > 0$$

[$\hat{V} = \overline{q} + \overline{\mu} > C$ ➔ $(q + \mu - C) - (q + \mu - \overline{q} - \overline{\mu}) > 0$ ➔ $(1-\theta)\cdot(q + \mu - C) - (q + \mu - \overline{q} - \overline{\mu}) > 0$ (since $q + \mu < C$)].

Note that $\frac{\partial W_S}{\partial q} = -\theta < 0$, and $W_S(q + \mu = C) = \overline{q} + \overline{\mu} - (q + \mu) > 0$.

Case II: $C < q + \mu < \overline{q} + \overline{\mu}$ (or $C - q < \mu < \overline{q} - q + \overline{\mu}$). In this case, $W_S = \overline{q} + \overline{\mu} - C > 0$.

Case III: $C < \overline{q} + \overline{\mu} < q + \mu$ (or $\mu > \overline{q} - q + \overline{\mu}$). In this case, $W_S = \overline{q} + \overline{\mu} - C > 0$.

Therefore: $\forall q \quad E[W_S|q] > 0$, and all sellers enter the market.

(iii) Since all sellers enter the market and only buyers with $\mu > \hat{\mu}$ enter the market, social, welfare equals $W^R = \int_0^1 \int_{\hat{\mu}}^1 \max(q + \mu - C, 0) f(\mu) k(q) d\mu dq$.

$$W^R = \int_0^1 \int_{\hat{\mu}}^1 \max(q + \mu - C, 0) f(\mu) k(q) d\mu dq \le \int_0^1 \int_{\mu_{\min}}^1 \max(q + \mu - C, 0) f(\mu) k(q) d\mu dq$$

(If $\hat{\mu} \le \mu_{\min}$, then $\int_0^1 \int_{\hat{\mu}}^1 \max(q + \mu - C, 0) f(\mu) k(q) d\mu dq = \int_0^1 \int_{\mu_{\min}}^1 \max(q + \mu - C, 0) f(\mu) k(q) d\mu dq$; if $\hat{\mu} > \mu_{\min}$, then $\int_0^1 \int_{\hat{\mu}}^1 \max(q + \mu - C, 0) f(\mu) k(q) d\mu dq < \int_0^1 \int_{\mu_{\min}}^1 \max(q + \mu - C, 0) f(\mu) k(q) d\mu dq$.)

And:

$$\int_0^1 \int_{\mu_{\min}}^1 \max(q + \mu - C, 0) f(\mu) k(q) d\mu dq < \int_{q_{\min}}^1 \int_{\mu_{\min}}^1 \max(q + \mu - C, 0) f(\mu) \frac{k(q)}{1 - K(q_{\min})} d\mu dq = W^{MC}$$

The welfare loss is: $\Delta W = W^{MC} - W^R = \Delta W_1 + \Delta W_2$, where:

$$\Delta W_1 = \int_{q_{\min}}^1 \int_{\mu_{\min}}^1 \max(q + \mu - C, 0) f(\mu) \frac{k(q)}{1 - K(q_{\min})} d\mu dq - \int_0^1 \int_{\mu_{\min}}^1 \max(q + \mu - C, 0) f(\mu) k(q) d\mu dq$$

$$\Delta W_2 = \int_0^1 \int_{\mu_{\min}}^1 \max(q + \mu - C, 0) f(\mu) k(q) d\mu dq - \int_0^1 \int_{\hat{\mu}}^1 \max(q + \mu - C, 0) f(\mu) k(q) d\mu dq$$

QED

The long-run behavior distortions under the Restitution Rule and the resulting welfare loss are stated in the following proposition.

