The Right of First Offer

Xinyu Hua*

Hong Kong University of Science and Technology

Abstract

This paper examines the right of first offer, which requires a seller to bargain with the contracted buyer before subsequent buyers arrive. The contract also prevents the seller from selling his *unique* asset to subsequent buyers at a price below what he offers to the contracted buyer. The right of first offer makes the seller less aggressive in bargaining with the contracted buyer, who is privately informed about his valuation. Such a contract can reduce inter-temporal misallocation, in which a subsequent buyer gets the asset when the contracted buyer has higher valuation. But it also may cause misallocation in which the contracted buyer gets the asset when subsequent buyers have higher valuations. Overall, whether the right of first offer can increase the joint surplus for the seller and the contracted buyer, as well as social welfare, depends on the contracted buyer's renegotiation power and the distribution of the buyers' valuations. This paper also discusses the differences between the right of first offer and the most-favored-customer clause.

Key words: Right of first offer, misallocation, rent seeking, renegotiation

JEL codes: D82, L14, K12

* Department of Economics, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong. Email: xyhua@ust.hk. Tel: 852-2358-7609. Fax: 852-2358-2084. I would like to thank the Editor and two anonymous referees for their valuable comments and suggestions. I would also like to thank Jiahua Che, Yuk-fai Fong, Oliver Hart, Tanjim Hossain, Fahad Khalil, Jennifer Reinganum, Kathy Spier, Danyang Xie, and Yaron Yehezkel, seminar participants at the 2008 International Industrial Organization Conference at Washington DC, the 2008 North America Summer Meeting of the Econometric Society in Pittsburgh, Pennsylvania (USA) for their discussions and valuable comments. All mistakes are my own.

Introduction

The right of first offer is often adopted in shareholders' agreements, property sales contracts or leases, licenses, and pre-acquisition contracts.[1] This contract clause specifies that a seller has to negotiate first with the contracted buyer before looking for subsequent buyers and it prevents the seller from selling his asset to a subsequent buyer at a price below the price he has offered to the contracted buyer.[2] The right of first offer is often regarded as a measure that protects the right holders, but under such a contract potential sellers may be "held up" by the right holders and the sellers' trading opportunities or revenue from the subsequent market would be reduced. This paper will address two questions: First, under what conditions would firms adopt the right of first offer? Second, would such contracts increase or decrease social welfare?

As will be shown, the right of first offer would make a seller less aggressive in bargaining with an early buyer (i.e. the contracted buyer). On the one hand, this contract mitigates the seller's rent seeking vis-à-vis the early buyer and reduces inter-temporal asset misallocation in which one subsequent buyer gets the asset when the early buyer has higher valuation. On the other hand, it may also cause another type of misallocation: the early buyer may obtain the asset even if his valuation is smaller than subsequent buyers' expected valuation.

Shareholder agreements often adopt this contract for closely held companies. For example, in 2005, Alnylam Pharmaceutical Inc. granted Novartis AG the right of first offer for Alnylam's potential sales of shares. Alnylam disclosed in financial statements

[1] The right of first offer is related to but different from the right of first refusal. The right of first refusal permits the contracted buyer to obtain the asset by matching other buyers' price offers. That is, the seller should have received a price offer before the contracted buyer exercises the right.

[2] Rights of first offer are often signed long time before potential sellers decide to sell their assets. Such contracts sometimes also specify certain periods within which the rights of first offer are valid.

that this right of first offer "may make it difficult to form future alliances with other parties."[3] The use of rights of first offer is also common in sales or leases of properties, licenses, and other assets. For example, APP Pharmaceuticals Inc. entered into a contract including the right of first offer for future sales of licenses.[4] There have been debates on whether the rights of first offer cause misallocation or anti-competitive effects and whether courts should enforce these contracts.[5] In practice, when courts enforce such contracts, they often adopt the "specific performance" damage provision.[6] That is, courts require the contracted seller to follow the terms specified by the right of first offer and not to sell the asset to any subsequent buyer at a price below the price offered to the early buyer.

Formally, this paper considers a framework in which a single seller, with one indivisible asset to sell, faces a buyer at an early stage and other buyers in a subsequent market. The seller and the early buyer decide whether to sign an ex ante contract with the right of first offer.[7] After the contracting stage, the early buyer privately learns about his valuation. The seller then makes a take-it-or-leave-it price offer to the early buyer. If the buyer accepts, the asset is sold. However, if the early buyer rejects the offer, the seller goes to the subsequent market. If there is no ex ante contract, the seller and subsequent buyers can trade at any price; however, if the seller and the early buyer have signed a

[3] Disclosure SEC Database.
[4] All these examples are from the Disclosure SEC Database. Details can be found in companies' reports to the SEC, such as their 8-K reports.
[5] For example, Exxon Mobile complained that the right of first offer signed by Enbridge Pipelines and some committed shippers were anticompetitive against Exxon Mobile (Inside FERC, May 16, 2011).
[6] Standard court-imposed damage provisions include specific performance, expectation damage, and reliance damage rules. For more details, see Shavell (1984) and Polinsky and Shavell (2007). Under the specific performance rule, courts typically require contracting parties to exactly follow the contract terms. Related examples and discussions on contract enforcement are provided in Section 3.
[7] The seller cannot sell the asset to the early buyer at the ex ante stage, for example, because there is a limited resale probability, or because the asset or property is under development and ex ante sales are not possible.

right of first offer, the seller cannot sell the asset in the subsequent market at any price below the price offered to the early buyer. The seller and the early buyer can renegotiate over their ex ante contract. [8]

A key feature in this paper is that the value of trade may not be persistent over time. That is, if the early buyer does not accept the seller's price offer, he may not stay in the market and his valuation may decrease. For example, the buyer may obtain an alternative asset and does not have more liquidity to buy the original asset, or waiting is too costly so that the buyer's valuation becomes very small if there is a delay.

If there is no ex ante contract, the seller would offer the early buyer a price higher than his expected revenue from the subsequent market, in order to extract rent from the early buyer. Such rent seeking causes misallocation: the early buyer may not obtain the asset even if his valuation is higher than the subsequent buyers' expected valuation. In contrast, under the right of first offer, when the early buyer rejects the price offer and the subsequent buyers' valuation is lower than this previous price offer, the right of first offer reduces the seller's trading opportunities. Thus, the seller would be less aggressive in bargaining with the early buyer. Note that renegotiation over the contract would not remove the above effects: anticipating renegotiation or "hold-up" benefits, the early buyer is less likely to accept the price offer in the early stage.

When the early buyer does not stay and compete in the subsequent market, as long as the early buyer's renegotiation power is not overly large and the buyers' valuations are not overly high, the right of first offer increases the joint surplus for the seller and the early buyer, as well as social welfare. However, if the early buyer's renegotiation power is large enough, or the buyers' valuations are high enough, the right of first offer causes

[8] See Section 2 for practical examples about renegotiation over the right of first offer.

misallocation in which the early buyer gets the asset when the subsequent buyers have higher valuations. This may reduce the joint surplus for the seller and the early buyer, as well as social welfare.

When the early buyer stays and competes directly in the subsequent market, if his valuation decreases significantly over time, the right of first offer can still increase the joint surplus for the seller and the early buyer.

This paper contributes to the literature on contract theory. One related paper is Choi (2009), who shows that the right of first refusal could strategically extract rent from future buyers, but cause asset misallocation. Bikhchandani, Lippman, and Ryan (2005) also show that the right of first refusal may cause inefficiency.[9] Kahan, Leshem, and Sundaram (2008) compare the right of first refusal to the right of first offer. Different from these studies, this paper focuses on inter-temporal (mis)allocation caused by the right of first offer and also examines the welfare implications. It also considers the effects from potential renegotiation over the right of first offer. Grosskopf and Roth (2009) conduct an interesting experimental analysis showing that the right of first offer combined with the right of first refusal is disadvantageous to the right holder, although they do not consider inter-temporal (mis)allocation and the reduction of trade value. Another related study by Hua (2007) shows that strategic ex ante contracts not only cause asset misallocation, but also facilitate more trade by reducing ex post rent seeking between contracting parties. These previous studies assume that the contracted buyer and other buyers can compete during the same period. This paper applies to a different framework, where the early buyer and subsequent buyers may not compete in the same period, and delays reduce the value of trade.

