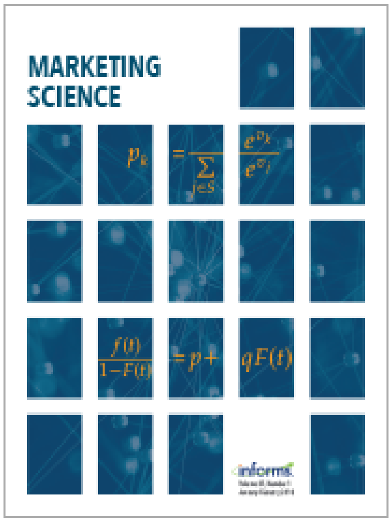

Marketing Science

Publication details, including instructions for authors and subscription information:
http://pubsonline.informs.org

Reputation in Marketing Channels: Repeated-Transactions Bargaining with Two-Sided Uncertainty

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Marketing channel interactions typically feature three characteristics that have not been incorporated together in an analytic study: (1) the parties can do business repeatedly over time, often under different terms of trade (e.g., prices may vary), (2) the terms that the seller offers one buyer may be different from those she offers another, giving each interaction the flavor of bilateral monopoly bargaining, and (3) the buyer and seller come to the interaction uncertain about the valuations each holds for the good, but they do know each other's *reputation* for valuation. The seller might, for example, come to the bargaining table aware that the buyer has a strong reputation for being willing to pay only low prices, and the buyer might come aware that the seller is strongly reputed for high cost and is, therefore, willing to offer only high prices.

The latter characteristic raises an interesting question: When engaged in a marketing channel interaction, what type of reputation is best for a buyer or seller to take to the bargaining table? In this paper, we answer that question by incorporating each of the characteristics that typify channel interactions in a formal game-theoretic bargaining model. We determine how the reputations that buyers and sellers bring to the bargaining table affect their equilibrium strategies and payoffs.

Our analysis shows that, in general, the best reputation for the seller to take to the bargaining table is one that makes the buyer nearly certain in his belief that the seller's cost is high, a result that matches intuition. The best reputation for the buyer, however, is counterintuitive. We show that an increase in the buyer's reputed willingness to pay can actually cause the seller to offer a *lower* price. The best reputation for the buyer to take to the bargaining table is, therefore, one that makes the seller believe that there is a significant chance that he is willing to pay a high price. This result is new to the literature and brings with it immediate managerial implications that we discuss. Our analysis also shows that modeling the buyer as a forward-looking strategic player yields different results than does following the normal convention of modeling the buyer as a nonstrategic price-taker. We discuss why future research on channels and on reference-dependent utility theory should consider these differences.
(*Bargaining; Channels of Distribution; Game Theory; Pricing Research*)

1. Introduction

Suppose that software giant, Microsoft, has an innovative new product, the marginal cost of which is high. They decide that the best channel for selling the product to customers is through retailing giant Wal-Mart, and Wal-Mart highly values the product. As is typical of marketing channel interactions, Wal-Mart does not know what Microsoft's cost is, and Microsoft is likewise uncertain about Wal-Mart's valuation. In other words, there is "two-sided uncer-

0732-2399/02/2103/0251/$05.00
1526-548X electronic ISSN

tainty.'' The firms are, however, familiar with each other's ''reputations,'' i.e., Microsoft's reputed marginal costs of such products and Wal-Mart's reputed willingness to pay for them.[1] Consider this question. Will Wal-Mart wind up paying Microsoft a lower or a higher price for the product if it (Wal-Mart) has a strong reputation for having a low willingness to pay for such products?

By most definitions, this marketing channel interaction is a form of bargaining (cf. Lilien et al. 1992, p. 155). It may surprise the reader that existing bargaining theory does not answer the preceding question or many others that are important to marketing practitioners and researchers. This is because, as noted by Fudenberg and Tirole (1996, p. 419), until now there has been no analysis of bargaining situations that typify channel interactions—specifically, interactions in which the parties can engage in ongoing transactions with one another, i.e., ''repeated transactions,'' and each side is uncertain about the reservation price of the other, i.e., two-sided uncertainty.[2] The answer to our question, which we present later in this section, may also be surprising.

Bargaining has held the attention of scholars in economics and business for many years. Its source of interest is natural because, in organizational markets, a bargaining process often determines the price and quantity of goods. Indeed, in many parts of the world, bargaining forms the dominant mode of all buyer-seller interactions, even in markets for simple consumer goods. It is not surprising, then, that the study of bargaining has been an important focus of the literature in marketing (see Lilien et al. 1992 for an overview of marketing contributions to bargaining theory).

Bargaining situations in which the parties have complete information about one anothers' reservation prices have been well understood for some time (cf. Rubinstein 1982). It is clearly a rare encounter, however, to find a business situation in which the parties have complete information about each others' reservation prices. Models of incomplete information take this into account, explicitly modeling a party's uncertainty about his or her opponent's reservation price as a fallible belief born of the opponent's reputation, and showing how these beliefs affect the bargaining process and outcomes (see Kennan and Wilson 1993 for a detailed review).

The key result of these models is that the bargainers try to signal to one another that their reservation prices may not be what the opponent believes. The seller tries to convince the buyer that her cost is higher than the buyer believes in an attempt to get the buyer to pay more. The buyer tries to convince the seller that his valuation is lower than the seller believes, in the hope that this will induce the seller to offer a lower price. Costly delay provides a means for the parties to credibly signal their reservation prices to one another, which facilitates the process of reaching agreement. These reputation effects have been tested in the marketing literature, and the tests have generally supported the models' qualitative predictions (cf. Srivastava et al. 2000).

An assumption of almost all of these models is that the terms of a given transaction are unaffected by any past or future transactions between the parties, i.e., these models consider ''single-transaction'' interactions. This limits their applicability because, in channel interactions for example (such as between a retail buyer and a manufacturer), each transaction may bring with it not just the immediate gains or losses that result from a specific agreement but also long-run implications. To examine such long-run relationships, we must analyze repeated-transactions bargaining. Two papers, Hart and Tirole (1988) and Schmidt (1993), have studied

[1]The most productive way to think about a firm's cost or valuation reputation is that it is a common subjective probability distribution over the possible values of its cost or valuation. For example, if you know Microsoft's (Wal-Mart's) cost (valuation) reputation, then you can associate a probability with each possible cost (valuation).

[2]The reservation price is the price at which a party is indifferent between accepting and rejecting trade in a single-period interaction. In this paper, we call the buyer's reservation price his valuation and the seller's her cost.

repeated-transactions bargaining. Both consider the behavior of buyers and sellers in the restricted case of "one-sided uncertainty," e.g., the seller knows her cost but is uncertain about the buyer's valuation, while the buyer knows both his and the seller's reservation prices. Hence, only the buyer has to worry about his reputation. The main finding is that reputation effects are stronger than they are in single-transaction interactions. That is, in a repeated-transactions interaction, a buyer with private information about his valuation tries even harder to convince the seller that it is lower than she believes (and vice versa if the seller has private information about her cost).

However, how often is it the case that in a channel relationship, only one party is uncertain about the other's reservation price or concerned about its reputation? Would one assume, for example, that Microsoft is any more or less concerned about its reputation than is Wal-Mart about its own? Despite the ease with which this question is answered, there has been no analysis of repeated-transactions bargaining with two-sided uncertainty to show whether or not and, if so, how reputation concerns on both sides affect ongoing trade relationships.

In this paper, we analyze a formal game-theoretic model of repeated-transactions bargaining with two-sided uncertainty to show how reputation concern on both sides affects strategies and outcomes. In our model, a seller with private information about her cost makes a take-it-or-leave-it price offer each period to a buyer with private information about his valuation, and the buyer may either accept or reject the seller's offer. We show that reputation concern on both sides does, indeed, make a difference. The price that Wal-Mart winds up paying can actually *decrease* as its reputed valuation *increases.* This result is new to the literature and contradicts those of one-sided uncertainty models in which the buyer is never better off if the seller believes that he is willing to pay more (cf. Hart and Tirole 1988). The logic behind this result follows.

If Wal-Mart is strongly reputed to be *un*willing to pay high prices, then the only thing that would cause Microsoft to offer a high price is high cost. This is because Wal-Mart's "tough" reputation would cause a *low cost* Microsoft to expect higher profit from offering a price that is low enough that even a tough Wal-Mart would accept it. In other words, if Wal-Mart has an extremely tough reputation, then a high price is proof of Microsoft's high cost. Now, because Wal-Mart highly values the product, it will pay a high price if there is no way that it can extract a low price from Microsoft. And there is no way if Microsoft's cost is too high for it to profitably sell the product at a low price. So, proof of Microsoft's high cost means that Wal-Mart will pay a high price, and Wal-Mart's tough reputation creates just the right conditions for Microsoft to deliver such proof.

The balance of the paper is organized as follows. We introduce the model in §2. We use a formal game-theoretic approach to model the interaction between buyer and seller. Specifically, we model a multiperiod, multistage game of incomplete information. Our analyses reveal that optimal strategies are of several qualitatively different types. To understand these strategies, it is helpful to see how they arise in simpler situations. Thus, in §2, we also examine the actions that a myopic buyer and seller would take to establish some important preliminary results. The main analysis is presented in §3, where we derive the equilibrium paths of the game. The key to the analyses is understanding how different buyer and seller reputations lead to different strategies. Sections 2 and 3 are, therefore, primarily devoted to establishing the reputation boundaries that mark qualitatively different buyer and seller strategies and explaining the intuition behind the results. In §4, we discuss the players' optimal reputations, i.e., the reputations that lead to maximum payoffs. In §5, we discuss the implications of the results for marketing theory and practice. The discussions in the text describe the basic logic behind the results and their implications. Readers interested in details of the derivations of the results will find them in the appendices. Throughout the text, footnotes direct interested readers to the appropriate parts of the appendices.

2. The Model

There are many different sorts of business situations that can be modeled as repeated-transactions bargaining with two-sided uncertainty. In our analysis, we simplify this rich domain to two-period games. There is an opportunity for a transaction in each period. The key characteristics of each player, i.e., the buyer's valuation and the seller's cost, are exogenously determined, are the same each period, and are known with certainty for his own but only probabilistically for his opponent's characteristics. In each period, the risk-neutral seller chooses a price and the risk-neutral buyer accepts or declines the offer. The following stylized example introduces the model's basic setup (the formal model on which the following example is based is presented in Table A.1 in Appendix 1):

B represents a major construction firm. For a given project, B purchases plywood on two occasions: A first purchase at the foundation phase of the project and a second at the roofing phase. B can buy plywood from an internal source at a transfer price, v, that is one of two values, low, v^-, or high, v^+. The transfer price is the same over both phases of a given project but may change from project to project. Alternatively, B can buy the plywood from S, who represents a major plywood supplier, at the price S offers (if S's price is no more than the transfer price; the transfer price, v, thus represents B's valuation of S's plywood). B may accept or reject S's offer, but there is no haggling (or both parties appropriately regard any haggling as cheap talk). B knows his valuation but S does not. The current belief in the industry is that there is a $\beta_0 \in (0, 1)$ probability that B's valuation is high, v^+. B knows his firm's reputation (i.e., he knows that S assigns a β_0 probability to the event that his valuation is high).

Building on this setup, we next establish some preliminary results that will prove useful for our subsequent analyses.