Proposition 6: Under the Restitution Rule, in the long-run –

(i) If $C \le 1$, then—

- No buyers enter and the market collapses completely.
- The welfare loss, as compared to the Mutual Consent Rule, is

$$\Delta W = W^{MC} - W^{R} = W^{MC} = \frac{1}{1-K(q_{\min})} \cdot \int_{q_{\min}}^{1} \int_{\mu_{\min}}^{1} (q+\mu-C) f(\mu) k(q) d\mu dq$$

(ii) If $C > 1$, then—

- Only high-valuation buyers, i.e., buyers with $\mu > \hat{\mu}_T$, will enter the market, where $\hat{\mu}_T$ is defined by $\hat{\mu}_T = \overline{\mu} + \Pr(q < C - \hat{\mu}_T) \cdot E\left[(1-\theta)\cdot(q+\hat{\mu}_T - C) \middle| q < C - \hat{\mu}_T\right]$ and satisfies $\hat{\mu}_T > \hat{\mu}$.
- All sellers will enter the market.
- The welfare loss, as compared to the Mutual Consent Rule, is $\Delta W = W^{MC} - W^{R} = \Delta W_1 + \Delta W_2$, where:

$$\Delta W_1 = \int_{q_{\min}}^{1} \int_{\mu_{\min}}^{1} \max(q+\mu-C,0) f(\mu) \frac{k(q)}{1-K(q_{\min})} d\mu dq - \int_{0}^{1} \int_{\mu_{\min}}^{1} \max(q+\mu-C,0) f(\mu) k(q) d\mu dq$$

represents the welfare loss from inclusion of low-quality sellers, and

$$\Delta W_2 = \int_{0}^{1} \int_{\mu_{\min}}^{1} \max(q+\mu-C,0) f(\mu) k(q) d\mu dq - \int_{0}^{1} \int_{\hat{\mu}}^{1} \max(q+\mu-C,0) f(\mu) k(q) d\mu dq$$

represents the welfare loss from exit by low-valuation buyers.

Proof:

(i) Part (i) of proposition 5 showed that in the short-run only the upper part of the buyer-value distribution, $\mu > \hat{\mu}$, remains. In the long-run, the court will realize that it is facing a new distribution, $f_1(\mu)$, over the $(\hat{\mu}, \mu_{\max}]$ range, and will adjust its value estimate upward to $\overline{\mu}_1 > \overline{\mu}$. The higher estimate implies a higher threshold $\hat{\mu}_1 > \hat{\mu}$. To see this recall that the threshold must satisfy $\hat{\mu} = \overline{\mu} + \Pr(q < C - \hat{\mu}) \cdot E\left[(1-\theta)\cdot(q+\hat{\mu}-C) \middle| q < C - \hat{\mu}\right]$. Denote $A(\hat{\mu}) \equiv \Pr(q < C - \hat{\mu}) \cdot E\left[(1-\theta)\cdot(q+\hat{\mu}-C) \middle| q < C - \hat{\mu}\right]$. Hence, we have $\hat{\mu} = \overline{\mu} + A(\hat{\mu})$. Implicit differentiation yield: $\frac{\partial \hat{\mu}}{\partial \overline{\mu}} = \frac{1}{1-(1-\theta)K(C-\hat{\mu})} > 0$ (since $A'(\hat{\mu}) = (1-\theta)K(C-\hat{\mu})$). The higher threshold will again induce a higher value estimate. Etc'.

To find the long-term threshold value we return to $E\left[W_B \middle| \hat{\mu}\right] = \hat{\mu} - \overline{\mu} + \Pr(q < C - \hat{\mu}) \cdot E\left[-(1-\theta)\cdot(q+\hat{\mu}-C) \middle| q < C - \hat{\mu}\right]$. Substituting the long-run condition $\overline{\mu} = \frac{1}{2}(\hat{\mu}+1)$, we obtain: $E\left[W_B \middle| \hat{\mu}\right] = \frac{1}{2}\hat{\mu} - A(\hat{\mu}) - \frac{1}{2}$. A complete market collapse occurs when $E\left[W_B \middle| \hat{\mu}=1\right] = 0$, which implies $A(1) = 0$ or $\Pr(q < C-1) \cdot E\left[(1-\theta)\cdot(q+1-C) \middle| q < C-1\right] = 0$. Therefore, the market will collapse iff

$\forall q \; q \geq C-1$ or $C \leq 1$. When $C > 1$, a complete collapse will be avoided. The threshold value $\hat{\mu}$ solves $E[W_B|\hat{\mu}]=0$ or $\frac{1}{2}\hat{\mu} - A(\hat{\mu}) - \frac{1}{2} = 0$.[10] [11]

(ii) When $C \leq 1$, the market completely collapses under the Restitution Rule, and the welfare loss as compared to the Mutual Consent Rule equals the social welfare under the Mutual Consent Rule. When $C > 1$, the calculation of the long-term welfare cost is similar to the calculation of the short-term welfare cost, substituting the short-term threshold, $\hat{\mu}$, with the long-term threshold, $\hat{\mu}_T$.