[9] Kahan (1999) also analyzed various versions of the right of first refusal without sellers' rent seeking.

Contracts can be used as strategic tools to deter entry or to extract rent from entrants (Aghion and Bolton, 1987). Strategic contracts could also preserve incentives for relationship-specific investments (Rogerson, 1984, 1992; Chung, 1991; Spier and Whinston, 1995; Che and Chung, 1999; Che and Hausch, 1999; Segal and Whinston, 2000; Che and Lewis, 2007) or facilitate trade by imposing lower values on outside options (Matouschek and Ramezzana, 2007). Most of the literature implies that strategic contracts may cause more misallocation. In contrast, this paper will reveal that the right of first offer may enhance efficiency by reducing misallocation.

This paper is also related to the literature on most-favored-customer clauses. The literature primarily views most-favored-customer clauses as commitment tools to deal with the time inconsistency problem of durable goods (Butz, 1990). Spier (2003) analyzes the effects of most-favored-customer clauses in sequential litigations: A defendant may offer plaintiffs most-favored-customer clauses to encourage early settlements, and therefore, save litigation costs. Daughety and Reinganum (2004) discuss the signaling effects of most-favored-customer clauses.[10] Different from most-favored-customer clauses, the right of first offer is often used when there is only one asset, where intertemporal allocation among different buyers becomes more important.[11]

The next section presents the basic model. The third section examines the private incentives of the seller and the early buyer to adopt the right of first offer, when the early buyer does not compete directly in the subsequent market. Social welfare effects are also discussed. The fourth section checks the robustness of the results when the early buyer

[10] In addition, Cooper and Fries (1991) and Neilson and Winter (1994) reveal the strategic effects of the most-favored-customer clauses to extract more revenue from subsequent buyers, without addressing buyers' private information.

[11] More detailed comparisons between these two contracts will be provided in Section 5.1.

could also compete in the subsequent market. The fifth section discusses a few extensions. The last section offers concluding remarks. All proofs will be in the appendix.

2. The model

A seller, S, has one indivisible asset to sell. A buyer, B, arrives before the seller has access to a subsequent market with other buyers. This paper will consider two types of subsequent market structures separately: one competitive market where there are many subsequent buyers with common value,[12] and another market where a single subsequent buyer has private valuation of the asset. All players are risk neutral and S's costs for the asset are normalized to zero.

A key feature in this model is that delays may reduce the value of trade. Waiting may be too costly for buyer B, or B no longer needs the asset in future periods.[13] In the basic model, assume that if B does not obtain the asset, he would not stay to compete with subsequent buyers. This admittedly strong assumption simplifies the analysis. In Section 4, we will relax this assumption and verify the robustness of the results.

Note that if delays do not affect the early buyer's valuation of the asset, then as shown in the literature, the socially efficient mechanism is a standard first-price or second-price auction: all potential buyers bid in the same stage at date 3. In such cases, the right of first offer would reduce social welfare. In this paper, we focus on those scenarios where delays reduce the buyer's valuation.

---

[12] An equivalent scenario is that there is only one subsequent buyer but his valuation for the asset can be observed by the seller.

[13] For example, in sales of real estate, if a seller and a buyer do not reach a deal, the buyer may purchase other real estate in the market. In this situation, the buyer may not compete with subsequent buyers, or the buyer's valuation on the seller's real estate will decrease. Similarly, in sales of stock shares or ownership, delays in sales may also reduce the seller's as well as the potential buyers' incentives to make investments or cause management inertia. This would reduce the value of trade.

The early buyer's valuation v_1 and the subsequent buyers' valuation v_2 for the asset are independently drawn from a distribution $F(v)$ on $[\underline{v}, \bar{v}]$. The corresponding density function is $f(v)$, which is bounded above by a fixed number *M*. The distribution has a monotone hazard rate: $H(v) = (1 - F(v))/f(v)$ decreasing in v.

The timing for the model is as follows:

At date 1, S and B can choose whether to sign an ex ante contract with the right of first offer or not. The contract may include an upfront transfer from B to S to split their expected joint surplus.[14]

At date 2, B privately learns of his valuation v_1. S makes a take-it-or-leave-it price offer p_1 to B. If B accepts the offer, he obtains the asset and pays the price p_1; otherwise, the game goes to date 3.[15]

At date 3, the subsequent buyers arrive and privately learn of v_2. S and B may first renegotiate their ex ante contract. S has renegotiation power $1-\alpha$ and B has renegotiation power α: With probability α, B makes a take-it-or-leave-it offer in the renegotiation. With probability $1-\alpha$, S makes a renegotiation offer. Then, if the subsequent market is competitive with many buyers, competition among the subsequent buyers drives the price p_2 equal to v_2. If there is only one subsequent buyer, S makes a take-it-or-leave-it price offer p_2 to the subsequent buyer.

[14]Many contracts include upfront payments in cash, or by other means. For example, if a lessee rents a property from a lessor, it is possible the lessor may later want to sell the property. The property rental contract may offer the lessee the right of first offer and adjust the rental fees as upfront payments.

[15] More generally, this model can be extended to a scenario where both S and B have opportunities to make the take-it-or-leave-it offer. However, since B always knows v_1, when he has market power to make the price offer, the price is always optimal for the joint surplus of S and B, no matter whether they have signed the right of first offer or not.

The model assumes that S cannot commit to any reserve price in the long run, and that S cannot offer B an option right to buy the asset at a fixed price. In fact, the model can be generalized such that the distribution of the buyers' valuations $F(v|s)$ depends on a signal *s*. The signal is realized only at date 2. In such scenarios, an option contract with a unique exercise price signed at date 1 could not maximize the joint surplus for S and B. This assumption is realistic. For example, in real estate rentals, owners may learn more about the costs of the asset, or the distribution of trade values, over time. S does not always have incentives to sell his asset and it is difficult to specify the exercise price for the option right.

We allow the possibility of renegotiation between S and B over the ex ante contract. In practice, renegotiation over the right of first offer is not rare. For example, IP Co. LLC and Cellnet Tech Inc. had signed the right of first offer regarding the future sales of certain patents. In 2009, the two parties agreed on a release which effectively waived the right of first offer.[16] For another example, in 2004, Enron and Prudential Inc. renegotiated and signed an agreement under which Enron waived its right of first offer.[17] In the model, if renegotiation is not allowed, the right of first offer may destroy trading opportunities for S at date 3, even if the subsequent buyers' valuation v_2 is positive. Therefore, eventually there may not be sales.[18] In contrast, if renegotiation is allowed, trading opportunities may not be destroyed. However, as long as B has some renegotiation power,

[16] See US Dist. Lexis 89467 (2009).
[17] See US. Dist. Lexis 136989 (2011).
[18] An earlier version of this paper examined the scenario without renegotiation. The right of first offer was found to destroy trading opportunities sometimes. This effect also makes the seller less aggressive in bargaining with the early buyer and therefore mitigates inter-temporal misallocation, similar to the results found in this current paper. This analysis is available upon request.

S may face a potential holdup problem, which motivates S to offer a lower price to B at date 2. [19]

The model also assumes that when there are many subsequent buyers they have common value. Early buyer B may have a different valuation. This is not uncommon in those scenarios where the right of first refusal is adopted. For example, shareholders' agreements often contain the right of first offer. Consider two shareholders of a company. If one shareholder tries to sell its shares, outside buyers may have the same or similar valuation, while the other current shareholder (i.e., the early buyer in our model) can have a different valuation given his inside information on assets or concerns about changes brought by new shareholders. For another example, pharmaceutical firms and bio-tech research companies often adopt the right of first offer in their R&D contracts. Given that they have the same limited information, other pharmaceutical firms may have the same forecast about the market value of R&D outcomes. However, a contracted pharmaceutical firm (i.e. the early buyer in our model) often has a different valuation given its early involvement in the R&D project or potential complementarity between R&D outcomes and its other business. Similar features about buyers' valuations can also be observed in sales of leased properties, where leases often include the right of first offer.

This paper will primarily compare the right of first offer to the benchmark scenario without any ex ante contract.[20] It will also discuss the differences between the right of first offer and the most-favored-customer clause (MFN).