2.1. Both Parties Are Myopic

Assume that both B and S are myopic. That is, at the foundation phase of the project, they seek to maximize profit for that phase only, ignoring how their decisions may potentially affect their payoffs at the roofing phase. As is standard, we assume that when B is myopic, he will accept any offer from S that is less than or equal to his valuation, the transfer price. Therefore, at phase t (where $t = 1$ is the foundation and $t = 2$ is the roofing phase), B will always accept a price, p_t, up to v^-. So S will never offer any price lower than v^-. Also, the only price greater than v^- that S will consider offering is v^+, because B will accept a price greater than v^- only if his valuation is v^+, in which case he will accept v^+. Which of the two prices, v^- or v^+, is chosen by S depends on B's reputation entering period t, β_{t-1}, and on the cost, κ, of plywood to S. Like B's valuation, S's cost is the same over both phases of the project but may change from project to project. The cost of plywood to S takes on one of two values, low, κ^-, or high, κ^+. S knows if her cost is low or high, but B does not. B does know, however, that the current common belief in the industry is that there is a $b_0 \in (0, 1)$ probability that S's cost is high, κ^+. S knows her firm's reputation. We assume that $\kappa^- < v^- < \kappa^+ < v^+$. This assumption says that a low cost S can profitably trade with B whether B's valuation is low or high, but that a high cost S can profitably trade with B only if B's valuation is high. This allows our model to capture a wide range of uncertainty in market conditions. From the seller's perspective, some potential customers are profitable and others are not. From the buyer's perspective, some sellers can offer surplus while others cannot. We believe that this is realistic because in real markets, the parties usually will not know ahead of time if the buyer's valuation and the seller's cost are such that trade will benefit them both.

For notational convenience, from here on, we will use some shorthand when referring to the seller. If S's cost is low, then S^- will be used to refer to her. If her cost is high, S^+ will refer to her. It is important to remember, however, that there is but one seller in the model; S^- refers to her *in the event that* her cost is low while S^+ refers to her in the event that her cost is high.

If the Seller's Cost Is Low. S^- can offer v^- for a sure payoff of $v^- - \kappa^-$, or she can offer v^+ for an expected payoff of $(v^+ - \kappa^-)\beta_{t-1}$. Thus, it is easy to see that (a myopic) S^- will price high (i.e., $p_t = v^+$) if $\beta_{t-1} > \beta^\circ$, where

$$\beta^\circ = \frac{v^- - \kappa^-}{v^+ - \kappa^-}. \tag{1}$$

If $\beta_{t-1} < \beta^\circ$, then S^- will price low (i.e., $p_t = v^-$), and she is indifferent between pricing high and pricing low if $\beta_{t-1} = \beta^\circ$. In essence, a myopic S^- faces a choice between two strategies: She can either "gamble" on a high valuation buyer by pricing high, or "take the sure thing" by pricing low. Our subsequent analyses will show that these two generic pricing strategies can be optimal for S^- even when she is forward looking, but in many cases new strategies emerge that are superior to both.

If the Seller's Cost Is High. For S^+, offering the low price yields a negative payoff because her cost, κ^-, exceeds the low price, v^-. Her best strategy, then, is simple: A myopic S^+ always offers the high price, v^+.

The Role and Evolution of the Buyer's Reputation. The mutual myopia that we have thus far assumed provides the easiest case in which to examine how the buyer's reputation affects the seller's pricing strategy and how his reputation evolves. We have seen that the best period t price for a myopic S^- depends on the relationship between the reputation that B brings to the table, β_{t-1}, and the threshold β°. β° is an important boundary in all of our subsequent analyses, and we will refer to it frequently. From here on, we will say that S is "optimistic" in period t when $\beta_{t-1} > \beta^\circ$ and "pessimistic" when $\beta_{t-1} < \beta^\circ$. This means that a myopic S^- prices low if she is pessimistic and high if she is optimistic (and either low or high if $\beta_{t-1} = \beta^\circ$).[3] Reputation plays no role in the pricing strategy of a myopic S^+ because v^- is below her cost.

The simplicity of a myopic B's strategy (i.e., accept S's price if it is no higher than his valuation and, otherwise, reject it) allows the simplest demonstration of the Bayesian process by which B's reputation evolves from its period t prior, β_{t-1}, to its period t posterior, β_t. If S offers the high price at the foundation phase and it is accepted, then S knows that B's valuation is high, i.e., $\beta_1 = 1$, because if his valuation was low, he would have rejected this price. If, on the other hand, B rejects the high price, then S knows that B's valuation is low, i.e., $\beta_1 = 0$. If S offers the low price at the foundation phase, its acceptance tells S nothing about B and his reputation is unchanged, i.e., $\beta_1 = \beta_0$, because B accepts the low price whether his valuation is low or high.[4]

The Key Results. There are two key results in this subsection. First, because B's valuation and S's cost are not the same from one project to another, they both *should* be myopic in the second period of a project. Hence, the myopic results are, in fact, the optima of the second period of the interaction. Second, B's action in the first period may tell S something about him that she can later use. Suppose, for example, that: (1) S's cost is low, (2) at the foundation phase she is optimistic, and (3) B rejects the high price that S offers. At the roofing phase, then, S will not repeat that mistake! Having learned that B's valuation is low, she

[3]The labels "optimistic" and "pessimistic" are used for convenience. The reader should not interpret them to mean that if the seller is optimistic or pessimistic, her belief about the buyer deviates from the norm. Rather, they describe how the norm, as captured by the buyer's reputation in the industry, β_0, affects the seller's outlook. That is, the seller is more optimistic (pessimistic) about her odds of being paid a high price if the buyer's reputation for having a high valuation is stronger (weaker), i.e., if β_0 is larger (smaller).

[4]S's posterior belief, $\beta_1(\bullet)$, is actually a function of several arguments, but we will suppress the arguments unless they are needed for clarity. Equation (A.1) and accompanying discussion in Appendix 1, give the details of the function. The reader may be wondering: "What does S conclude if B rejects the low price?" Surprisingly, answering such a question can be rather involved, but in this particular instance it is not. Rejecting the low price is suboptimal for B whether his valuation is low or high, so such an occurrence tells S nothing. Her posterior belief is the same as her prior belief. More generally, such an occurrence is an instance of what game theorists have termed "zero (prior) probability events." Given the occurrence of such an event, Bayes' rule provides no updating guidance. The most influential paper on how to deal with this problem is Cho and Kreps (1987), and in our analyses, we apply their Intuitive Criterion wherever possible to restrict beliefs following zero probability events.

will offer the low price and make the sale. Of course, a myopic S does not look ahead to the potential benefits or costs of this learning when she chooses her foundation phase price, and nor does a myopic B when he chooses to accept or reject her price. We next suppose that S is not so limited in her thinking, and things get more interesting.

2.2. Forward-Looking Seller and Myopic Buyer

Assume that S looks ahead to the roofing phase when she sets the price for the foundation phase of B's project but that B remains myopic (i.e., he will accept any price from S up to his valuation). With foresight, S looks ahead and can see that a high initial price is not an all-or-nothing proposition. If B accepts the high initial price, then S gets a payoff of $v^+ - \kappa$ in both periods. Even if B rejects the high price, S still gets a second-period payoff of $v^- - \kappa^-$ if her cost is low (and if her cost is high, she has learned that it was never feasible for them to do business). So, a forward-looking S^- can profit from what she learns from B's first-period response, no matter what that response is. When S's strategy exploits the ability to learn from B's first-period response, we say that she has opted for the "learn-then-discriminate" strategy.

If the Seller's Cost Is Low. To determine when the learn-then-discriminate strategy is the seller's best option, assume that S's cost is low and consider some first-period price, call it p', that B will accept if, but only if, his valuation is high, which implies $v^- < p' \leq v^+$. If B accepts this price, then S will know that his valuation is high, she will offer v^+ in the second period, and B will accept it. In this case, S obtains a payoff of $p' - \kappa^- + (v^+ - \kappa^-)\delta$, where $\delta \in (0, 1)$ is the discount factor. If B rejects this offer, then S will know that his valuation is low, she will offer v^- in the second period, and it will be accepted. In this case, her payoff is $(v^- - \kappa^-)\delta$. So, the expected payoff from offering p' in the first period, and then basing the second-period price on what is learned from B's first-period response is

$$\pi(p', \kappa^-) = [p' - \kappa^- + (v^+ - \kappa^-)\delta]\beta_0 + (v^- - \kappa^-) \times (1 - \beta_0)\delta.$$

Of course, if S^- opts to take the sure thing, i.e., $p_1 = p_2 = v^-$, she is assured a payoff of

$$\pi(v^-, \kappa^-) = v^- - \kappa^- + (v^- - \kappa^-)\delta. \tag{2}$$

It is easy to show that these strategies yield the same profit for S if $p' = p^+$, where

$$p^+ = \kappa^- + \frac{v^- - \kappa^-}{\beta_0} - (v^+ - v^-)\delta. \tag{3}$$

The value of p^+ makes an important difference in the strategy that S^- chooses.[5] Because B is myopic, if he will accept p^+, then he will accept any price up to v^+. So if S is going to offer a price higher than v^-, the best price to offer is v^+. This means that whether S's optimum strategy is to price low in both periods (i.e., take the sure thing) or to initially price high and then price in the second period based on B's response (i.e., learn then discriminate) depends on the relationship between p^+ and v^+. Figure 1 shows that a forward-looking S^- facing a myopic B will take the sure thing if $p^+ > v^+$. She will choose the learn-then-discriminate strategy if $p^+ < v^+$. S is indifferent between these two strategies if $p^+ = v^+$.

The point where $p^+ = v^+$ defines another key point of seller indifference. For if S^- is so pessimistic that she prefers take the sure thing over learn then discriminate when a high valuation B is certain to accept the highest of all prices (i.e., when $p^+ = v^+$), then she is quite pessimistic indeed! To see this,

[5]The precise definition of p^+ is that it is the first-period price that, if certain to be accepted by a high valuation B but certain to be rejected by a low valuation B, yields the same expected payoff to S^- as does take the sure thing.

define β^{--} as the value of B's initial reputation when $p^+ = v^+$, which yields

$$\beta^{--} = \frac{v^- - \kappa^-}{v^+ - \kappa^- + (v^+ - v^-)\delta}, \tag{4}$$

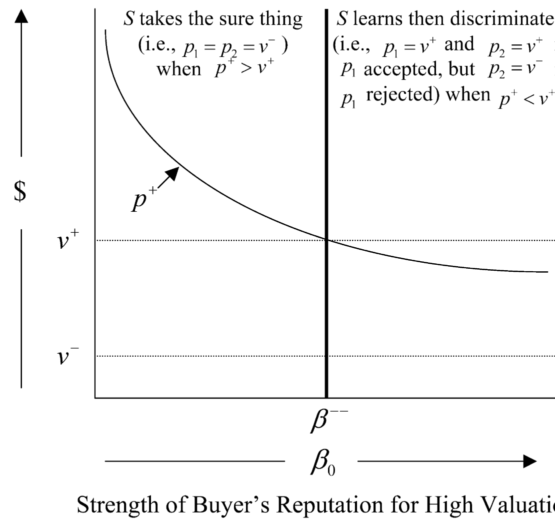
and note that $\beta^{--} < \beta^\circ$, as comparing Equations (1) and (4) shows. β^{--} is, thus, a critical boundary because what we have shown here is that if $\beta_0 < \beta^{--}$, then take the sure thing gives S^- a higher expected payoff than *any* other strategy and is the *strictly dominant* strategy for her if $\beta_0 < \beta^{--}$. $\beta_0 \geqslant \beta^{--}$ means that a forward-looking low-cost seller does not play it so safe in the first period *even if* $\beta_0 < \beta^\circ$ (recall that, if myopic, $\beta_0 < \beta^\circ$ means that she takes the sure thing). This shows that, compared to the situation if the seller is myopic, looking ahead makes a low-cost seller more aggressive in the sense that she is more willing to offer a high initial price to exploit the possibility that the buyer's valuation is high.