QED

Remark: Entry by low-quality sellers increases the likelihood of market collapse. When low-quality sellers enter, the market collapses only when $C \leq 1$. When only sellers with $q > q_{\min}$ enter the market, then the market collapses when $C \leq 1 + q_{\min}$.

5 Extensions

5.1 Costly Exit and Selective Sellers

We have thus far assumed that exit by low valuation buyers is costless. What happens when costly exit keeps low-valuation buyers in the market? This scenario proves especially interesting when sellers select which buyers to target (instead of the neutral random-matching assumption). Also, we return to the homogeneous-sellers model, which allows us to focus on this additional effect of buyer heterogeneity. Under certain assumptions, the Restitution Rule is shown to converge to the Mutual Consent Rule. This result is stated in the following proposition.

Proposition 7: Under the Restitution Rule, if the cost of exit is prohibitive, sellers select which buyers to target, and a random sample of transactions are litigated, then in the long-run the court's value estimate will fall below the seller's cost, *C*, and

---

[10] The equation $\frac{1}{2}\hat{\mu} - A(\hat{\mu}) - \frac{1}{2} = 0$ may have two solutions. This follows from: $E[W_B|\hat{\mu}=0] = -A(0) - \frac{1}{2}$, $\partial E[W_B|\hat{\mu}]/\partial\hat{\mu} = \frac{1}{2} - A'(\hat{\mu}) = \frac{1}{2} - (1-\theta)K(C-\hat{\mu})$ (when $\hat{\mu} < C$, and $\partial E[W_B|\hat{\mu}]/\partial\hat{\mu} = \frac{1}{2}$ when $\hat{\mu} < C$), and $\partial^2 E[W_B|\hat{\mu}]/\partial\hat{\mu}^2 = (1-\theta)k(C-\hat{\mu}) > 0$ (when $\hat{\mu} < C$, and $\partial^2 E[W_B|\hat{\mu}]/\partial\hat{\mu}^2 = 0$ when $\hat{\mu} < C$). We focus on the larger solution, because….

[11] The proof assumed that all sellers enter the market in the long-run. Indeed, all sellers remain in the market in the long-run. According to proposition 5(ii) all sellers enter the market in the short-run. The proof of proposition 5(ii) relied on the court's value estimate being above *C*, i.e., $\hat{V} > C$ (in the proof of proposition 5(ii) the court's value estimate was $\overline{q} + \overline{\mu}$, but the proof applies to any value estimate above *C*). This remains true in the long-run. In fact, the court's estimate only increases in the long-run.

the outcome under the Restitution Rule is identical to the outcome under the Mutual Consent Rule.

Proof:

At t = 0 the court's estimate of the buyer's value is $\bar{\mu} = \int \mu f(\mu) d\mu$. Since $\frac{\partial W_S}{\partial \mu} < 0$ (see proposition 2), if sellers select which buyers to target, they will target low-valuation buyers. Assume that sellers choose to make M transactions with the M buyers whose valuations lay in the interval $[0, \tilde{\mu}]$. Therefore, the court only hears cases featuring buyers with $\mu < \tilde{\mu}$, and thus sees an effective distribution of buyers $f_1(\cdot)$ with a support of $[0, \tilde{\mu})$. Accordingly at t =1 the court's estimate falls to $\bar{\mu}_1 = \int \mu f_1(\mu) d\mu < \bar{\mu}_0$. If $\bar{\mu}_1 < C$, the outcome under the Restitution Rule is identical to the outcome under the Mutual Consent Rule. In particular, if sellers can repeatedly target the buyer (or buyers) with the lowest valuation, i.e., the buyer (or buyers) with $\mu = 0$, then $\bar{\mu}_1 = 0 < C$.