---

[19] If S has all renegotiation power, then, at date 3, S will offer a price of zero to B, in exchange for a waiver of the right of first offer. The renegotiation is efficient ex post, but this scenario is equivalent to the case without any ex ante contract. In this case, the right of first offer has no effect at all.

[20] This paper does not consider the question of what would be the optimal mechanism for S to sell the asset. Instead, it focuses on the right of first offer which is used in practice and its welfare effect. Also, in the basic model, the early buyer B's valuation would be reduced by delays in trade, and B does not compete in the subsequent market. In such scenarios, the design of optimal mechanism would become complicated.

3. The Effects of Right of First Offer with the Early Buyer Not Competing in the Subsequent Market

This section discusses whether S and B have incentives to adopt the right of first offer, compared to the benchmark case without any ex ante contract. For simplicity, assume that B does not compete directly in the subsequent market.

3.1 The Competitive Subsequent Market

If there are many buyers in the subsequent market, competition among them will result in a price equal to their valuation v_2 for the asset. That is, S and B (jointly) capture the social surplus in any trade. Therefore, social welfare is equal to the joint surplus for S and B:

Proposition 1: If there are many subsequent buyers with common value, the private incentive for S and B to adopt the right of first offer is aligned with social desirability.

Equilibrium without any ex ante contract

At date 3, since the subsequent market is competitive with many buyers, the price is $p_2 = v_2$. Define $E[v_2] = \int_{\underline{v}}^{\bar{v}} v_2 dF(v_2)$, which is the seller's expected revenue from the subsequent market. At date 2, S chooses a price p_1:

$$Max_{p_1 \geq \underline{v}} (1 - F(p_1))p_1 + F(p_1)E[v_2]$$

The above objective function is concave, given the monotone hazard rate. Therefore, S's optimal price is $p_1^N = E[v_2] + \frac{1-F(p_1^N)}{f(p_1^N)} > E[v_2]$. That is, S offers a high price to extract rent from B, who is privately informed about his valuation v_1. This creates (inter-temporal) asset misallocation in which a subsequent buyer gets the asset when the early buyer has higher valuation.

Equilibrium with the right of first offer

Now suppose that S and B have adopted the right of first offer. If S and B do not trade at date 2, then at date 3, without renegotiation, S's price charge to the subsequent buyers must satisfy $p_2 \geq p_1$.

At date 3, when $v_2 \geq p_1$, S would sell the asset at $p_2 = v_2$. However, when $v_2 < p_1$, S would not be able to sell the asset. Therefore, S and B have incentives to renegotiate to waive the right of first offer. Given that B has some renegotiation power, S receives $(1-\alpha)v_2$ and B receives αv_2.

At date 2, S offers a price p_1 to B. B accepts the price if and only if $v_1 - p_1 \geq \int_{\underline{v}}^{p_1} \alpha v_2 dF(v_2)$. The right-hand side of this condition is B's expected benefit from renegotiation. S chooses p_1 based on the following problem:

$$Max_{p_1 \geq \underline{v}} (1 - F(p_1 + \int_{\underline{v}}^{p_1} \alpha v_2 dF(v_2)))p_1 + F(p_1 + \int_{\underline{v}}^{p} \alpha v_2 dF(v_2))\{E[v_2] - \int_{\underline{v}}^{p_1} \alpha v_2 dF(v_2)\}$$

Define the optimal price as p_1^R. The following lemma shows that the right of first offer makes S less aggressive in bargaining with B.

Lemma 1: Assume that $\alpha > 0$. Under the right of first offer, there exists a cut-off $\hat{v}_1^R$ such that B accepts the price offer at date 2 if and only if $v_1 \geq \hat{v}_1^R$. Compared to the benchmark scenario without any ex ante contract, S offers a lower price to B and B is more likely to obtain the asset, i.e., $p_1^R < p_1^N$. In addition, p_1^R and $\hat{v}_1^R$ decrease in α.

Intuitively, the right of first offer commits $p_2 \geq p_1$. This commitment reduces the trading opportunity in the subsequent market when $p_1 > v_2$. Therefore, at date 3, S and B have incentives to renegotiate to waive the right of first offer. As long as B has some renegotiation power, S's expected revenue from the subsequent market would be reduced. Furthermore, anticipating the renegotiation or "holdup" benefit, B has less incentive to accept the price offer at date 2. These two effects lead S to be less aggressive at date 2, reducing the price offered to B. The following proposition shows that the above effects may or may not increase the joint surplus for S and B.

Proposition 2*:* Assume that $\alpha > 0$. (1) There exists a cut-off $\hat{\alpha} \leq 1$, such that the right of first offer increases the joint surplus for S and B, if and only if $\alpha \leq \hat{\alpha}$, compared to the scenario without any ex ante contract. (2) Consider shifting the range $[\underline{v}, \bar{v}]$ for the distribution $F(v)$. There exists a cut-off $\Delta \geq 0$, such that the right of first offer increases the joint surplus for S and B if $\underline{v} \leq \Delta$. If v_1 and v_2 follow uniform distributions, then the right of first offer always increases the joint surplus for S and B.

The above results can be understood intuitively. Without any ex ante contract, S's rent seeking pricing at date 2 causes misallocation in favor of the subsequent buyers: B may not obtain the asset even if his valuation is higher than the subsequent buyers' expected valuation. In contrast, the right of first offer mitigates S's rent seeking. When B's renegotiation power is not too large, S's price offer at date 2 is still higher than the subsequent buyers' expected valuation. Therefore, there is less misallocation. However, when B's renegotiation power is too large, S's price offer at date 2 would be too low, such that there may be misallocation in which the early buyer gets the asset when the subsequent buyers have higher valuations.

Similarly, consider shifting the distribution of the buyers' valuations. The right of first offer induces S to reduce his price offer at date 2. If the distribution of the buyers' valuations is shifted to be on low values, S's price offer at date 2 is still higher than the subsequent buyers' expected valuation. Thus, the right of first offer increases the joint surplus for S and B. If the distribution is shifted to be on very high values, S's price at date 2 is too low and this leads to misallocation in which the early buyer gets the asset when the subsequent buyers have higher valuations. Hence, the right of first offer may reduce the joint surplus for S and B.

In summary, compared to the benchmark scenario without any ex ante contract, the right of first offer mitigates S's rent seeking vis-à-vis B, but can also create misallocation in which the early buyer gets the asset when the subsequent buyers have higher valuations.

3.2 The Non-competitive Subsequent Market

When there is only one subsequent buyer with private valuation at date 3, without any ex ante contract, S would offer a monopoly price to the subsequent buyer. In such a market, there may be divergence between the firms' private incentives and social desirability on whether to adopt the right of first offer or not.

Equilibrium without any ex ante contract

At date 3, if the subsequent buyer rejects S's price offer, there is no trade. S offers the subsequent buyer a price p_2 to maximize his expected revenue:

$Max_{p_2 \geq \underline{v}} (1 - F(p_2)) p_2$

The optimal price is $p_2{}^N = \max\{\underline{v}, \frac{1 - F(p_2{}^N)}{f(p_2{}^N)}\}$. Define $R(p_2) = (1 - F(p_2)) p_2$.

At date 2, S chooses a price p_1 to maximize his expected revenue:

$Max_{p_1 \geq \underline{v}} (1 - F(p_1)) p_1 + F(p_1) R(p_2{}^N)$

S's optimal price is $p_1{}^N = R(p_2{}^N) + \frac{1 - F(p_1{}^N)}{f(p_1{}^N)}$. Note that $p_1{}^N > p_2{}^N > R(p_2{}^N)$.

That is, given the expected revenue from the subsequent buyer, S offers a higher price at date 2 to extract rent from B.

Equilibrium with the right of first offer

Now suppose that S and B have adopted the right of first offer at date 1. If S and B do not trade at date 2, then at date 3, without renegotiation, S's price charge to the subsequent buyer must satisfy $p_2 \geq p_1$. If $p_1 > p_2{}^N$, S has to charge at least $p_2 = p_1$, which does not maximize his revenue at date 3. Therefore, S and B have incentives to

renegotiate their ex ante contract, so that S can charge $p_2 = p_2^N$. Given that B has renegotiation power, S expects to receive $R(p_1) + (1-\alpha)(R(p_2^N) - R(p_1))$ and B expects to receive $\alpha(R(p_2^N) - R(p_1))$. The right of first offer reduces S's expected revenue from the subsequent market if $p_1 > p_2^N$. Similar to the discussion in Section 3.1, this above effect causes S to be less aggressive in bargaining with B at date 2.