If the Seller's Cost is High. Because S^+ cannot profitably trade with a low valuation buyer, she cannot increase her payoff by using what she learns from the buyer's initial response. As before, the only price that she will offer is v^+.

The Key Results. The key results of this subsection are as follows. First, for S^-, offering any price less than p^+ but higher than v^- is less attractive than take the sure thing. So, *S^- will never offer a first-period price between v^- and p^+*. Second, if $\beta_0 < \beta^{--}$, then S^- strictly prefers take the sure thing to any other strategy. Finally, as compared to being myopic, looking ahead makes the seller more willing to offer a high first-period price to exploit the possibility that the buyer's valuation is high.

To this point, we have kept the buyer myopic to establish several useful results. Due to his myopia, the buyer acted as a "price-taker," always accepting the seller's price if it is no higher than his valuation, and has been oblivious to the potential benefits of managing his reputation. Moreover, because the only thing that has mattered to the buyer is how the seller's offer and his valuation compare, the seller has not had to worry about managing her reputation either. In the remainder of this paper, we lift this restriction on the buyer's thinking and move to the more realistic setting in which both players look ahead. We will see that this makes a big difference, as in this setting reputation concerns dominate the players' strategies.

Figure 1 **Effect of (Myopic) B's Reputation on Optimal Strategy for Low-Cost Forward-Looking S**



3. The Main Analysis

To derive the optimal strategies for the two-period repeated-transactions bargaining game in which both parties are free from the limitations of myopic thinking, we seek the perfect Bayesian equilibrium (PBE) paths of the formal model presented by Table A.1 in Appendix 1. A PBE requires that players' strategies be optimal given their beliefs, and beliefs are obtained from equilibrium strategies and observed actions using Bayes' rule where possible (Fudenberg and Tirole 1991). In this section we present the main PBE paths.

The notation and definitions introduced in the previous section carry over to the present discussion. As with the preliminary analyses, qualitative aspects of the strategies are strongly influenced by the reputation that B brings to the table, β_0. Also, as before, the qualitative aspects of the equilibrium strategies change depending on the relationships between β_0 and a small number of boundary values, $\beta^{--} < \beta^{-} < \beta^{\circ} \leqslant \beta^{+} \leqslant \beta^{++}$. Unlike the previous section, the buyer is now forward looking. As a result of this, the seller's initial and posterior reputations, b_0 and b_1, respectively, will also become important. In equilibrium, the seller offers a small number of initial prices, i.e., $v^{-} < p^{-} < p^{\circ} < p^{+} < v^{+}$.

In equilibrium, S^{-} chooses one of the three generic strategies described earlier: take the sure thing, learn then discriminate, or gamble. A new strategy emerges for the seller if her cost is high. Facing a forward-looking buyer gives S^{+} reason to be concerned about her reputation and, hence, she sometimes offers a price that proves to the buyer that her cost is high. Accordingly, when she does this, we say that she has opted for the strategy "signal high cost."

Because the lowest price that S offers in period 2 is v^{-}, it is a straightforward exercise in backward induction to show that the lowest price she offers in period 1 is also v^{-}. Therefore, if B's valuation is low (i.e., if $v = v^{-}$), he is a "price-taker." That is, in both periods, he accepts S's offer if it is no more than his valuation, v^{-}, and, otherwise, he rejects it. If B's valuation is low, then, he is not really a strategic player—his choice of strategy in no way affects the outcome. However, if the buyer's valuation is high, he has more options. Denote by y_1 the buyer's strategy if his valuation is high, where y_1 is the probability with which he accepts S's period 1 offer, and let y_1^{*} be his optimal strategy. Unless otherwise stated, subsequent discussion of buyer strategy refers to the choice of y_1, and we will not discuss the simple strategy that he uses if his valuation is low.

One of the important results of our analysis is that the buyer's choice of y_1 can affect the prices that the seller offers. For example, by being willing to reject a high price, i.e., $y_1 = 0$, the buyer can sometimes induce the seller to offer a lower price than she would otherwise. So, even though B makes no counteroffers, his strategy, y_1, does have an effect on the outcome. This is an important result for the marketing literature, because most models of buyer-seller interactions in marketing cast the buyer (whatever his valuation) as a simple price-taker when there is no haggling. Our results will show that when the buyer has a reputation to manage (i.e., when the seller is uncertain about his true valuation), then modeling the buyer as an intelligent, forward-looking player reveals that he is not powerless in the interaction; the buyer is a strategic player.

We do not restrict the buyer to pure strategies (i.e., we do not assume that y_1 must either be 1 or 0), so he may choose a mixed strategy (i.e., y_1 may lie anywhere in the interval [0,1]) if doing so optimizes his expected payoff.[6] Indeed, a fascinating result involves the buyer's use of a mixed strategy that makes high prices unattractive for S^{-}. When playing this strategy, the buyer accepts a high price with a small enough probability to cause S^{-} to take the sure thing, which means that S^{+} can signal high cost by offering a high price. When the buyer plays this strategy, we say that he opted to "screen the seller types."

Table 1 is an overview of the main results, the "pooling" and "separating" equilibria.[7]

In the remainder of this section, we describe the logic behind the equilibrium results presented in Table 1. Detailed discussions of these results are provided in the appendices.

3.1. A Hyperpessimistic Seller

When the prospects of facing a high valuation B are so slim that take the sure thing is the strictly dominant strategy for S^{-}, we say that S is "hyperpessimistic." So, S is hyperpessimistic when $\beta_0 < \beta^{--}$. Note that the boundary that defines hyperpessimism, β^{--}, is the same as discussed for a forward-looking S and a myopic B, and optimal strategies are similarly the same. S^{-} offers v^{-} in both periods.

[6] This makes it important to note the distinction between the buyer's strategy, y_1, which need not be binary, and his action. His action is binary because in the end, he will either accept or reject.

[7] There are three types of PBE of this game: pooling, separating, and hybrid. S^{-} and + S^{+} offer the same period 1 price in a pooling PBE and different prices in a separating PBE. In a hybrid PBE, S^{-} randomizes between pooling with and separating from S^{+}. In our analysis, hybrid PBE are special cases and are relegated to Appendix 2.

Table 1 Pooling and Separating Perfect Bayesian Equilibrium Paths

		Effect of Buyer's Initial Reputation, β_0, on Seller's Disposition					
		Hyper Pessimistic $\beta_0 < \beta^{--}$	*Very Pessimistic* $\beta^{--} \le \beta_0 < \beta^{-}$	*Moderately Pessimistic* $\beta^{-} \le \beta_0 < \beta^{\circ}$	*Moderately Optimistic* $\beta^{\circ} < \beta_0 < \beta^{+}$	*Very Optimistic* $\beta^{+} \le \beta_0 < \beta^{++}$	*Hyper Optimistic* $\beta^{++} \le \beta_0$
Seller's Strategy	Separating PBE						
	Low Cost Seller		$v^-, \{v^-, \varnothing\}$ Take-the-sure-thing			$p^-, \{v^+, v^-\}$ Learn-then-discriminate	
	High Cost Seller	$v^+, \{v^+, \otimes\}$	$p^+, \{v^+, \otimes\}$ Signal-high-cost	$v^+, \{v^+, v^+\}$		$v^+, \{v^+, v^+\}$ Signal-high-cost	
	Pooling PBE			$p^{\circ}, \{v^+, v^-/\otimes\}$ Learn-then-discriminate			$v^+, \{v^+, v^+\}$ Gamble
Buyer's Strategy	If $p_1 < v^+$			$y_1 = 1$ Take-the-surplus			
	If $p_1 = v^+$	$y_1 = 1$ Accept-fate	fate	$0 < y_1 < y^-$ Screen-the-seller-types		$y^{\circ} \le y_1 < y^+$ Screen-the-seller-types	$y_1 = y^{\circ}$ Accept-

Reading this table. Seller's prices are presented as follows: p_1, {p_2 if p_1 is accepted, p_2 if p_1 is rejected}, or p_1, {$p_2$if p_1 is accepted, low cost seller's p_2 if p_1 is rejected/high cost seller's p_2 if p_1 is rejected}. $\varnothing$ indicates outcomes that do not occur in equilibrium. $\otimes$ indicates that high cost seller withdraws because she cannot trade with the buyer. Shaded cells have no equilibrium activity: For example, there is no separating equilibrium when the seller is moderately optimistic.

Because a hyperpessimistic S^-'s dominant strategy is take the sure thing, S^+ can signal high cost by offering *any* price between the minimum acceptable to her, which we denote by $p^{\min}$ (and derive later in this section), and the maximum acceptable to the buyer, v^+.

Importantly, when S is hyperpessimistic, B is certain to accept any offer that convinces him that S's cost is high. This is because if B knows that S's cost is high, then he also knows that her second-period price will be high and that it does him no good to reject her initial offer.[8] So S^+ knows that B will accept any price that signals her high cost if his valuation is high. She will, of course, choose the highest such price. So when the seller is hyperpessimistic, the equilibrium is separating. S^- takes the sure thing, S^+ signals high cost by offering v^+, and B must "accept fate" and pay her high price.[9]

3.2. The Reputation Space

When the seller is hyperpessimistic, i.e., when $\beta_0 < \beta^{--}$, the parties' strategies are affected by only the *buyer's* reputation. If $\beta_0 \geqslant \beta^{--}$, optimal strategies depend on the interaction between B's and S's reputations. The key driver of this interaction is $p^{\min}$, the value of which depends on the reputation that S brings to the bargaining table, $b_0 \in (0,1)$.[10] Lemma 1 in Appendix 2 uses S's initial reputation to establish that $p^{\min}$ is the larger of p° and κ^+, where

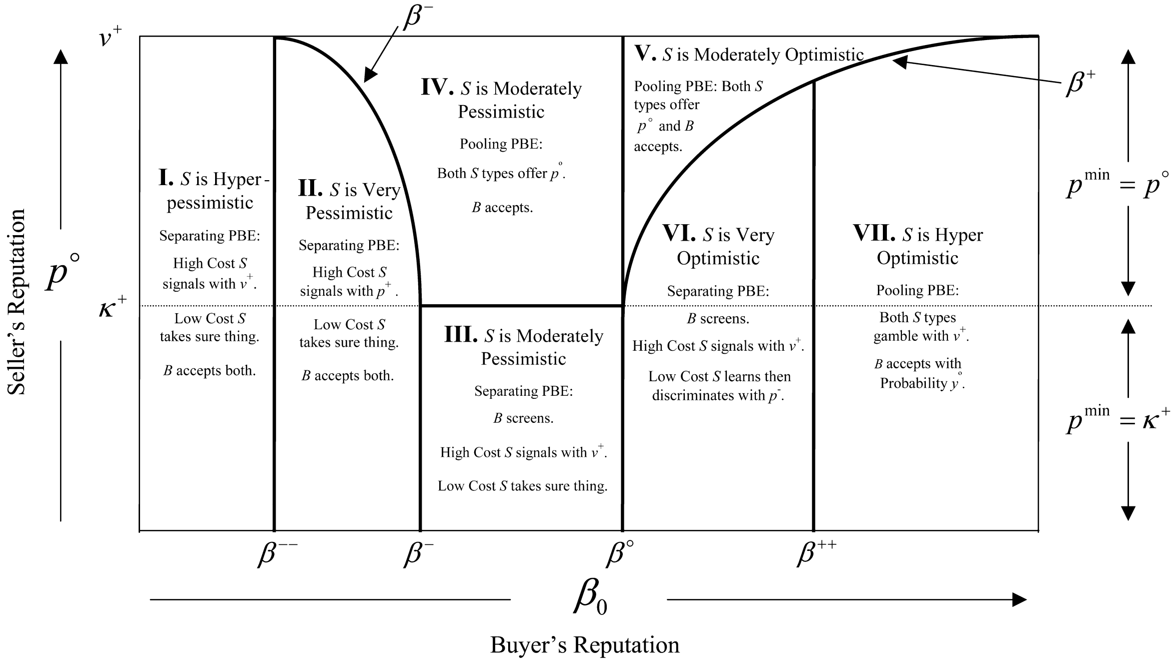
$$p^{\circ} = v^+ - (v^+ - v^-)(1 - b_0)\delta. \tag{5}$$

[8]Proposition 1 in Appendix 2 defines the generic set of first-period offers that the buyer is certain to accept.