QED

5.2 Other Pricing Rules

The preceding analysis focused on the Restitution Rule and compared this rule to the prevailing Mutual Consent Rule. We chose to focus on the Restitution Rule because it stands as a real-world alternative to the Mutual Consent Rule, at least under certain conditions. The Restitution Rule, however, is only one example of a pricing rule, i.e., a rule that gives the seller a put option to force the sale of a good or service at a court-determined price. Under the Restitution Rule the option's exercise price equals the benefit to the buyer. But rules setting different exercise prices can be easily imagined.

Our model can be extended to study a generic pricing rule with a court-determined exercise price of P. Proposition 5, which was based on the assumption that the court sets an exercise price equal to $\bar{q} + \bar{\mu}$ can be readily generalized to any court-determined exercise price P. (Assume $P > C$, otherwise the pricing rule is effectively identical to the Mutual Consent Rule.) This generalization is summarized in the following proposition.

Proposition 8: Under the Restitution Rule, in the short-run –

(i) Only high-valuation buyers, i.e., buyers with $\mu > \hat{\mu}$, will enter the market, where $\hat{\mu}$ is defined by $\hat{\mu} = P - \bar{q} + \Pr(q < C - \hat{\mu}) \cdot E\left[(1-\theta) \cdot (q + \hat{\mu} - C) \middle| q < C - \hat{\mu}\right]$, and $\frac{\partial \hat{\mu}}{\partial P} > 1$.

(ii) All sellers will enter the market.

(iii) The welfare loss, as compared to the Mutual Consent Rule, is $\Delta W = W^{MC} - W^{R} = \Delta W_1 + \Delta W_2$, where:

$$\Delta W_1 = \int_{q_{\min}}^{1}\int_{\mu_{\min}}^{1} \max(q+\mu-C,0) f(\mu)\frac{k(q)}{1-K(q_{\min})} d\mu dq - \int_{0}^{1}\int_{\mu_{\min}}^{1} \max(q+\mu-C,0) f(\mu)k(q) d\mu dq$$

represents the welfare loss from inclusion of low-quality sellers, and

$$\Delta W_2 = \int_{0}^{1}\int_{\mu_{\min}}^{1} \max(q+\mu-C,0) f(\mu)k(q) d\mu dq - \int_{0}^{1}\int_{\hat{\mu}}^{1} \max(q+\mu-C,0) f(\mu)k(q) d\mu dq$$

represents the welfare loss from exit by low-valuation buyers.
The welfare loss is increasing in *P*.

Proof:
(i) Based on the proof of proposition 5(i), we have:

$$E[W_B|\mu] = \Pr(q<C-\mu)\cdot E\left[-\left[(1-\theta)\cdot(q+\mu-C)-(q+\mu-P)\right]\middle| q<C-\mu\right] +$$
$$+\Pr(q>C-\mu)\cdot E[q+\mu-P|q>C-\mu] =$$
$$= E[q+\mu-P] + \Pr(q<C-\mu)\cdot E\left[-(1-\theta)\cdot(q+\mu-C)\middle| q<C-\mu\right] =$$
$$= \bar{q}+\mu-P+\Pr(q<C-\mu)\cdot E\left[-(1-\theta)\cdot(q+\mu-C)\middle| q<C-\mu\right]$$

Define $\hat{\mu}$ such that $E[W_B|\mu=\hat{\mu}]=0$ or $\hat{\mu} = P-\bar{q}+\Pr(q<C-\hat{\mu})\cdot E\left[(1-\theta)\cdot(q+\hat{\mu}-C)\middle| q<C-\hat{\mu}\right]$. Since $\frac{\partial E[W_B|\mu]}{\partial \mu}>0$, we have: $E[W_B|\mu<\hat{\mu}]<0$ and $E[W_B|\mu>\hat{\mu}]>0$.

Let $A(\hat{\mu}) \equiv \Pr(q<C-\hat{\mu})\cdot E\left[(1-\theta)\cdot(q+\hat{\mu}-C)\middle| q<C-\hat{\mu}\right] = \int_{0}^{C-\hat{\mu}}(1-\theta)\cdot(q+\hat{\mu}-C)k(q)dq$.

Hence $\hat{\mu} = P-\bar{q}+A(\hat{\mu})$. Differentiating we obtain $\frac{\partial\hat{\mu}}{\partial P} = 1\Big/\left(1-\frac{dA(\hat{\mu})}{d\hat{\mu}}\right)$. Since $A'(\hat{\mu}) = (1-\theta)\cdot K(C-\hat{\mu}) < 1$, we have $\frac{\partial\hat{\mu}}{\partial P}>1$.