Lemma 2: Assume that $\alpha > 0$. Under the right of first offer, there exists a cut-off $\tilde{v}_1^R$ such that B accepts the price offer at date 2 if and only if $v_1 \geq \tilde{v}_1^R$. Compared with the benchmark scenario without any ex ante contract, at date 2, S offers a lower price to B and B is more likely to obtain the asset, i.e., $p_1^R < p_1^N$. In addition, p_1^R and $\tilde{v}_1^R$ decrease in α.

The following proposition shows that S and B would always adopt the right of first offer when there is only one subsequent buyer with private valuation.

Proposition 3*:* Assume that $\alpha > 0$. If there is only one subsequent buyer with private valuation, compared to the benchmark scenario without any ex ante contract, the right of first offer always increases the joint surplus for S and B.

The difference between the results in Proposition 3 and the results in Proposition 2 is intuitive. When the subsequent market has many buyers, as shown in Section 3.1, competition leads to $p_2 = v_2$. At date 2, there is uncertainty about the future price p_2.

Given such uncertainty, B's expected renegotiation benefit is always positive. Therefore, for any price p_1, B may reject the price offer, even if $v_1 > p_1$. Therefore, S has to offer a much lower price to B. This effect, as discussed in Section 3.1, mitigates S's rent seeking vis-à-vis B but also creates too much misallocation in which the early buyer gets the asset when the subsequent buyers have higher valuations. In contrast, when there is only one subsequent buyer, the optimal price $p_2{}^N$, which maximizes the joint surplus for S and B, is fixed. In this case, the right of first offer still mitigates S's rent seeking vis-à-vis B, but does not cause too much misallocation in which the early buyer gets the asset when the subsequent buyer has higher valuation. Therefore, the joint surplus for S and B is always increased.

Since the subsequent buyer receives information rent, the joint surplus for S and B is not equal to social welfare. The following proposition shows that there may be a divergence between the firms' private incentives and social desirability to adopt the right of first offer.

Proposition 4*:* Assume that $\alpha > 0$. (1) If $p_1{}^N > \int_{p_2{}^N}^{\bar{v}} v_2 dF(v_2)$, there exists a cut-off $\tilde{\alpha} \le 1$, such that the right of first offer increases social welfare if and only if $\alpha \le \tilde{\alpha}$, compared to the scenario without any ex ante contract. (2) If $p_1{}^N \le \int_{p_2{}^N}^{\bar{v}} v_2 dF(v_2)$, the right of first offer always decreases social welfare. (3) Assume that v_1 and v_2 follow uniform distributions. Consider shifting the range $[\underline{v}, \bar{v}]$ of the distribution. There exists $\tilde{\Delta} > 0$: given any $\underline{v} < \tilde{\Delta}$, there exists a cut-off $\tilde{\alpha} \le 1$ such that the right of first offer

increases social welfare if and only if $\alpha \leq \tilde{\alpha}$. If $\underline{v} \geq \tilde{\Delta}$, the right of first offer always decreases social welfare.

Summarizing the results in Proposition 3 and Proposition 4, if there is only one subsequent buyer, the joint surplus of S and B is always increased by the right of first offer. If the potential trade values are not too high and B's renegotiation power is not too large, the right of first offer can also increase social welfare by reducing inter-temporal misallocation. However, if potential trade values are high enough, or if B's renegotiation power is too large, the right of first offer may cause too much misallocation in which the early buyer gets the asset when the subsequent buyers have higher valuations.

Overall, the analysis in Section 3 implies that the right of first offer can increase social welfare and courts may enforce the right of first offer under certain scenarios, for examples, if there are many competitive subsequent buyers, and if the contracted buyer does not have very large renegotiation power or the potential trade values are not too high.

In practice, when courts enforce the right of first offer, they often adopt the "specific performance" damage provision. That is, courts require the contracted seller to follow the terms specified by the right of first offer and not to sell the asset to any subsequent buyer at a price below the price offered to the early buyer. For example, a property owner in Georgia had granted the right of first offer to the Trust for Public Land, regarding the future sales of the property. In 2007, the owner argued against the implementation of the contract, in order to look for other buyers before negotiating with the Trust for Public Land and to remove any price restriction. However, the district court ruled that the right

of first offer was valid and enforceable.[21] Under the specific performance damage provision, as shown in this section, the right of first offer can increase social welfare by mitigating some inter-temporal misallocation.[22]

If courts adopt an alternative damage provision, for example, the expectation damage rule, the enforcement of the right of first offer would become complex. Applying the expectation damage rule would imply that, when a seller violates the right of first offer and sells the asset to a subsequent buyer at a lower price, the seller should compensate the early buyer for his expected damage. However, it is difficult to quantify the early buyer's damage given his private valuation.

In addition, if courts impose a monetary penalty or a breakup fee, the seller would be concerned about this potential penalty and therefore lower his price offer to the early buyer. If the penalty can be properly chosen, the seller would be induced to offer the early buyer a price equal to the seller's expected revenue from the subsequent buyers. That is, such a fixed penalty can be more socially efficient than the specific performance rule regarding the enforcement of the right of first offer. However, in practice courts may not have sufficient information to choose the optimal penalty.

4. Extension: The Effects of Right of First Offer with the Early Buyer also Competing in the Subsequent Market

[21] See US Dist. Lexis 7777 (2007). Note that the district court did not force the owner to sell the property to the contracted buyer, since the right of first offer does not specify that the seller must sell it to the contracted buyer.

[22] In practice, it may be difficult for courts to observe whether and to what extent the early buyer's valuation is reduced by delays. Correspondingly, courts cannot fully avoid the potential holdup problems between the seller and the early buyer.

The basic model assumes that the early buyer does not stay in the subsequent market. This section will show that the effects of the right of first offer identified in Section 3 still exist under the scenario where B also competes in the subsequent market: At date 3, he can stay and bid for the asset in the subsequent market but his valuation is decreased to δv_1, where $\delta < 1$. As discussed in the introduction, this reduction in valuation can be due to the waiting costs of the early buyer, or the early buyer B has already obtained another asset.

For simplicity, assume that if there is no ex ante contract, at date 3, B and the subsequent buyers compete in the standard first-price or second-price auction and there is no reserve price. The assumption of having no reserve price does not affect the main intuition. Furthermore, this section will focus on the scenario in which there is a competitive subsequent market with many buyers.[23] Given the competition among the subsequent buyers, social welfare equals the joint surplus for S and B.

The analysis is similar to that in Section 3, except for the following complication. In this scenario, in which B can stay and bid for the asset in the subsequent market, renegotiation between S and B over the right of first offer may fail. This is because B privately knows his valuation of the asset (even in the subsequent market) and can still bid for the asset. We put the detailed analysis in the appendix.

Intuitively, the right of first offer specifies $p_2 \geq p_1$. This contract induces S to be less aggressive in bargaining with B at date 2. Therefore, B is more likely to obtain the asset at date 2. This mitigates inter-temporal misallocation in which a subsequent buyer gets

[23] The main intuition holds when there is one unique subsequent buyer. However, the analysis would become more complicated by including both renegotiation over the right of first offer under asymmetric information between S and B and design of the mechanism selling the asset when there is competition between B and the subsequent buyer at date 3. Using a mechanism design approach, Hua (2007) characterizes the optimal contract for S and B when the early buyer B's valuation is not reduced by delays.

the asset when the early buyer has higher valuation, but may cause misallocation in which the early buyer gets the asset when the subsequent buyers have higher valuations. The following proposition shows that the right of first offer can still increase the joint surplus for S and B under certain conditions.

Proposition 5*:* (1) There exists $\delta_H \in (0,1)$ such that the right of first offer reduces the joint surplus for S and B if $\delta \geq \delta_H$, compared to the scenario without any ex ante contract. (2) Suppose that v_1 and v_2 follow uniform distributions. There exists $\delta_L \in (0, \delta_H]$: for any $\delta \leq \delta_L$, there exists a cut-off $\ddot{\alpha}(\delta) < 1$ such that the right of first offer increases the joint surplus for S and B if B has large renegotiation power of $\alpha \geq \ddot{\alpha}(\delta)$, compared to the scenario without any ex ante contract.