[9]Lemma 3 provides details of the buyer's beliefs and strategy when the seller is hyperpessimistic. Proposition 3 formally states the equilibrium. Both are in Appendix 2.

[10]The seller's initial reputation, b_0, also represents the buyer's initial belief about the probability that the seller's cost is high, and like β_0, it is common knowledge.

Figure 2 Summary of the Effects of the Parties' Reputations on Equilibrium Strategies with p° as Proxy for S's Reputation



The proof establishes that if S^+ is willing to offer p°, then B is certain to accept it even if the offer gives him no information about S's cost. In fact, the precise definition of p° is that it is the highest "pooling price" that B is certain to accept in the first period.[11] Importantly, this means that B will reject any pooling price higher than p°.[12] Notice that as b_0 increases (i.e., as the seller's initial reputation for high cost grows stronger), p° increases. This makes p° a good proxy for the strength of S's initial reputation for high cost, and we will often use it as such.

Figure 2 is a summary illustration of the main results. It shows how the initial reputations interact to yield the various equilibria. For the reader's convenience, the figure depicts seven regions, labeled I through VII. Each region describes a pooling or separating equilibrium. Region I of Figure 2 describes the separating equilibrium that arises when S is hyperpessimistic, i.e., when $\beta_0 < \beta^{--}$, which we discussed in §3.1. The figure makes clear that to identify which region describes any equilibrium except that in Region I, it is necessary to consider both B's initial reputation for high valuation, β_0, and S's initial reputation for high cost, captured by p°. For example, suppose that B's reputation is a little beyond the boundary for hyperpessimism, β^{--}. Then, either region II or IV could describe the situation, depending on whether S's reputation for high cost is strong. If S's reputation for high cost is strong, i.e., if p° is large, then Region IV applies; if her reputation for high cost is not strong, Region II applies. The same is true for all of Regions II through VII, and the balance of this section is devoted to discussing those regions.

3.3. A Very Pessimistic Seller

As B's initial reputation for having a high valuation grows stronger (i.e., as β_0 increases), S^- becomes tempted to offer a price that B would accept only if his valuation is high instead of taking the sure thing. This means that p^+ decreases as β_0 increases

[11] A "pooling price" does not change the seller's reputation. So, if $b_1(b_0, p_1) = b_0$, then p_1 is a pooling price.

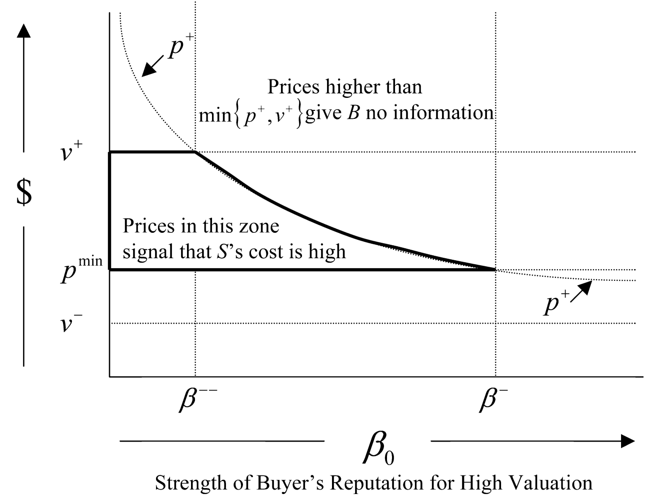
[12] Corollary 1 in Appendix 2 defines the generic set of first-period prices that the buyer is certain to reject.

(see Equation (3)). This is bad news for S^+, for when $p^+ \leqslant v^+$ she cannot signal high cost by offering a price as high as v^+ because S^- is also willing to offer this price. In fact, because S^- is willing to offer any price of p^+ or more, S^+ cannot signal high cost with any offer higher than p^+. B will, therefore, reject any price higher than p^+.[13] However, until p^+ falls to the point where $p^+ = p^{\min}$, there remain some prices that are acceptable to S^+ (i.e., prices at least as high as $p^{\min}$) that are unacceptable to S^- (i.e., prices higher than v^- but lower than p^+). Define β^- as B's initial reputation at the point where $p^+ = p^{\min}$.[14] Then, $\beta^{--} \leqslant \beta_0 < \beta^-$, means that S^+ can signal her high cost by offering any price between $p^{\min}$ and p^+. When $\beta^{--} \leqslant \beta_0 < \beta^-$, we say that S is "very pessimistic." Figure 3 illustrates this discussion and that of §3.1, showing the set of prices that signal high cost when the seller is very pessimistic (i.e., $\beta^{--} \leqslant \beta_0 < \beta^-$) as well as hyperpessimistic (i.e., $\beta_0 < \beta^{--}$).

Any offer in the signal zone informs B that S's cost is high, which also informs B that the second-period price will be high. B, therefore, knows that it does him no good to reject any such offer. Region II of Figure 2 describes the separating equilibrium that results: S^+ offers the highest price that signals high cost, p^+, and S^- takes the sure thing.[15]

This equilibrium shows for the first time how the buyer's strategy, and not just his reputation, can affect the price that the seller offers. To see how this happens, just note that if B were willing to accept any first-period offer up to his valuation, v^+, then the (very pessimistic) seller would offer v^+ whether her cost is low or high, and B would get no surplus. Because B is a forward-looking strategic player, he is willing to reject any first-period offer that is higher than p^+ when S is very pessimistic. It is only because of this willingness that S^- chooses take the sure thing, S^+ chooses to signal high cost with p^+, and B enjoys positive surplus whether S's cost is low or high.

Figure 3 **Effects of *S*'s First-Period Offer on Her Reputation When *S* Is Hyper- or Very Pessimistic**



It is important to understand why B stands ready to reject any first-period offer that is higher than p^+, even if the price is *not* higher than his valuation, v^+. It is because, were he willing to pay such a price, then a very pessimistic S would offer it whether her cost is low or high. Then, however, the offer would give B no new information about S's cost (i.e., his posterior belief about the seller's cost would be the same as his prior). In other words, it would be a pooling offer that exceeds $p°$. However, as Corollary 1 establishes, B rejects any pooling offer that is higher than $p°$ when S is pessimistic. We further comment on this in the discussion in §5.

The Region II equilibrium also answers the question with which we opened this paper, and it provides what is, perhaps, the most surprising result of our analyses. The buyer actually winds up better off with a *stronger* reputation for having a *high* valuation. In short, this happens because when S is less pessimistic, high prices are more tempting to S^-. As

[13]Because S^- is willing to offer any price of p^+ or more when she is very pessimistic, any such offer would give B no new information about S's cost (i.e., when the seller is very pessimistic, then $(b_1(b_0, p_1) = b_0$ if $p_1 > p^+)$. Then we would have a pooling offer that exceeds $p°$, and Corollary 1 establishes that B rejects any such offer when S is pessimistic.

[14]β^- is derived in Appendix 1 (see Equation (A.2) and accompanying discussion).

[15]Actually, the highest price that would be a foolproof signal of high cost is just lower than p^+, i.e., $p^+ - \epsilon$, where ϵ is some vanishingly small positive number. We ignore this nuance with no qualitative effect. Lemma 3 gives details of the buyer's beliefs and strategy when the seller is very pessimistic. Proposition 3 formally states the equilibrium.

a result, S^+ must signal by offering relatively lower prices, a phenomenon that is clearly illustrated by Figure 3. The managerial significance of this result is immediate and powerful. Intuition, as well as analyses of one-sided uncertainty models, says that a buyer cannot be better off when his reputation for having a high valuation grows stronger. As a result, most firms understandably try to cultivate the toughest possible reputations as buyers, i.e., they want β_0 as close to zero as possible. However, once we allow that the seller is also concerned about its reputation and may, therefore, seek to signal its cost, we see that the toughest possible reputation is not best for the buyer. When we derive optimal reputations in §4, we will see that the optimal value of β_0 may be quite a bit larger than zero.

3.4. A Moderately Pessimistic or Moderately Optimistic Seller

As B's reputation for having a high valuation, β_0, grows even stronger, there comes a point at which S^- is willing to offer *any* first-period price that S^+ is willing to offer if she knows B will accept it. Figure 3 shows that this is the case when $\beta_0 = \beta^-$ because then $p^+ = p^{\min}$ (recall that $p^{\min}$ is defined as the lowest price that S^+ will offer). The important thing to note here is that when $p^+ \leqslant p^{\min}$ (or, equivalently, when $\beta_0 \geqslant \beta^-$), S^+ cannot signal high cost with any price that B is certain to accept. The issue that S^+ must resolve, then, is whether it is optimal for her to offer the pooling price that B is certain to accept, p°, or if it is best for her to offer a higher price that B will accept only probabilistically. The answer depends on the strength of S's repuation for high cost. If her reputation for high cost is strong enough that $p^\circ \geqslant \kappa^+$ (i.e., if $p^{\min} = p^\circ$), then S^+ is willing to offer p° up to the point at which she becomes optimistic enough to offer a higher first-period price, which occurs when $\beta_0 = \beta^+$.[16] We say that S is "moderately optimistic" when $\beta^\circ < \beta_0 < \beta^+$ and "moderately pessimistic" when $\beta^- \leqslant \beta_0 < \beta^\circ$.

When the Seller Has a High-Cost Reputation ($p^{\min} = p^\circ$). When S's reputation is such that $p^\circ \geqslant \kappa^+$ (i.e., $p^{\min} = p^\circ$), and she is moderately pessimistic (i.e., $\beta^- \leqslant \beta_0 < \beta^\circ$) or moderately optimistic (i.e., $\beta^\circ < \beta_0 < \beta^+$), Regions IV and V, respectively, of Figure 2 describe the pooling equilibrium that results. In either case, S^+ offers p° in the first period, and B accepts. Because B accepts p°, this price is also attractive to S^-, who can learn then discriminate by offering it.[17]

When the Seller Has a Low-Cost Reputation ($p^{\min} = \kappa^+$). When $p^\circ < \kappa^+$ (i.e., $p^{\min} = \kappa^+$), then B knows that S^+ will not offer p°. So, certain acceptance of this price is no longer optimal for him. Region III of Figure 2 describes the separating equilibrium that results when $p^{\min} = \kappa^+$ and S is moderately pessimistic.[18] Like that in Region II, this equilibrium is an example of how the buyer's strategy affects the seller's offer. B screens-the-seller-types by accepting a high initial price, v^+, with large enough probability to make offering this price appeal to S^+, but too small a probability to make it appeal to S^-. Specifically, B accepts v^+ with any probability, y_1, that satisfies $0 < y_1 < y^-$, and this mixed strategy response invites S^+ to offer v^+ but forces S^- to take the sure thing.[19] It is important to note here that on observing an offer of v^+, B is indifferent as to the outcome of his mixed strategy. If he accepts, then his payoff is obviously zero. If he rejects, his expected payoff is also zero because his

[16] We derive β^+ in Appendix 1 (see Equation A.3) and accompanying discussion).