(ii) Immediate from the proof of proposition 5(ii).
(iii) Immediate from the proof of proposition 5(iii).
QED

5.3 The Takings Rule

We demonstrated the disadvantage of the Restitution Rule as compared to the Mutual Consent Rule. Recognizing that the Restitution Rule is the mirror image of the well-studied Takings Rule, our analysis can be readily extended to the Takings Rule. The application of our analysis to the Takings Rule formalizes and extends the arguments made by Kaplow and Shavell (1996).

The symmetry between the Restitution Rule and the Takings Rule can be demonstrated as follows. Under the Restitution Rule the seller has an option to sell at the court-determined exercise price (a put option). Under the Takings Rule the buyer has an option to buy/take at the court-determined exercise price (a call option).

Under the Restitution Rule the exercise price is equal to the court's best estimate of the benefit to the buyer. Specifically, we assumed that this benefit has a seller-specific component, quality (q), and a buyer-specific component, idiosyncratic valuation (μ). Given the court's imperfect information, its estimate equals the average benefit: $\hat{V} = \frac{1}{\Pr(q \in \Omega_S)} \int_{\Omega_S} qk(q)dq + \frac{1}{\Pr(\mu \in \Omega_B)} \int_{\Omega_B} \mu f(\mu)d\mu$, where Ω_S and Ω_B are the sub-groups of sellers and buyers, respectively, that come before the court.

Under the Takings Rule the exercise price is equal to the court's best estimate of the cost to the seller. This cost clearly has a seller-specific component. It can also have a buyer-specific component, especially if the buyer can force the seller to produce and deliver a good or a service according to the buyer's specification. For consistency denote the seller-specific component and the buyer-specific component q and μ, respectively. Given the court's imperfect information, its estimate equals the average cost: $\hat{C} = \frac{1}{\Pr(q \in \Omega_S)} \int_{\Omega_S} qk(q)dq + \frac{1}{\Pr(\mu \in \Omega_B)} \int_{\Omega_B} \mu f(\mu)d\mu$, where Ω_S and Ω_B are the sub-groups of sellers and buyers, respectively, that come before the court.

It should now be clear that the ex ante distortions identified in our analysis of the Restitution Rule have immediate equivalents under the Takings Rule. The Restitution Rule has been shown to induce inefficient exit by low-valuation buyers, and potentially to bring about a complete collapse of the market in the long run as more and more buyers exit. Similarly, the Takings Rule would induce exit by high-cost sellers, and can potentially cause a complete collapse of the market in the long run as more and more sellers exit. In addition, the Restitution Rule has been shown to induce inefficient entry by low-quality sellers. Similarly, the Takings Rule would induce inefficient entry by buyers with excessive, high-cost demands.

6 Concluding Remarks

6.1 Non-Consequentialist Justifications for Mutual Consent

This paper focuses on economic, consequentialist advantages of the Mutual Consent Rule. It does not address the important, non-consequentialist justifications for the mutual consent requirement. It may well be that these non-consequentialist justifications are at least partially responsible for the prevalence of the Mutual

Consent Rule. One limit on the explanatory power of non-consequentialist, and specifically, autonomy-based justifications, goes to the nature of the actors. When these actors are firms, rather than individuals, the autonomy argument looses some of its force.

Moreover, in the realm of markets and economic activity it is difficult to imagine a legal rule rising to such (almost) universal prominence when an obvious, more efficient alternative exists. Demonstrating that at least some obvious alternatives are less efficient than the Mutual Consent Rule should, therefore, be part of the explanation for the prevalence of the Mutual Consent Rule.
[TO BE COMPLETED]

6.2 Ex Post Efficiency

We began our analysis with a rejection of the Posnerian argument for the Mutual Consent Rule and against the Restitution Rule—an argument based on ex post efficiency concerns. Adopting Posner's assumption that bargaining is easy, we observed that ex post efficiency will be attained under the Restitution Rule as well as under the Mutual Consent Rule (an application of the Coase Theorem). We then shifted focus to ex ante efficiency concerns.