Intuitively, if δ is large enough, B's valuation of the asset does not decrease by too much even if there is no trade at date 2. That is, waiting is not too costly. In such a scenario, without any ex ante contract, the inter-temporal misallocation is very small. However, the right of first offer would create larger misallocation in which the early buyer gets the asset when the subsequent buyers have higher valuations. Therefore, the joint surplus of S and B is reduced.

If δ is not too large and the buyers' valuations follow uniform distributions, the right of first offer helps to reduce inter-temporal misallocation. Furthermore, when B's renegotiation power is large enough, it is more likely that renegotiation at date 3 will succeed. In this scenario, the right of first offer would increase the joint surplus for S and B, as well as social welfare.

In summary, this section shows that, even when the early buyer can compete directly with the subsequent buyers at date 3, the right of first offer can still increase the joint surplus for S and B as well as social welfare under certain conditions.

5. Discussion

5.1 Right of First Offer vs. Most-Favored-Customer (MFN) Clause[24]

Another commonly used contract in practice is the MFN clause. Typically, the MFN clause specifies that an early buyer would obtain a refund from a seller when the seller sells his product to other subsequent buyers at a lower price. The right of first offer is similar to, but different from, MFN in the following aspects.

First, MFN is often used when a seller has many units of a product for sale, so that there is no misallocation among different buyers. In contrast, the right of first offer is used when the seller has only one asset.

Second, MFN typically reduces social welfare under scenarios with durable goods (Butz, 1990). As shown by Spier (2003), MFN may increase social welfare when used in settlement and litigation, where early settlement is always more efficient than late settlement or litigation. In contrast, in this paper, since the seller has only one asset, there may be inter-temporal misallocation, and therefore early trade may or may not be more efficient than trade in the subsequent market at date 3.

Third, MFN typically provides the early buyer with more incentives to accept the price offer made by the seller; whereas, if the price offer is fixed, the right of first offer may make the early buyer less likely to accept the price offer. In other words, under MFN, there may be a penalty for the seller only when the early buyer accepts the price. Under

[24] I would like to thank Jennifer Reinganum for suggesting this analysis.

the right of first offer, however, there may be a penalty (i.e. fewer trading opportunities) for the seller only when the early buyer rejects the price offer.

5.2 Strategic Effects of the Right of First Offer

The analysis in Section 3 and Section 4 assumed that S had all the power to make price offers to subsequent buyers. If there is only one subsequent buyer who also has market power, the right of first offer may have strategic effects to extract more rent from the subsequent buyer.[25]

To illustrate such strategic effects, reconsider the scenario discussed in Section 3.2: there is only one subsequent buyer with private valuation and B does not compete at date 3. Suppose that the subsequent buyer has all the market power at date 3. If there is no ex ante contract, S's expected revenue from the subsequent market is zero. In contrast, if S and B have adopted the right of first offer, then at date 3, the contract provides commitment such that $p_2 \geq p_1$. This commitment forces the subsequent buyer to pay a price higher than zero, which increases the expected revenue for the seller S. [26]

6. Conclusion

This paper has examined the use of the right of first offer between a seller and a buyer, before the buyer learns of his private valuation and before the seller goes to a subsequent market. The right of first offer would reduce the seller's expected revenue from the

[25] Cooper and Fries (1991) and Neilson and Winter (1994) reveal similar strategic effects of the most-favored-customer clauses, without addressing buyers' private information.

[26] However, given the increased revenue from the subsequent market, S may even offer a higher price to B at date 2, than his price offer without any ex ante contract. That is, S may become more aggressive in bargaining with B when there are strategic benefits in the subsequent market. This may create more asset misallocation.

subsequent market. Furthermore, given the anticipated renegotiation or "holdup" benefits from the right of first offer, the early buyer may be less likely to accept the seller's price offer. These effects mitigate the seller's rent seeking vis-à-vis the early buyer, and therefore reduce inter-temporal misallocation in which a subsequent buyer gets the asset when the early buyer has higher valuation. However, the right of first offer may also create misallocation in which the early buyer gets the asset when the subsequent buyer(s) has higher valuation.

More specifically, suppose that the early buyer's valuation would be reduced to zero if there is a delay. When the subsequent market is competitive with many buyers, the seller and the early buyer would adopt the right of first offer if the early buyer's renegotiation power is not overly large, or the potential trade values are not overly high. Social welfare is also increased under these situations. When there is only one subsequent buyer with private valuation, the seller and the early buyer would always adopt the right of first offer. However, this contract may reduce social welfare when the trade values are high enough or the early buyer's renegotiation power is too large. In contrast, when the early buyer's renegotiation power is not too large or the potential trade values are not too high, the right of first offer can increase social welfare, and therefore courts may enforce such a contract.

It is important to note that the right of first offer may not be the optimal contract in the framework with sequential buyers. This paper does not consider the mechanism design question. Further research to characterize the optimal contract or mechanism in such scenarios would be meaningful. In addition, it would also be interesting to explore

the way in which the right of first offer affects sellers' or buyers' relationship-specific investments, especially in the context of shareholder or partner relationships.

Appendix

Proof of Lemma 1:

Under the right of first offer, S chooses p_1 based on the following problem:

$$Max_{p_1 \geq \underline{v}} (1 - F(p_1 + \int_{\underline{v}}^{p_1} \alpha v_2 dF(v_2)))p_1 + F(p_1 + \int_{\underline{v}}^{p} \alpha v_2 dF(v_2))\{E[v_2] - \int_{\underline{v}}^{p_1} \alpha v_2 dF(v_2)\}$$

Define $\hat{v}_1 = p_1 + \int_{\underline{v}}^{p_1} \alpha v_2 dF(v_2)$.

This problem can be rewritten as:

$$Max_{\hat{v}_1 \geq \underline{v}} (1 - F(\hat{v}_1)\hat{v}_1 + F(\hat{v}_1)E[v_2] - \int_{\underline{v}}^{p_1} \alpha v_2 dF(v_2)$$

Define the optimal price for the above problem as p_1^R. Correspondingly, define $\hat{v}_1^R = p_1^R + \int_{\underline{v}}^{p_1^R} \alpha v_2 dF(v_2)$.

Since p_1^N maximizes $(1 - F(p_1))p_1 + F(p_1)E[v_2]$, it satisfies

$$1 - F(p_1^N) + f(p_1^N)\{E[v_2] - p_1^N\} = 0 \qquad \text{(A1)}$$

Given $\hat{v}_1^R = p_1^R + \int_{\underline{v}}^{p_1^R} \alpha v_2 dF(v_2)$, $\frac{dp_1^R}{d\hat{v}_1^R} = \frac{1}{1 + \alpha p_1^R f(p_1^R)}$.

Since $\hat{v}_1^R$ maximizes $(1 - F(\hat{v}_1)\hat{v}_1 + F(\hat{v}_1)E[v_2] - \int_{\underline{v}}^{p_1} \alpha v_2 dF(v_2)$, it satisfies

$$1 - F(\hat{v}_1^R) + f(\hat{v}_1^R)\{E[v_2] - \hat{v}_1^R\} - \frac{\alpha p_1^R f(p_1^R)}{1 + \alpha p_1^R f(p_1^R)} = 0 \qquad \text{(A2)}$$

Therefore, $1-F(\hat{v}_1^{\,R})+f(\hat{v}_1^{\,R})\{E[v_2]-\hat{v}_1^{\,R}\} > 1-F(p_1^{\,N})+f(p_1^{\,N})\{E[v_2]-p_1^{\,N}\}$.

Given that $(1-F(p_1))p_1+F(p_1)E[v_2]$ is concave, $\hat{v}_1^{\,R} < p_1^{N}$.

Define $M(\hat{v}_1)$ as the value of S's revenue. According to the envelope theorem, $\frac{\partial M(\hat{v}_1^{\,R})}{\partial \alpha} = -F(v_1^{\,R})\int_{\underline{v}}^{p_1^{\,R}} v_2 dF(v_2) < 0$. Furthermore, $\frac{\partial M(\hat{v}_1^{\,R})}{\partial \alpha \partial p_1^{\,R}} < 0$, since $\hat{v}_1^{\,R}$ increases in $p_1^{\,R}$. Therefore, when α increases, $p_1^{\,R}$ and $\hat{v}_1^{\,R}$ must decrease. Q.E.D.