[17] Note that when $p^\circ \geqslant \kappa^+$, the pooling equilibrium also holds if $\beta_0 = \beta^\circ$. However, note that if $\beta_0 = \beta^-$, then S^- is indifferent between take the sure thing and learn then discriminate, and the equilibrium is hybrid. Proposition 2 formally states the pooling equilibria and Proposition 4 gives the hybrid equilibria of the game. Both are in Appendix 2.

[18] S cannot be moderately "optimistic" when $p^{\min} = \kappa^+$ because then, as Figure 2 illustrates, $\beta^+ = \beta^\circ$.

[19] We derive y^- in Appendix 1 (see Equation (A.4) and accompanying discussion). The logic here is that if B's response to v^+ was $y_1, \geqslant y^-$ then S^- would also offer v^+. So to force S^- to offer a lower price, B must accept v^+ with smaller probability than y^-. A detailed discussion of B's strategy, including the reasons that no pure strategy is optimal for the buyer and why he must accept v^+ with positive probability even though his surplus is zero, is contained in the proof of Lemma 3. Proposition 3 formally states the equilibrium.

strategy is such that a first-period offer of v^+ convinces him that he faces a high-cost seller who will offer v^+ again in the second period. It is this indifference between the outcomes that allows B to use a mixed strategy to screen the seller types.[20] The benefit to the buyer can be seen by noting that if he acted nonstrategically (i.e., if he accepted any price up to his valuation), then the seller would offer the *highest* price, v^+, *whether her cost is low or high.* However, because B's response here is a strategic one, i.e., a screening strategy, the seller is induced to offer the *lowest* price, v^-, if her cost is low.

3.5. A Very Optimistic or Hyperoptimistic Seller

Region VI of Figure 2 describes the separating equilibrium that results when S^+ is too optimistic to offer any price lower than v^+, which is the case when $\beta_0 \geqslant \beta^+$, but S^- is not optimistic enough to offer such a high price. The probability with which B accepts v^+ is at least y°.[21] However, y°, which is an increasing function of B's initial reputation, β_0, is not large enough to make v^+ the most attractive initial price for S^- until $\beta_0 \geqslant \beta^{++}$.[22] If B's reputation falls between the boundaries β^+ and β^{++}, we say that S is "very optimistic." When very optimistic, the most attractive price for S^- is p^-, where

$$p^- = v^+ - (v^+ - v^-)\delta. \tag{6}$$

Importantly, B will accept p^- even if he *knows* that S's cost is low. So, in this equilibrium S^+ signals high cost by offering v^+. B screens the seller types, by accepting v^+ with any probability, y_1, that is at least as large as y° but smaller than y^+ so that S^- is not tempted to offer this price.[23] Because B is certain to accept p^-, S^- learns then discriminates by offering p^-.

Finally, Region VII of Figure 2 describes the pooling equilibrium that arises when S is hyperoptimistic, i.e., when $\beta_0 \geqslant \beta^{++}$. Then, B's initial reputation for high valuation is so strong that S, whether her cost is low or high, is willing to gamble and offer v^+. B accepts with probability y°.[24]

3.6. A Summary of the Main Results

Analyses of buyer-seller interactions have usually assumed that the parties are myopic or that only one is concerned about its reputation. We have shown that considering the key features of marketing channel interactions, specifically, the (1) long-term nature of the relationships, (2) fact that the terms of trade change from time to time, and (3) uncertainty that both parties bring to the bargaining table, yield different results. If myopic, the buyer is nonstrategic; he is a price-taker who accepts any offer up to his valuation. Reputations play no role in his decision; all that matters is how the offer compares with his valuation. The seller's offers depend on the buyer's reputation and her cost, but not on her own reputation. If her cost is low, she compares the expected payoff of "gambling" (i.e., offering a price, v^+, that will be accepted only if the buyer's valuation is high) to that of "take the sure thing" (i.e., offering a price, v^-, that the buyer will accept whatever his valuation). She chooses the price that, given the buyer's reputation, has the greater expected payoff (i.e., if the buyer's reputation makes her pessimistic, she takes the sure thing, and if optimistic, she price gambles). If the seller's cost is high, she has no decision to make; she prices high.

When we allow that the parties are concerned about the future and that each comes to the bargaining table uncertain about the other's reservation price, however, strategies are not so simple. A forward-looking buyer does not act as a price-taker and, as a result, may significantly improve his posi-

[20]Indeed, such indifference is a necessary condition whenever a mixed strategy is played.

[21]Corollary 2 in Appendix 2 formally states this result; its proof in the Technical Appendix (found at ⟨www.marketingscience.org⟩) explains details of the logic behind the result. We derive y° in Appendix 1 (see Equation (A.5) and accompanying discussion).

[22]β^{++} is derived in Appendix 1 (see Equation (A.6) and accompanying discussion).

[23]y^+ is derived in Appendix 1 (see Equation (A.7) and discussion). The detailed discussion of the buyer's beliefs and strategy when the seller is very optimistic is in Lemma 4, and Proposition 3 formally presents the equilibrium.

[24]Lemma 4 gives details of the buyer's beliefs and strategy when the seller is hyperoptimistic. Proposition 2 formally states the pooling equilibrium path. Note that if $\beta_0 = \beta^{++}$, then a low-cost S is indifferent between offering p^- and v^+. The equilibrium is then hybrid and is given by Proposition 4.

tion. Even when there is no haggling (i.e., the seller makes take-it-or-leave-it offers), he can often force the seller to offer lower prices than she would otherwise. Only at the extremes, hyperpessimism (Region I of Figure 2) and hyperoptimism (Region VII), are the seller's offers the same as they would be if the parties were myopic. However, new prices emerge in all of the other regions. If B's reputation makes S very pessimistic (Region II), then S^+ offers p^+ (which is lower than B's valuation, v^+) to signal high cost because B will reject any higher offer. B, thus, enjoys positive surplus whether S's cost is low or high. When B's reputation makes S moderately pessimistic or moderately optimistic (Regions III, IV, and V), then S's strategy depends not only on B's reputation but also on her own. If S has a high-cost reputation, there is a pooling equilibrium with S offering p°, which is lower than v^+, so again B enjoys positive surplus whatever S's cost. However, if S has a low-cost reputation, B screens the seller types by accepting a high price, v^+, with a probability that makes it attractive to S only if her cost is high, which forces S^- to take the sure thing by offering the lowest of all prices, v^-. When the seller is very optimistic (Region VI), B again screens the seller types, which causes S^- to learn then discriminate with an initial price of p^-, which is lower than v^+.

4. Optimal Reputations

Two related questions no doubt come to mind on examining Figure 2. In which region is it best for a seller like, for example, Microsoft to be? In which region is it best for a buyer like Wal-Mart to be? We address these questions in this section. We consider which reputations yield the buyer and seller the highest payoffs, the consideration of which enables us to offer advice on reputation management. The bases of this discussion are the seller's and buyer's expected payoffs in each of the equilibrium regions. Table A.2 in Appendix 1 presents those payoffs. We assume that each party takes the other's reputation as given. We, therefore, consider the following question: Given the reputation of the buyer (seller), what is the best reputation for the seller (buyer) to take the bargaining table?

We begin with the seller. First, as mentioned in §3.2, S's reputation is not relevant in Region I or on the boundary between Regions I and II of Figure 2 (i.e., if $\beta_0 \leqslant \beta^{--}$). S's reputation matters, however, if $\beta_0 > \beta^{--}$, which is because if S's initial reputation for high cost is maximally strong, then p° approaches the highest equilibrium price of all, v^+, and Region IV or V depicts the equilibrium.[25] On the other hand, if S's reputation for high cost is not so strong, then Region II, III, VI, or VII describes the situation. It is easy to show that, for given buyer reputations (i.e., for given values of β_0), if the seller's reputation for high cost is maximally strong (i.e., if p° is arbitrarily close to v^+), then the seller's profit in Regions IV and V is at least as large as it is in Regions II, III, VI, and VII if her cost is high.[26] This combined with the fact that the seller's reputation is irrelevant when $\beta_0 \leqslant \beta^{--}$ leads to the following intuitively appealing remark.

Remark 1. Whatever the buyer's reputation, if the seller's cost is high, it is optimal for her to have the strongest possible reputation for high cost.

Remark 1 confirms the intuition that in marketing channel interactions, a high-cost seller is best off with a reputation that matches its high-cost reality. However, what if the seller's cost is low? Then, while it is easy to show that Region V dominates Regions VI and VII from S's perspective, it is not necessarily the case that Region IV dominates Regions II and III. To see this, note that in Region IV, S's first-period offer of p° will be accepted if B's valuation is high, so Region IV dominates II and III for a low cost S if B's valuation turns out to be high. However, p° will be rejected if B's valuation is low, and then a low cost S's realized profit in Region IV is $(v^- - \kappa^-)\delta$, while in Regions II and III, it is $v^- - \kappa^- + (v^- - \kappa^-)\delta$! What this shows is that when S's cost and B's valuation are both low, a high-cost rep-

[25] Specifically, $p^\circ \to v^+$ as $b_0 \to 1$ (see Equation (5)).

[26] If p° is arbitrarily close to v^+, then S's *expected* profit is actually greater in Regions IV and V (see Table A.2 for the expected equilibrium payoffs). A high-cost S's *realized* payoffs can, however, be the same in Regions III, VI, and VII as they are in IV and V, because in the former three equilibria B accepts v^+ with positive probability.

utation leading to the equilibrium described by Region IV is "inefficient" while those described by Regions II and III are "efficient."[27] Hence, we have the following remark.

REMARK 2. If the seller's cost is low, the strongest possible high-cost reputation is optimal unless the buyer's reputation makes the seller moderately pessimistic and the buyer's valuation is low, in which case a high-cost reputation leads to an inefficient outcome.

The fact that a high-cost reputation is not always best for a seller may be somewhat surprising. We point out, however, that this is a limited caveat because (1) it applies only to a low-cost seller when (2) the buyer's reputation falls within a particular range (specifically, $\beta^{--} < \beta_0 < \beta^{\circ}$), and (3) it turns out that the buyer's valuation is, in fact, low. Because the coincidence of the latter two conditions is likely to be rare, the result that emerges is that, *in general*, the seller is best off with the strongest possible high-cost reputation.

We now consider the optimal buyer reputation. From the buyer's perspective, the ideal situation is for the seller, whatever her cost, to offer the lowest price that is acceptable to her. This would mean that S^- takes the sure thing and S^+ signals high cost by offering $p^{\min}$. While there is no buyer reputation that induces precisely this outcome, there is one in Region II that comes close to it. Specifically, within Region II, as the buyer's reputation approaches β^-, S^+'s offer, p^+, approaches $p^{\min}$ and S^- takes the sure thing. So, if B's reputation is arbitrarily close to but does not reach β^-, the buyer essentially gets his maximum payoff no matter what reputation S has and irrespective of whether her cost is low or high.[28] From this we have the following surprising remark.

[27]If the equilibrium is efficient, there is a transaction in every period if trade can benefit both buyer and seller. If B's valuation and S's cost are both low, then trade can benefit them both.