But the fact that ex post efficiency is not an issue under one set of assumptions does not mean that it is not an issue. Ex post efficiency considerations may well be relevant to the comparison between the Mutual Consent Rule and the Restitution Rule. We begin this remark by questioning yet another common ex post argument in favor of the Mutual Consent Rule and against the Restitution Rule. We then briefly discuss an important ex post consideration – asymmetric information. We conclude that concerns about asymmetric information also do not seem to favor the Mutual Consent Rule.

A common ex post argument is that the Restitution Rule entails higher litigation costs than the Mutual Consent Rule: estimating the benefit to a buyer is more expensive than ascertaining whether consent was given. This need not be the case. First, the cost of estimating the benefit to the buyer is increasing in the precision of the estimate. A rough estimate should not cost much to obtain. Second, ascertaining whether consent was given can be quite costly, especially when written consent is absent. The cost of ascertaining consent (and the accuracy of the resulting determination) depends on rules of legal procedure and evidence that determine how consent is proved. Accordingly, it is not clear that litigation costs are necessarily higher under the Restitution Rule.

A potentially important impediment to ex post efficiency is asymmetric information. Our analysis assumes symmetric information at the ex post bargaining stage. But buyers and sellers rarely posses identical information. Sellers have better information about the quality of their products and buyers have better information about their idiosyncratic valuations. How does asymmetric information affect the comparison between the Mutual Consent Rule and the Restitution Rule? A formal

analysis of asymmetric information is beyond the scope of this paper. One observation, however, should be made. Asymmetric information cannot explain the prevalence of the Mutual Consent Rule. If anything, asymmetric information cuts in favor of the Restitution Rule. The reason is that the Restitution Rule renders much of the parties' private information – concerning quality and valuation – irrelevant. If the price is determined by a court, based on information that is common knowledge, bargaining is not hindered by asymmetric information.[12] Therefore, accounting for asymmetric information does not provide an ex post explanation for the prevalence of the Mutual Consent Rule. Our ex ante analysis, however, offers such an explanation.

6.3 Legal Doctrine

In the Introduction we mentioned a few legal doctrines – recovery for assistance to an unconscious or drowning person and recovery from members of a class under the common fund doctrine – that follow the Restitution Rule. We argued that these exceptions, featuring substantial impediments to a voluntary agreement, prove the Mutual Consent rule.

Other legal doctrines, where the Restitution Rule has been adopted, are also consistent with our analysis. For instance, recovery will be ordered when a benefit has been conferred by mistake. Consider the following example. A and B own adjacent tracts of land. A builds a house on B's land, mistakenly thinking that the house is being built on his (A's) land. Under Restitution law A is entitled to recovery for the benefit that he conferred on B. Recovery in cases of mistake can be justified by high transaction costs. If A does not think that he is conferring a benefit on B, A will not bargain with B. Mistake is another example of an impediment to a voluntary agreement. But there is another justification. Our analysis, demonstrating the inferiority of the Restitution Rule, assumes intentional, strategic behavior by sellers. The inefficiencies we identify are not present when an inadvertent seller mistakenly confers a benefit on a buyer.

[OTHER LEGAL DOCTRINES?]

[12] Moreover, the Restitution Rule may solve the "lemons problem" that arises under the Mutual Consent Rule.

REFERENCES

Calabresi, Guido, and Douglas A. Melamed (1972), "Property Rules, Liability Rules and Inalienability: One View of the Cathedral," *Harvard Law Review*, 85, 1089-1128.

Coase, Ronald H. (1960), "The Problem of Social Cost," *Journal of Law & Economics*, 3, 1-44.

Kaplow, Louis, and Steven Shavell (1996), "Property Rules versus Liability Rules: An Economic Analysis," *Harvard Law Review*, 109, 713-790.

Levmore, Saul (1985), "Explaining Restitution," *Virginia Law Review*, 71, 65-124.

Posner, Richard A. (2003), *Economic Analysis of Law* (6th ed., Aspen Publishers).

Schankerman, Mark, and Suzanne Scotchmer (2001), "Damages and Injunctions in Protecting Intellectual Property," *RAND Journal of Economics*, 32, 199-220.