Proof of Proposition 2:

(1) If B accepts the price offer from S when $v > \hat{v}_1$, the joint surplus for S and B is $\int_{\hat{v}_1}^{\bar{v}} v_1 dF(v_1) + F(\hat{v}_1)E[v_2]$, which is concave and maximized when $\hat{v}_1 = E[v_2]$. Under the benchmark scenario without ex ante contracts, $p_1^{\,N} > E[v_2]$.

Under the right of first offer, as shown in Lemma 1, $p_1^{R} < \hat{v}_1^{\,R} < p_1^{N}$. When α is zero, $\hat{v}_1^{\,R} = p_1^{\,N}$. Furthermore, when α increases, $\hat{v}_1^{\,R}$ decreases. Therefore, the joint surplus for S and B, $\int_{\hat{v}_1}^{\bar{v}} v_1 dF(v_1) + F(\hat{v}_1)E[v_2]$, would first increase and finally may decrease if $\hat{v}_1^{\,R}$ is too small. Given continuity, there exists $0 < \hat{\alpha} \le 1$ such that the right of first offer increases the joint surplus for S and B if and only if $\alpha \le \hat{\alpha}$.

(2) Consider shifting the range of the distribution $F(v_i), i = 1,2$ by increasing $\underline{v}$. Under the benchmark scenario without any ex ante contract, condition (A1) implies that $p_1^{\,N} - E[v_2]$ is unchanged, and therefore, social welfare does not change when the distribution is shifted.

In contrast, under the right of first offer, when $\underline{v}$ is increased, if $\hat{v}_1^R - E[v_2]$ does not change, $1 - F(\hat{v}_1^R) + f(\hat{v}_1^R)\{E[v_2] - \hat{v}_1^R\} - \frac{\alpha p_1^R f(p_1^R)}{1 + \alpha p_1^R f(p_1^R)}$ would increase, since the absolute value of p_1^R increases. Then, in order to keep condition (A2), $\hat{v}_1^R - E[v_2]$ must decrease. Therefore, the relative misallocation loss between B and the subsequent buyers first decreases and eventually may increase. Correspondingly, given continuity, there exists $\Delta \geq 0$ such that the right of first offer increases the joint surplus for S and B, if $\underline{v} \leq \Delta$.

When $\underline{v}$ is overly large, the right of first offer may not increase the joint surplus for S and B. It suffices to show one example. Consider the following distribution: $f(\underline{v})$ is fixed and arbitrarily close to zero, while $\underline{v} f(\underline{v})$ is arbitrarily large when $\underline{v}$ is large enough. Furthermore, assume $F(v_i)$ is strictly convex, which guarantees that S's expected revenue is concave in the price offer at date 2. When the distribution is shifted such that $\underline{v}$ goes to infinity, condition (A2) and the above distribution features imply that $\hat{v}_1^R$ is arbitrarily close to $\underline{v}$. However, if $\hat{v}_1^R = \underline{v}$, social welfare is $E[v_1]$, which is smaller than social welfare without any ex ante contract.

Finally, suppose that v_1 and v_2 follow uniform distributions. Without loss of generality, let $\bar{v} - \underline{v} = 1$. If there is no ex ante contract, $E[v_2] - p_1^N$ =-1/4. In contrast, under the right of first offer, $\frac{\alpha p_1^R f(p_1^R)}{1 + \alpha p_1^R f(p_1^R)}$ is always less than 1. Condition (A2) then implies that $1 - F(\hat{v}_1^R) + f(\hat{v}_1^R)\{E[v_2] - \hat{v}_1^R\} = 2\bar{v} - 2\hat{v}_1^R - 1/2 < 1$. Furthermore, $\hat{v}_1^R < p_1^N$. Therefore, $-1/4 < E[v_2] - \hat{v}_1^R < 1/4$. That is, there is less misallocation

compared to that without any ex ante contract. Correspondingly, social welfare is higher than under the scenario without any ex ante contract. Q.E.D.

Proof of Lemma 2*:*

Under the right of first offer, at date 2, S offers the price p_1 to B. It is easy to show that S would never offer $p_1 < p_2{}^N$. Suppose that $p_1 \geq p_2{}^N$, B accepts the price, if and only if $v_1 - p_1 \geq \alpha(R(p_2{}^N) - R(p_1))$. The right-hand side of this condition is B's expected benefit from renegotiation. Define $\tilde{v}_1 = p_1 + \alpha(R(p_2{}^N) - R(p_1))$. S chooses p_1, or equivalently $\tilde{v}_1$, to maximize his expected revenue:

$$Max_{\tilde{v}_1 \geq \underline{v}} (1 - F(\tilde{v}_1))\tilde{v}_1 + F(\tilde{v}_1)R(p_2{}^N) - \alpha(R(p_2{}^N) - R(p_1))$$

The optimal price is $p_1{}^R$. Define $\tilde{v}_1{}^R = p_1{}^R + \alpha(R(p_2{}^N) - R(p_1{}^R))$. The following proof is similar to that of Lemma 1. Q.E.D.

Proof of Proposition 3*:*

Under the benchmark scenario without any ex ante contract, S offers p_1^N at date 2 and $p_2{}^N$ at date 3. The joint surplus for S and B is $\int_{p_1{}^N}^{\bar{v}} v_1 dF(v_1) + F(p_1{}^N)(1 - F(p_2{}^N))p_2{}^N$.

Under the right of first offer, S offers p_1^R at date 2 and B accepts the price if and only if $v_1 \geq \tilde{v}_1{}^R$. Therefore, the joint surplus for S and B is $\int_{\tilde{v}_1{}^R}^{\bar{v}} v_1 dF(v_1) + F(\tilde{v}_1{}^R)(1 - F(p_2{}^N))p_2{}^N$.

Define $Y(x) = \int_x^{\bar{v}} v_1 dF(v_1) + F(x)(1 - F(p_2{}^N))p_2{}^N$. Taking the derivative of *Y(x)* leads to $Y'(x) = f(x)[(1 - F(p_2{}^N))p_2{}^N - x]$, which is negative when $x > (1 - F(p_2{}^N))p_2{}^N$.

According to Lemma 2, $p_2{}^N \le p_1^R < \tilde{v}_1{}^R < p_1^N$. Furthermore, $p_2{}^N \ge (1 - F(p_2{}^N))p_2{}^N$. Therefore, $Y(p_1{}^N) < Y(\tilde{v}_1{}^R)$, that is, the joint surplus for S and B is higher under the right of first offer. Q.E.D.

Proof of Proposition 4:

Under the benchmark scenario without ex ante contracts, social welfare is $\int_{p_1{}^N}^{\bar{v}} v_1 dF(v_1) + F(p_1{}^N)\int_{p_2{}^N}^{\bar{v}} v_2 dF(v_2)$.

Under the right of first offer, S offers p_1^R at date 2 and B accepts the price if and only if $v_1 \ge \tilde{v}_1{}^R$. The joint surplus for S and B is $\int_{\tilde{v}_1{}^R}^{\bar{v}} v_1 dF(v_1) + F(\tilde{v}_1{}^R)\int_{p_2{}^N}^{\bar{v}} v_2 dF(v_2)$.

Define $Z(x) = \int_x^{\bar{v}} v_1 dF(v_1) + F(x)\int_{p_2{}^N}^{\bar{v}} v_2 dF(v_2)$. Taking the derivative of *Z(x)* leads to

$Z'(x) = -xf(x) + f(x)\int_{p_2{}^N}^{\bar{v}} v_2 dF(v_2)$, which is negative if $x > \int_{p_2{}^N}^{\bar{v}} v_2 dF(v_2)$ and positive if $x < \int_{p_2{}^N}^{\bar{v}} v_2 dF(v_2)$.

Note that, if $\alpha = 0$, then $\tilde{v}_1{}^R = p_1{}^N$. According to Lemma 2, $\tilde{v}_1{}^R$ decreases in α. If $p_1{}^N > \int_{p_2{}^N}^{\bar{v}} v_2 dF(v_2)$, under the right of first offer, when α increases from zero, social

welfare first increases and may decrease eventually. If $p_1^N \le \int_{p_2^N}^{\bar{v}} v_2 dF(v_2)$, when α increases from zero, social welfare always decreases.