[28]To see this, first observe that in Region II, a high cost S offers p^+. Equation (3) shows that p^+ decreases in β_0. Substituting β^- (see Equation (A.2)), into Equation (3) for β_0 shows that $p^+ = p^{\min}$ when $\beta_0 = \beta^-$, from which it follows that $\beta_0 = \beta^- - \epsilon$ implies that $p^+ \approx p^{\min} + \epsilon$. Finally, observe that a low-cost S takes the sure thing for all $\beta_0 < \beta^-$. So, $\beta_0 = \beta^- - \epsilon$ means that the price offered by S is approximately the lowest acceptable to her, whatever her cost.

REMARK 3. Whatever the seller's reputation, the optimal buyer reputation is $\beta^- - \epsilon$, where ϵ is some arbitrarily small positive number.

This result is likely to be seen as counterintuitive. It says that a buyer like Wal-Mart should prefer a reputation that makes Microsoft believe that there is a significant chance that they have a high willingness to pay over one that makes Microsoft believe that there is almost no chance of this. Why is this optimal? The reason is that if Wal-Mart is extremely strongly reputed to have a low valuation, then Microsoft would not offer a high price if its cost is low. A low-cost Microsoft would expect more profit from take the sure thing. A high price would, therefore, be a credible signal to Wal-Mart that Microsoft's cost is high and, hence, that rejecting the high price does it no good because all subsequent prices will also be high. So, Wal-Mart winds up paying the high price. Now, change Wal-Mart's reputation so that Microsoft believes that there is a better chance that Wal-Mart's valuation is high. As Wal-Mart's reputation for having a high valuation grows stronger, there comes a point at which Microsoft would be willing to gamble and offer a high price *even if its cost were low.* At that point, to prove that its cost is high, Microsoft must offer a *lower* price than it would have to offer if Wal-Mart's reputation had not changed. So, the basic logic behind this striking result is that a stronger buyer reputation for having a high willingness to pay makes it harder for a high-cost seller to prove that its cost is high, forcing it to offer a lower price.[29]

5. Discussion

We have considered bargaining situations that typify marketing channel interactions: The interactions are

[29]The reader may be thinking, "But this stronger reputation for having a high valuation might also cause the seller to offer a higher price if its cost is low, thus, eliminating the buyer's expected gains." This does not happen because the buyer's strategy is to reject any offer higher than v^- that the seller might have made if its cost is low, which forces the seller to take-the-sure-thing if its cost is low. Lemma 3 provides the details.

Table 2 The Key Findings

1. The Effect of Seller Uncertainty and Long-Term Relationships on Buyer Power	When the seller is uncertain about the buyer's reservation price and faces repeated transactions with the same buyer, she is often forced to offer lower prices than she would in a one-time transaction. This is because there is a credible threat that a buyer with a high willingness to pay will reject high-priced offers (foregoing short-term gains) to sustain the seller's uncertainty and obtain lower prices in the future (obtaining higher long-term gains). This is true even if any haggling is regarded as cheap talk and has no effect on the buyer or seller.
2. The Effects of Reputations on Strategies	The seller's pricing strategy is influenced by the reputations of both players (i.e., by what the buyer believes about the seller's cost and what the seller believes about the buyer's valuation). The buyer's response to the seller's price is also affected by the seller's beliefs (i.e., by the buyer's own reputation). However, the buyer's responses are *not* influenced by the seller's reputation, because everything the buyer needs to know about the seller is communicated by the price she offers.
3. The Effects of Reputations on Outcomes	As might be expected, the seller's profit is almost always higher when she has a strong reputation for having high costs. But, surprisingly, the buyer is often hurt by too strong a reputation for having a low valuation. Ideally for the buyer, the seller will be pessimistic, but not too pessimistic. This is because extreme pessimism allows a high-cost seller to successfully signal her cost with the highest possible price.

long-lived; the terms of trade change over time; and both buyer and seller are uncertain about the other's reservation price. To gain insight into the best strategies in such situations and the outcomes those strategies produce, we analyzed a simple two-period model. From our analysis has come several results, and, for the reader's convenience, we have summarized the most significant findings in Table 2.

We now discuss the research and managerial implications of these findings.

The first key finding, that a forward-looking buyer has the power to affect the seller's prices even when there is no haggling, is significant because it yields outcomes that differ significantly from those obtained when the buyer is assumed to be a price-taker. Future channel research should, therefore, carefully consider the appropriateness of assuming that downstream channel members (i.e., buyers) are price-takers. This finding may also be relevant for research in reference-dependent utility theory, which posits that fairness considerations explain the observed phenomena of buyers rejecting prices that do not exceed their valuations, and sellers offering prices that are lower than the targeted buyers' valuations. These phenomena cannot be explained by a standard, nonreference-dependent utility function if the buyer is assumed to be a price-taker. Invariably, the null model against which reference-dependent utility theory compares its predictions is one that assumes that the buyer is a price-taker. We have shown that the price-taker assumption need not hold in long-lived relationships and, hence, the same phenomena are predicted by simple, nonreference dependent utility functions.

Our second key finding provides an interesting and testable difference between our results and the predictions of reference-dependent utility theory. Reference-dependent utility theory predicts that the buyer is more likely to accept a high price from a seller if the seller comes to the bargaining table with a reputation for high cost (cf. Thaler 1985). However, examining the buyer's equilibrium strategies in our analysis reveals that his optimum response, y_1^*, is never a function of the seller's initial reputation, b_0. The buyer may, however, condition his response on his *own* initial reputation, β_0. In every situation in which the buyer is not certain to accept the seller's offer (i.e., Regions III, VI, and VII of Figure 2), his response may be a function of β_0 (see Equations (A.4) and (A.5) in Appendix 1). Contrary to the conventional wisdom, then, the buyer's response to the seller's offer is not a function of the reputation that the seller brings to the bargaining table but may be a function of his own reputation. Note also that the price that the seller offers is sometimes a function of her own reputation; specifically, in Regions IV and V of Figure 2 the seller offers $p°$, which is an increasing function of the strength of her initial reputation for high cost. Thus, while the buyer's strategy is not a function of the seller's intial reputation, the seller's strategy can be.

Our third key finding confirms the intuition that, in general, sellers are best off with the strongest possible high-cost reputations. This finding is subject to the caveat that a high-cost reputation can cause a seller whose cost is low to miss out on some opportunities when the buyer's reputation falls within a particular range, and it turns out that the buyer's valuation is low. However, such inefficient outcomes are likely to be rare. Sellers are, thus, well advised to seek any means at their disposal to be strongly reputed as high cost-types.

Perhaps the most surprising finding of our analysis is that the buyer's reputation does not always lead to the types of outcomes that intuition suggests it should. Contrary to the conventional wisdom, in the typical channel interaction, a stronger reputation for having a low (high) valuation can result in the buyer paying a higher (lower) price. It has been known that a buyer might wind up paying more if his reputation makes the seller believe that he is likely to have a high valuation (cf. Fudenberg and Tirole 1983; Hart and Tirole 1988). However, until now, it had not been known that a buyer might also wind up paying more if his reputation makes the seller believe that he is *unlikely* to have a high valuation. Buyers, therefore, seem to covet reputations that convince sellers that they have the lowest possible valuations in the belief that such reputations always lead sellers to offer the lowest possible prices. We have shown that this may be a mistaken belief. A high valuation buyer that has cultivated an extremely tough reputation is often paying more than he would otherwise. Because this result is new, there is an important managerial implication: Many firms probably need to reconsider the way that they manage their reputations as buyers in channel interactions. There are many tactics that firms might use to shape the reputations that they take to the bargaining table, a comprehensive analysis which is beyond the scope of this paper. One obvious tactic is the firm's policy with respect to its statements to the trade press. For example, if a retailer's current media policy is to emphasize in its statements that because of its low retail prices, it is strictly unwilling to pay high prices to its suppliers, it should probably adjust its rhetoric. Rather than focusing on low retail prices and, thereby, a tough stance against suppliers' prices, perhaps it should emphasize an insistence on delivering its customers high value for money spent and receiving the same from its suppliers. We leave complete analyses of such tactics for future research.

There are limitations of our analysis that should be noted. We assumed a discrete distribution of buyer valuations and seller costs, with two of each. While discrete uncertainty is a reasonable approximation of the way managers typically approach decisions under uncertainty, it would be useful to extend the model to the case of continuous uncertainty or discrete uncertainty with arbitrarily many buyer and seller types. In our model, the seller makes the offers. This is probably the appropriate representation for most marketing channel interactions, but not for all of them. In relationships where the buyer is a more powerful player than the seller, it is more likely to be the case that the buyer makes take-it-or-leave-it offers to the seller (cf. Iyer and Villas-Boas 1998). It would be interesting to see if such an institutional difference would alter any of our results. We assumed a finite horizon, which is appropriate when the bargainers face a known end point, as is the case if, for example, the product becomes obsolete at some point in time. An interesting extension of the model would be the case of an indefinite horizon, which represents many actual situations. Closely related to the previous limitation is that our model captures what might be considered only a portion of the long-run relationship between a buyer and seller in a channel interaction. A channel relationship usually has a longer life than does any single good. Using the example with which we opened the paper, the new product that Microsoft introduces today will be obsolete in a few years, but then the firm will introduce another product that Wal-Mart will carry. Moreover, the cost of the next product to Microsoft may or may not be high, and Wal-Mart may or may not highly value it. So, while the products and their particular characteristics come and go, the relationship between the parties endures. It would be interesting to see how an extension of our modeling approach that captures this aspect of channel relationships might enrich the analysis. Finally, because some of our results run counter to conventional wisdom, they naturally lead to a discussion of the potential testability of the ideas presented here—an undertaking that is beyond the scope of the current work. Thus, an opportunity for future research is to put our results to the empirical test.

Acknowledgments
The authors thank Wilfred Amaldoss, Sherrod Banks, Mike Cucka, Alison Lo, Mary Frances Luce, Jagmohan Raju, and Rafael Rob for helpful discussions; they also thank Bill Boulding, Preyas Desai, Kendra Harris, Debu Purohit, Rick Staelin, the editor, area editor, and two anonymous reviewers for valuable comments on earlier drafts of this paper.