Assume that v_1 and v_2 follow uniform distributions. Without loss of generality, let $\bar{v} - \underline{v} = 1$. When $\underline{v} < 1$, $p_1^N = \frac{\underline{v}^2 + 4\underline{v} + 3}{4}, p_2^N = \frac{\underline{v}+1}{2}$, and therefore, $p_1^N > \int_{p_2^N}^{\bar{v}} v_2 dF(v_2)$. When $\underline{v} > 1$, $p_1^N = \underline{v} + 1/2, p_2^N = \underline{v}$, and therefore, $p_1^N \le \int_{p_2^N}^{\bar{v}} v_2 dF(v_2)$. Q.E.D.

Proof of Proposition 5:

We will first prove two claims about the equilibrium without ex ante contracts and the equilibrium under the right of first offer. Then we will compare the two scenarios.

Claim 1: *If there is no ex ante contract at date 2, S offers* $p_1 \ge E[v_2]$. *There exists a unique cut-off* $\ddot{v}_1^N$ *such that B accepts the price offer at date 2 if and only if* $v_1 \ge \ddot{v}_1^N$.

To prove Claim 1, suppose that there is no ex ante contract. At date 3, B and the other buyers compete in the subsequent market. If $\delta v_1 \ge v_2$, B acquires the asset and pays $p_2 = v_2$. If $\delta v_1 < v_2$, one of the subsequent buyers acquires the asset and pays $p_2 = v_2$. That is, S's expected revenue from the subsequent market is always $E[v_2]$.

At date 2, B would accept the price offer p_1, if and only if $v_1 - p_1 \ge \int_{\underline{v}}^{\delta v_1} (\delta v_1 - v_2) dF(v_2)$. Define v_1^N as $v_1^N - \int_{\underline{v}}^{\delta v_1^N} (\delta v_1^N - v_2) dF(v_2) = p_1$. S chooses the price offer p_1, or equivalently v_1^N, to maximize his expected revenue:

$$Max_{v_1^N \geq \underline{v}} (1 - F(v_1^N))(v_1^N - \int_{\underline{v}}^{\delta v_1^N} (\delta v_1^N - v_2) dF(v_2)) + F(v_1^N) E[v_2] \quad \text{(A3)}$$

Define the solution to the above problem as $\ddot{v}_1^N$. S would offer $p_1 \geq E[v_2]$. Correspondingly, $\ddot{v}_1^N = p_1 + \int_{\underline{v}}^{\delta \ddot{v}_1^N} (\delta \ddot{v}_1^N - v_2) dF(v_2) \geq E[v_2] + \int_{\underline{v}}^{\delta \ddot{v}_1^N} (\delta \ddot{v}_1^N - v_2) dF(v_2)$

$$= \int_{\underline{v}}^{\delta \ddot{v}_1^N} \delta \ddot{v}_1^N dF(v_2) + \int_{\delta \ddot{v}_1^N}^{\bar{v}} v_2 dF(v_2) .$$

Claim 2*: Suppose that S and B have adopted the right of first offer. There exists a unique cut-off* $\ddot{v}_1^R$ *such that B accepts the price offer at date 2 if and only if* $v_1 \geq \ddot{v}_1^R$. *Compared to the benchmark scenario without any ex ante contract, at date 2, B is more likely to obtain the asset, i.e.* $\ddot{v}_1^R < \ddot{v}_1^N$.

To prove Claim 2, suppose that S and B have adopted the right of first offer. When renegotiation is allowed, there are two possible cases at date 3. First, when $v_2 \geq p_1$, given the competition between B and the subsequent buyers, S always obtains $p_2 = v_2$, the same as under the scenario without any ex ante contract.

Second, when $v_2 < p_1$, without renegotiation, the subsequent buyers could not compete. Therefore, B obtains the assets at a price of zero, even if $\delta v_1 < v_2$. Thus, S and B have incentives to renegotiate to waive the right of first offer. However, given that B has private information, renegotiation may fail. With probability α , B has all the renegotiation power: B receives $\max(\delta v_1, v_2)$ and S receives zero. With probability $1 - \alpha$, S has all the renegotiation power and offers B a transfer $t < v_2$ to waive the right of first offer. B will accept the renegotiation offer if and only if $\delta v_1 \leq t$. If $\delta v_1 > t$, renegotiation fails and then B obtains the asset at a price of zero.

Assume that, given a price offer p_1, there exists a cut-off v_1^R such that B rejects the price offer at date 2 if and only if $v_1 < v_1^R$. This will be shown to be true below.

At date 3, S updates his belief about B's valuation to be within $[\delta \underline{v}, \delta v_1^R)$. Therefore, when S has all the renegotiation power, he offers t to B, in order to maximize his expected renegotiation benefit $\frac{F(t/\delta)}{F(v_1^R)}(v_2 - t)$. Define the solution as $t(v_2)$ and define $T(v_2) = F(t(v_2)/\delta)[v_2 - t(v_2)]$.

At date 2, If $v_1 < p_1$, clearly B would reject the price offer. Now consider the case with $v_1 \geq p_1$.

When $\delta v_1 \geq p_1$, B accepts the price if and only if $v_1 - p_1 \geq \int_{\underline{v}}^{p_1} \delta v_1 dF(v_2) + \int_{p_1}^{\delta v_1} (\delta v_1 - v_2) dF(v_2)$. The right-hand side of this above inequality is B's expected benefit in the subsequent market: at date 3, if $v_2 < p_1 \leq \delta v_1$, renegotiation never succeeds and B gets the asset at a price of zero; if $p_1 \leq v_2 \leq \delta v_1$, the right of first offer is not effective and B obtains the asset at a price equal to v_2. Note that, given p_1, $v_1 - p_1 - \{\int_{\underline{v}}^{p_1} \delta v_1 dF(v_2) + \int_{p_1}^{\delta v_1} (\delta v_1 - v_2) dF(v_2)\}$ increases in v_1. Therefore, B is more likely to accept the same price offer if v_1 is higher.

If $\delta v_1 < p_1 \leq v_1$, B accepts the price if and only if $v_1 - p_1 \geq \int_{\underline{v}}^{\delta v_1} \delta v_1 dF(v_2) + \int_{\delta v_1}^{p_1} [\alpha v_2 + (1-\alpha)\max(\delta v_1, t(v_2))] dF(v_2)$. The right-hand side of this inequality is B's expected benefit in the subsequent market: if $v_2 \leq \delta v_1 < p_1$, renegotiation never succeeds and B gets the asset at a price of zero; if $\delta v_1 < v_2 < p_1$, with

probability α, B has all the renegotiation power and gets v_2, and with probability $1-\alpha$, S makes the renegotiation offer $t(v_2)$ and B accepts it only when $\delta v_1 < t(v_2)$. Now define $Q(v_1) = \quad v_1 - p_1 - \int_{\underline{v}}^{\delta v_1} \delta v_1 dF(v_2) - \int_{\delta v_1}^{p_1} [\alpha v_2 + (1-\alpha)\max(\delta v_1, t(v_2))] dF(v_2)$. Note that $\delta v_1 \geq t(v_2 = \delta v_1)$. Thus $\frac{\partial Q(v_1)}{\partial v_1} \geq 1 - \delta F(\delta v_1) - (1-\alpha)[\delta F(p_1) - \delta F(\delta v_1)] \geq 0$. Therefore, B is more likely to accept the same price offer if v_1 becomes higher. This implies that, given a price p_1, there indeed exists a cut-off v_1^R such that B accepts the price offer if and only if $v_1 \geq v_1^R$.

S chooses p_1, or equivalently, chooses v_1^R to maximize his expected revenue

$$Max_{v_1^R \geq \underline{v}} (1 - F(v_1^R)) p_1 + F(v_1^R)[\int_{p_1}^{\bar{v}} v_2 dF(v_2) + \int_{\underline{v}}^{p_1} (1-\alpha) \frac{T(v_2)}{F(v_1^R)} dF(v_2)\} \qquad \text{(A4)}$$

First of all, if $\delta v_1^R \geq p_1$, then $v_1^R - p_1 = \int_{\underline{v}}^{p_1} \delta v_1^R dF(v_2) + \int_{p_1}^{\delta v_1^R} (\delta v_1^R - v_2) dF(v_2)$.