Appendix 1. The Formal Model and Important Derivations

Define $a_1 \in \{0, 1\}$ as the observed outcome of B's Period 1 strategy, where $a_1 = 1$ if the first-period offer is accepted and $a_1 = 0$ otherwise. Then, as both buyer types accept any offer up to v^-, applying Bayes' rule provides

$$\beta_1(\beta_0, p_1, y_1(p_1, v), a_1) = \begin{cases} \beta_0, & \text{if } p_1 \leq v^-, \\ \frac{(1-y_1)\beta_0}{1-y_1\beta_0}, & \text{if } p_1 > v^- \text{ and } a_1 = 0; \\ 1, & \text{if } p_1 > v^- \text{ and } a_1 = 1. \end{cases} \tag{A1}$$

To derive β^- set $p^+ = p^{\min}$. Then, substituting into Equation (3) and rearranging terms yields

$$\beta^- = \frac{v^- - \kappa^-}{p^{\min} - \kappa^- + (v^+ - v^-)\delta}. \tag{A2}$$

To derive β^+, we use the result from Corollary 2, that when the seller is optimistic, the buyer accepts any $p_1 \leqslant v^+$ with probability at least as large as y°. We equate a high-cost seller's payoff from $p_1 = p^{\min}$ when $y_1(p^{\min}) = 1$, i.e., $\pi_1(p^{\min}, \kappa^+) = [p^{\min} - \kappa^+ + (v^+ - \kappa^+)\delta]\beta_0$, with that from $p_1 = v^+$ when $y_1(v^+) = y^\circ$, i.e., $\pi_1(v^+, \kappa^+) = [(1 + \delta)(v^+ - \kappa^+)y^\circ + (v^+ - \kappa^+)(1 - y^\circ)\delta]\beta_0$, and solve for the initial buyer reputation that satisfies this equation. The result is

$$\beta^+ = \frac{(v^- - \kappa^-)(v^+ - \kappa^+)}{(v^- - \kappa^-)(p^{\min} - \kappa^+) + (v^+ - \kappa^-)(v^+ - p^{\min})}. \tag{A3}$$

Define $y^-(p')$ as the buyer response to arbitrary $p' \in (v^-, v^+]$ that makes a low-cost seller indifferent between $p_1 = p'$ and $p_1 = v^-$. Derive it by equating a pessimistic low-cost seller's payoff from $p_1 = v^-$ (see Equation (2)) with her payoff from $p_1 = p' \in (v^-, v^+]$, $\pi_1(p', \kappa^-) = y_1(p')[p' - \kappa^- + (v^+ - \kappa^-)\delta]\beta_0 + (v^- - \kappa^-)[(1 - y_1(p')\beta_0]\delta$, and solving for the buyer strategy that satisfies this equation. Note that y^- is simply $y^-(p')$ when $p' = v^+$, the result of which is

$$y^- = \frac{v^- - \kappa^-}{[v^+ - \kappa^- + (v^+ - v^-)\delta]\beta_0}. \tag{A4}$$

Define y° as the unique buyer response that will leave S^- indifferent between taking the sure thing and gambling in Period 2 if

Table A.1 The Formal Model

Steps	Description
1	Nature selects B's valuation, $v \in \{v^-, v^+\}$, and S's cost, $\kappa \in \{\kappa^-, \kappa^+\}$ according to the following commonly known probabilities: $Pr(v = v^+) = \beta_0$ and $Pr(\kappa = \kappa^+) = b_0$.
2	B privately learns his valuation, $v \in \{v^-, v^+\}$, and S privately learns her cost, $\kappa \in \{\kappa^-, \kappa^+\}$.
3	S chooses the first period offer, p_1^*, that she believes will maximize her total (discounted) profit over Periods 1 and 2.
4	Having seen the first-period offer, B updates his belief about S's cost to $b_1(b_0, p_1)$. With this updated belief, he accepts the offer with the probability, $y_1^*(p_1, v)$, that he believes will maximize his total (discounted) surplus over both periods.
5	S sees whether or not B accepts her first-period offer and updates her belief about his reservation value to $\beta_1(\beta_0, p_1, y_1(p_1, v), a_1)$.
6	In the second (and final) period S chooses the second-period offer that, given her updated belief about B, she believes will maximize her Period 2 profit and B accepts the offer if doing so maximizes his Period 2 surplus and, otherwise, he rejects it.

the Period 1 outcome is rejection. Then, to derive it, we set $\beta_1(\beta_0, p_1, y_1, 0) = \beta^\circ$ for $p_1 > v^-$ (see Equation (A.1)) and solve for y_1. The result is Equation (A.5):

$$y^\circ = \frac{\beta_0 - \beta^\circ}{(1 - \beta^\circ)\beta_0}. \tag{A5}$$

We use Corollary 2 to derive β^{++}. Set an optimistic low-cost seller's payoff from $p_1 = p^-$, $\pi_1(p^-, \kappa^-) = [p^- - \kappa^- + (v^+ - \kappa^-)\delta]\beta_0 + (v^- - \kappa^-)(1 - \beta_0)\delta$, equal to her payoff from $p_1 = v^+$ when $y_1(v^+) = y^\circ$, $\pi_1(v^+, \kappa^-) = (1 + \delta)(v^+ - \kappa^-)y^\circ \beta_0 + (v^- - \kappa^-)(1 - y^\circ\beta_0)\delta$, and solve for the initial buyer reputation that satisfies this equation. The result is Equation (A.6).

$$\beta^{++} = \frac{[v^+ - \kappa^- + (v^+ - v^-)\delta]\beta^\circ}{v^- - \kappa^- + (v^+ - v^-)\delta}. \tag{A6}$$

Define $y^+(p')$ as the buyer's response to arbitrary $p' \in (p^-, v^+]$ that makes a low-cost seller indifferent between $p_1 = p'$ and $p_1 = p^-$. Derive it by equating an optimistic low-cost seller's payoff from $p_1 = p^-$ with that from $p_1 = p' \in (p^-, v^+]$ assuming that $y_1(p') \geq y^\circ$, which yields $\pi_1(p', \kappa^-) = y_1(p')[p' - \kappa^- + (v^+ - \kappa^-)\delta]\beta_0 + (v^- - \kappa^-)[1 - y_1(p')\beta_0]\delta$. Observe that y^+ is simply $y^+(p')$ when $p' = v^+$, the result of which is Equation (A.7).

$$y^+ = \frac{v^+ - \kappa^-}{v^+ - \kappa^- + (v^+ - v^-)\delta}. \tag{A7}$$

Appendix 2. The Formal Results

In this appendix, we present the formal results of the analysis. The proofs are presented in a Technical Appendix, which is available on the *Marketing Science* website at ⟨http://mktsci.pubs.informs.org⟩. In our presentation of these results, whenever the buyer is certain to accept the seller's offer, we simply say that he accepts. However, if he responds to an offer probabilistically, we qualify his response by stating the probability (or the set of admissible probabilities if his response is not unique) with which he accepts.

PROPOSITION 1. *Let*

$$p^\bullet = v^+ - (v^+ - v^-)[1 - b_1(b_0, p_1)]\delta. \tag{A8}$$

The buyer accepts any $p_1 \leq p^\bullet$ if p_1 is "small" (i.e., if $p < v^+$). He accepts $p_1 = p^\bullet$ if p_1 is "large" (i.e., if $p_1 = v^+ = p^\bullet$) so long as certain acceptance of $p_1 = v^+$ does not make this price optimal for a low-cost seller. The buyer's optimum response to any $p_1 > p^\bullet$ is to reject the offer or to accept it probabilistically.

COROLLARY 1. *If the seller is initially pessimistic, the buyer's optimum response to any Period 1 offer that is higher than $p^\bullet$ is to reject it.*

LEMMA 1. *(i) p^{min} is the larger of p° and a high-cost seller's cost, κ^+, i.e., $p^{min} = max\{p^\circ, \kappa^+\}$.*
(ii) If $p_1 < p^{min}$, then the buyer concludes that the seller's cost is low.

LEMMA 2. *(i) A high valuation buyer accepts any price up to p^-. (ii) An optimistic low-cost seller will offer no first-period price that is lower than p^-.*

LEMMA 3. *If the seller is pessimistic, the buyer rejects all $p_1 \in (p^-, p^{min})$. (i) If the seller is hyperpessimistic, $b_1(b_0, p_1) = 1$ for $p_1 \in [p^{min}, v^+]$. The buyer accepts all $p_1 \in [p^{min}, v^+]$.*
(ii) If the seller is very pessimistic,

$$b_1(b_0, p_1) = \begin{cases} b_0 & \text{for } p_1 > p^+, \\ 1 & \text{for } p_1 \in [p^{\min}, p^+]. \end{cases}$$

The buyer accepts any $p_1 \in [p^{min}, p^+]$ and rejects all $p_1 > p^+$.

Table A.2 The Seller's and the Buyer's Expected Payoffs in Each Equilibrium Region

Regions	S^-'s Profit		S^+'s Profit*	B's Surplus**	
	Low Valuation B	High Valuation B		If S is S^-	If S is S^+
I	$v^- - \kappa^- + (v^- - \kappa^-)\delta$	$v^- - \kappa^- + (v^- - \kappa^-)\delta$	$v^+ - \kappa^+ + (v^+ - \kappa^+)\delta$	$v^+ - v^- + (v^+ - v^-)\delta$	0
II	$v^- - \kappa^- + (v^- - \kappa^-)\delta$	$v^- - \kappa^- + (v^- - \kappa^-)\delta$	$p^+ - \kappa^+ + (v^+ - \kappa^+)\delta$	$v^+ - v^- + (v^+ - v^-)\delta$	$v^+ - p^+$
III	$v^- - \kappa^- + (v^- - \kappa^-)\delta$	$v^- - \kappa^- + (v^- - \kappa^-)\delta$	$(v^+ - \kappa^+)\delta < \pi(.) < (v^+ - \kappa^+)y^- + (v^+ - \kappa^+)\delta$	$v^+ - v^- + (v^+ - v^-)\delta$	0
IV	$(v^- - \kappa^-)\delta$	$p^\circ - \kappa^- + (v^+ - \kappa^-)\delta$	$p^\circ - \kappa^+ + (v^+ - \kappa^+)\delta$	$v^+ - p^\circ$	$v^+ - p^\circ$
V	$(v^- - \kappa^-)\delta$	$p^\circ - \kappa^- + (v^+ - \kappa^-)\delta$	$p^\circ - \kappa^+ + (v^+ - \kappa^+)\delta$	$v^+ - p^\circ$	$v^+ - p^\circ$
VI	$(v^- - \kappa^-)\delta$	$p^- - \kappa^- + (v^+ - \kappa^-)\delta$	$(v^+ - \kappa^+)y^\circ + (v^+ - \kappa^+)\delta \leqslant \pi(.) < (v^+ - \kappa^+)y^+ + (v^+ - \kappa^+)\delta$	$v^+ - p^-$	0
VII	0	$(v^+ - \kappa^-)y^\circ + (v^+ - \kappa^-)\delta$	$(v^+ - \kappa^+)y^\circ + (v^+ - \kappa^+)\delta$	0	0

Notes. *The table shows S^+'s profit only when she faces a high valuation B. This is because S^+ cannot trade with a low valuation B; if B's valuation is low, S^+'s profit is zero. In Regions III and VI, B's equilibrium responses to S^+'s offers are not unique, so in these regions S^+'s expected profit is, likewise, not unique.

**The table shows only a high valuation B's surplus because a low valuation B's surplus is always zero.

(iii) If the seller is moderately pessimistic:

(a) If $p^\circ \geqslant \kappa^+$ then $b_1(b_0, p_1) = b_0$ for $p_1 \geqslant p^\circ$. The buyer accepts $p_1 = p^\circ$ and rejects all $p_1 > p^\circ$.

(b) If $p^\circ < \kappa^+$ then

$$b_1(b_0,\ p_1) = \begin{cases} 0 & \text{for } p_1 < \kappa^+, \\ b_0 & \text{for } p_1 \in [\kappa^+, v^+), \\ 1 & \text{for } p_1 = v^+. \end{cases}$$

The buyer accepts $p_1 = v^+$ with probability $y_1 \in (0, y^-)$ and rejects all $p_1 \in [\kappa^+, v^+)$.

Corollary 2. *If the seller is initially optimistic, the buyer's optimum response to any Period 1 price higher than $p^\bullet$ and up to v^+ is to accept with probability y°. If $p^\bullet = v^+$, the buyer accepts v^+ with probability at least as large as y°.*

Lemma 4. *Define $p^\times \in (p^{min}, v^+)$ as the lowest Period 1 price that satisfies $\pi_1(p^\times, \kappa^+) = \pi_1(v^+, \kappa^+)$ when B accepts p_+ with certainty and accepts v^+ probabilistically.*

(i) If the seller is hyperoptimistic,

$$b_1(b_0, p_1) = \begin{cases} 0 & \text{for } p_1 < p^\times \\ b_0 & \text{for } p_1 \geqslant p^\times \end{cases}$$

The buyer optimally accepts all $p_1 \in (p^-, v^+]$ with probability y°.

(ii) If the seller is very optimistic,

$$b_1(b_0,\ p_1) = \begin{cases} 0 & \text{for } p_1 < p^\times, \\ b_0 & \text{for } p_1 \in [p^\times, v^+), \\ 1 & \text{for } p_1 = v^+. \end{cases}$$

The buyer optimally accepts all $p_1 \in (p^-, v^+)$ with probability y° and he accepts $p_1 = v^+$ with probability $y_1 \in [y^\circ, y^+)$.

(iii) If the seller is moderately optimistic,

$$b_1(b_0, p_1) = \begin{cases} 0^\circ & \text{for } p_1 < p^{\min} = p^\circ \\ b_0 & \text{otherwise.} \end{cases},$$

The buyer optimally accepts $p_1 = p^\circ$. He accepts all $p_1 \in (p^-, p^\circ)$ and $p_1 \in (p^\circ, v^+]$ with probability y°.

Proposition 2. *Pooling PBE paths arise as follows.*

(i) If the seller is moderately pessimistic, $\beta_0 > \beta^-$, and $p^\circ \geqslant \kappa^+$, or if the seller is moderately optimistic, the PBE path is unique. Both seller types offer $p_1 = p^\circ$. The buyer's updated belief about the seller is the same as his prior, i.e., $b_1(\bullet) = b_0$; he accepts if his valuation is high and rejects if his valuation is low. Given the buyer's strategy, if the Period 1 price is accepted, the seller updates her belief about the buyer to $\beta_1(\bullet) = 1$ and offers $p_2 = v^+$ whether her cost is low or high. If the Period 1 price is rejected, the seller updates to $\beta_1(\bullet) = 0$ and offers $p^2 = v^-$ if her cost is low, but if her cost is high, the seller withdraws from the interaction, realizing that she cannot trade with the buyer.

(ii) If the seller is hyperoptimistic and $\beta_0 > \beta^{++}$, the PBE path is unique. The seller offers $p_1 = v^+$ whether her cost is low or high. The buyer's updated belief about the seller is the same as his prior, i.e., $b_1(\bullet) = b_0$; he accepts with probability y° if his valuation is high and rejects if his valuation is low. Given the buyer's strategy, if the Period 1 price is accepted, the seller updates her belief about the buyer to $\beta_1(\bullet) = 1$ and offers $p_2 = v^+$ whether her cost is low or high. If the Period 1 price is rejected, the seller updates to $\beta_1(\bullet) = \beta^\circ$ (recall that the buyer's optimum

strategy here, y°, is defined as that strategy that induces exactly this seller posterior belief; in the event that the offer is rejected, see Equation (A.5) and accompanying discussion in Appendix 1), and if her cost is high, the seller offers $p_2 = v^+$. If the seller's cost is low, she is indifferent between offering $p_2 = v^+$ and $p_2 = v^-$ when $\beta_1(\bullet) = \beta^{\circ}$, and in her indifference she offers $p_2 = v^+$ with probability $\eta_2^*(p_1)$, which equals 1 when $p_1 = v^+$ (see Equation (A.12) in Appendix 2). Therefore, a low-cost seller offers $p_2 = v^+$ whatever the period 1 outcome (Corollary 2 explains the logic underlying the seller's strategy in this condition if her cost is low).

PROPOSITION 3. *Separating PBE paths arise as follows.*

(i) If the seller is hyperpessimistic, the PBE path is unique. A low-cost seller offers $p_1 = v^-$, upon which the buyer concludes that the seller's cost is low, i.e., his updated belief is $b_1(\bullet) = 0$, and whatever his valuation he accepts. A high cost seller offers $p_1 = v^+$, upon which the buyer concludes that the seller's cost is high, i.e., $b_1(\bullet) = 1$, and he accepts if his valuation is high-but rejects if his valuation is low. As her first-period offer is accepted by the buyer whatever his valuation, a low-cost seller's updated belief about the buyer is the same as her prior, i.e., $\beta_1(\bullet) = \beta_0$, and she offers $p_2 = v^-$. As for a high-cost seller, if her first-period offer is accepted, she updates her belief about the buyer to $\beta_1(\bullet) = 1$ and offers $p_2 = v^+$, but if her first-period offer is rejected, she updates to $\beta_1(\bullet) = 0$ and withdraws, realizing that she cannot trade with the buyer.

(ii) If the seller is very pessimistic, the PBE path is unique. A low-cost seller offers $p_1 = v^-$, the buyer concludes that the seller's cost is low, i.e., $b_1(\bullet) = 0$ and whatever his valuation, the buyer accepts. A high-cost seller offers $p_1 = p^+$, which makes the buyer conclude that the seller's cost is high, i.e., $b_1(\bullet) = 1$, and the buyer accepts if his valuation is high but rejects if his valuation is low. Because the buyer accepts a low-cost seller's first-period offer whatever his valuation, a low-cost seller's updated belief about the buyer is the same as her prior, i.e., $\beta_1(\bullet) = \beta_0$ and she offers $p_2 = v^-$. A high-cost seller updates her belief about the buyer to $\beta_1(\bullet) = 1$ if her first-period offer is accepted, and she offers $p_2 = v^+$. However, if a high-cost seller's first-period offer is rejected, she updates to $\beta_1(\bullet) = 0$ and withdraws.

(iii) If the seller is moderately pessimistic and $p^{\circ} < \kappa^+$, the PBE path is unique up to the buyer's response to a high-cost seller's Period 1 offer. A low-cost seller offers $p_1 = v^-$, the buyer concludes that the seller's cost is low, i.e., $b_1(\bullet) = 0$, and whatever his valuation, the buyer accepts. A high-cost seller offers $p_1 = v^+$, the buyer concludes that the seller's cost is high, i.e., $b_1(\bullet) = 1$, and the buyer accepts with probability $y_1 \in (0, y^-)$ if his valuation is high but rejects if his valuation is low. Because the buyer accepts a low-cost seller's first-period offer whatever his valuation, a low-cost seller's updated belief is the same as her prior, i.e., $\beta_1(\bullet) = \beta_0$, and she offers $p_2 = v^-$. A high-cost seller updates her belief about the buyer to $\beta_1(\bullet) = 1$ if her first-period offer is accepted, and she offers $p_2 = v^+$. If her first-period offer is rejected, a high-cost seller updates to $\beta_1(\bullet) \in (\beta^{\&}, \beta_0)$ ($\beta^{\&}$ is derived and defined in the proof, which is in the Technical Appendix), and she offers $p_2 = v^+$. Hence, whatever the first-period outcome, a high-cost seller offers $p_2 = v^+$.

(iv) If the seller is very optimistic, the PBE path is unique up to the buyer's response to a high-cost seller's Period 1 offer. A low-cost seller offers $= p_1 = p^-$, the buyer concludes that the seller's cost is low, i.e., $b_1(\bullet) = 0$, and he accepts if his valuation is high but rejects if is valuation is low. A high-cost seller offers $p_1 = v^+$, the buyer concludes that the seller's cost is high, i.e., $b_1(\bullet) = 1$, and he accepts with probability $y_1 \in [y^{\circ}, y^+)$ if his valuation is high but rejects if his valuation is low. Because the buyer accepts a low-cost seller's offer if his valuation is high but rejects if his valuation is low, a low-cost seller's updated belief about the buyer is $\beta_1(\bullet) = 1$ if her first period offer is accepted, and she offers $p_2 = v^+$; if her first-period offer is rejected, her updated belief is $\beta_1(\bullet) = 0$, and she offers $p_2 = v^-$. A high-cost seller updates her belief about the buyer to $\beta_1(\bullet) = 1$ if her offer is accepted, and she offers $p_2 = v^+$. If her first-period offer is rejected, she updates to $\beta_1(\bullet) \in (\ddot{\beta}, \beta^{\circ}]$ ($\ddot{\beta} > 0$ is derived and defined in the proof, which is in the Technical Appendix), and she offers $p_2 = v^+$. Hence, whatever the Period 1 outcome, a high-cost seller offers $p_2 = v^+$.

PROPOSITION 4. *Hybrid PBE paths arise as follows.*

(i) Let λ_1 be the probability with which the seller offers v^- in the first period if her cost is low, and let its optimum be λ_1^*. If the seller is moderately pessimistic, and $p^{\circ} \geqslant \kappa^+$, and $\beta_0 = \beta^-$, then a low-cost seller offers $p_1 = v^-$ or $p_1 = p^{\circ}$, where $\lambda_1^* \in [0,1]$. A high-cost seller offers $p_1 = p^{\circ}$. If the first-period offer is v^-, the buyer concludes that the seller's cost is low, i.e., $b_1(\bullet) = 0$, and he accepts. If the first-period offer is p°, the buyer's updated belief is $b_1(\bullet) \in [b_0, 1]$, and he accepts if his valuation is high but rejects if his valuation is low. If a low-cost seller's first-period offer is v^-, then her updated belief about the buyer is the same as her prior, i.e., $\beta_1(\bullet) = \beta_0$, and in Period 2, she offers $p_2 = v^-$. If a low-cost seller's Period 1 offer is p°, her updated belief is $\beta_1(\bullet) = 1$ if the offer is accepted, and she offers $p_2 = v^+$; if the offer is rejected, her updated belief is $\beta_1(\bullet) = 0$, and she offers $p_2 = v^-$. A high-cost seller's updated belief is $\beta_1(\bullet) = 1$ if her first-period offer is accepted, and in Period 2, she offers $p_2 = v^+$; if her first-period offer is rejected, her updated belief is $\beta_1(\bullet) = 0$, and she withdraws, realizing that she cannot trade with the buyer.

(ii) Let η_1 be the probability with which the seller offers v^+ in the first period if her cost is low, and let its optimum be η_1^*. If the seller is hyperoptimistic and $\beta_0 = \beta^{++}$, a low-cost seller offers $p_1 = p^-$ or $p_1 = v^+$, where $\eta_1^* \in [0,1]$. A high-cost seller offers $p_1 = v^+$. If the first-period offer is p^-, the buyer concludes that the seller's cost is low, i.e., $b_1(\bullet) = 0$, and he accepts if his valuation is high but rejects if his valuation is low. If the first-period offer is v^+, the buyer's updated belief is $b_1(\bullet) \in [b_0, 1]$, and he accepts with probability y° if his valuation is high but rejects if his valuation is low. If a low-cost seller's first-period offer is p^-, her updated belief is $\beta_1(\bullet) = 1$ if the offer is accepted, and she offers $p_2 = v^+$; if the offer is rejected, her updated belief is $\beta_1(\bullet) = 0$, and she offers $p_2 = v^-$. If a low-cost seller's first period offer is v^+, her updated belief is $\beta(\bullet) = 1$ if the offer is accepted, and she offers $p_2 = v^+$; if the offer is rejected, her updated belief is $\beta(\bullet) = \beta^{\circ}$, which makes her indifferent between offering $p_2 = v^-$ and $p_2 = v^+$. In her indifference, a low-cost seller who offers v^+ in the first period makes a second-period offer of $p_2 = v^+$ with probability $\eta_2^*(p_1)$, which equals 1 when $p_1 = v^+$. Therefore, a low-cost seller who offers v^+ in period 1 offers $p_2 = v^+$ whatever the

first-period outcome. If a high-cost seller's first-period offer is accepted, her updated belief is $\beta_1(\bullet) = 1$*, and she offers* $p_2 = v^+$*; if the offer is rejected, she updates to* $\beta_1(\bullet) = \beta^{\circ}$ *and offers* $p_2 = v^+$

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This paper was received December 13, 1999, and was with the authors 17 months for 3 revisions; processed by Rajiv Lal.