Then the difference between the two objective functions in (A3) and (A4) is $-\int_{\underline{v}}^{p_1} [v_2 - (1-\alpha)T(v_2)] dF(v_2)$. Taking the derivative of $-\int_{\underline{v}}^{p_1} [v_2 - (1-\alpha)T(v_2)] dF(v_2)$ with respect to v_1^R results in $-(p_1 - (1-\alpha)T(p_1)) f(p_1) \frac{dp_1}{dv_1^R}$. Note that $\frac{dp_1}{dv_1^R} = \frac{1 - \delta F(\delta v_1^R)}{1 + \delta p_1 f(p_1)} > 0$.

Furthermore, $p_1 - (1-\alpha)T(p_1) = p_1 - (1-\alpha)F(t/\delta)(p_1 - t) > 0$.

Therefore, $-(p_1 - (1-\alpha)T(p_1)) f(p_1) \frac{dp_1}{dv_1^R} < 0$. Correspondingly, $\ddot{v}_1^R < \ddot{v}_1^N$.

Second, if $\delta v_1^R < p_1 \leq v_1^R$, then

$$v_1^R - p_1 = \int_{\underline{v}}^{\delta v_1^R} \delta v_1^R dF(v_2) + \int_{\delta v_1^R}^{p_1} [\alpha v_2 + (1-\alpha)\max(\delta v_1^R, t(v_2))] dF(v_2).$$

The difference between the two objective functions in (A3) and (A4) is

$$U(v_1^R) = -(1-F(v_1^R))\{\int_{\underline{v}}^{\delta v_1^R} v_2 dF(v_2) + \int_{\delta v_1^R}^{p_1} [\alpha v_2 + (1-\alpha)\max(\delta v_1^R, t(v_2)] dF(v_2)\}$$

$$- F(v_1^R)\int_{\underline{v}}^{p_1} v_2 dF(v_2) + \int_{\underline{v}}^{p_1} (1-\alpha) T(v_2) dF(v_2)$$

Using the fact that $\delta v_1^R \geq t(\delta v_1^R)$ and $T(p_1) = F(t(p_1)/\delta)(p_1 - t(p_1)) \leq p_1 F(v_1^R)$, it can be shown that $dU(v_1^R)/dv_1^R < 0$. Therefore, $\ddot{v}_1^R < \ddot{v}_1^N$.

Given Claim 1 and Claim 2 above, we can proceed to prove Proposition 5.

First consider the case with δ=1. That is, B's valuation does not decrease at all even if there is no trade at date 2. If there is no ex ante contract, the proof of Claim 1 implies that $\ddot{v}_1^N = \bar{v}$: B obtains the asset at date 2 only if he has the highest possible valuation. Therefore, there is no misallocation loss and the joint surplus for S and B is maximized. In contrast, if S and B adopt the right of first offer, according to Claim 2, $\ddot{v}_1^R < \ddot{v}_1^N = \bar{v}$: B may obtain the asset at date 2 even if his valuation is lower than the subsequent buyers' valuation. Therefore, the joint surplus for S and B is reduced. By continuity, there exists $\delta_H \in (0,1)$ such that the right of first offer reduces the joint surplus for S and B if $\delta \geq \delta_H$.

Suppose that $\alpha = 1$. Then renegotiation at date 3 always succeeds and there is no ex post misallocation at date 3. Furthermore, note that, if δ=0, this becomes the scenario analyzed in Section 3. According to Proposition 2, if δ=0 and the buyers' valuations follow uniform distributions, the right of first offer increases the joint surplus for S and

B. Therefore, given $\alpha = 1$, there exists $\delta_L \in (0, \delta_H]$ such that for any $\delta \le \delta_L$, the right of first offer increases the joint surplus for S and B. By continuity, given any fixed $\delta \le \delta_L$, there exists $\ddot{\alpha}(\delta) < 1$ such that the right of first offer increases the joint surplus for S and B if $\alpha \ge \ddot{\alpha}(\delta)$. Q.E.D.

References

Aghion, Philippe and Patrick Bolton. "Contracts as a Barrier to Entry." *American Economic Review* Vol. 77 (1987), pp. 388-401.

Bikhchandani, Sushil, Steven A. Lippman, and Reade Ryan. "On the Right-of-First-Refusal." *BE Journals of Theoretical Economics: Advances in Theoretical Economics*, Vol. 5 (2005), Article 4.

Butz, David A. "Durable Goods Monopoly and Best-Price Provisions." *American Economic Review*, Vol. 80 (1990), pp. 1062-1076.

Che, Yeon-Koo and Tai-Yeong Chung. "Contract Damages and Cooperative Investments." *Rand Journal of Economics*, Vol. 30 (1999), pp. 84-105.

Che, Yeon-Koo and Donald B. Hausch. "Cooperative Investments and the Value of Contracting." *American Economic Review*, Vol. 89 (1999), pp. 125-147.

Che, Yeon-Koo and Tracy R. Lewis. "The Role of Lockups in Takeover Contests." *Rand Journal of Economics*, Vol. 38 (2007), pp. 648-669.

Choi, Albert. "A Rent Extraction Theory of the Right of First Refusal." *Journal of Industrial Economics*, Vol. 57 (2009), pp. 252-262.

Chung, Tai-Yeong. "Incomplete Contracts, Specific Investments, and Risk Sharing." *Review of Economic Studies*, Vol. 58 (1991), pp. 1031-1042.

Cooper, T. and T. L. Fries. "The Most Favored Nation Pricing Policy and Negotiated Prices." *International Journal of Industrial Organization* (1991)

Daughety, Andrew and Jennifer Reinganum. "Exploiting Future Settlements: A Signaling Model of Most-Favored-Nation Clauses in Settlement Bargaining." *Rand Journal of Economics*, Vol.35 (2004), pp. 467-485.

Grosskopf, Brit and Alvin E. Roth. "If You are Offered the Right of First Refusal, Should You Accept? An Investigation of Contract Design." *Games and Economic Behavior,* Vol. 65 (2009), pp. 176-204.

Hua, Xinyu. "Strategic Ex ante Contracts: Rent Extraction and Opportunity Costs." *Rand Journal of Economics,* Vol. 38 (2007), pp. 786-803

Kahan, Marcel. "An Economic Analysis of Rights of First Refusal." Working paper, New York University, 1999.

Kahan, Marcel, Shmuel, Leshem, and Rangarajan, Sundaram. "Rights of First Refusal." Working paper, 2008.

Matouschek, Niko and Paolo Ramezzana. "The Role of Exclusive Contracts in Facilitating Market Transactions." *Journal of Industrial Economics*, Vol. 55 (2007), pp. 197-222.

Neilson, W. and H. Winter. "Enhancing Bargaining Power with Most Favored Customer Pricing." *Economics Letters*, Vol. 44 (1994), pp. 61-66.

Polinsky, A. Mitchell and Steve Shavell. The Handbook of Law and Economics. North-Holland, 2007.

Rogerson, William P. "Efficient Reliance and Damage Measures for Breach of Contracts." *Rand Journal of Economics*, Vol. 26 (1984), pp. 39-53.

Rogerson, William P. "Contractual Solutions to Hold-up Problems." *Review of Economic Studies*, Vol. 59 (1992), pp. 777-793.

Shavell, Steve. "The Design of Contracts and Remedies for Breach." *Quarterly Journal of Economics*, Vol. 99 (1984), pp. 121-148.

Segal, Ilya R. and Michael D. Whinston. "Exclusive Contracts and Protection of Investment." *Rand Journal of Economics*, Vol. 31 (2000), pp. 603-633.

Spier, Kathryn E. "The Use of 'Most-Favored-Nation' Clauses in Settlement of Litigation." *Rand Journal of Economics*, Vol.34 (2003), pp.78-95.

Spier, Kathryn E. and Michael D. Whinston. "On the Efficiency of Privately Stipulated Damages for Breach of Contract: Entry Barriers, Reliance, and Renegotiation." *Rand Journal of Economics*, Vol. 26 (1995), pp. 180-202.