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How Target Shareholders Benefit from Value-Reducing Defensive Strategies in Takeovers

ELAZAR BERKOVITCH and NAVEEN KHANNA*

ABSTRACT

This paper shows that target shareholders can be made better off through the use of certain types of defensive strategies that reduce the value of the target by different amounts for different bidders. In many cases, simply the threat of such strategies can make target shareholders better off. Therefore, empirical tests based on stock price reactions at the adoption of defensive strategies may be underestimating the effect of such strategies. The paper also identifies the necessary characteristics that make these strategies effective and shows that many observed defenses possess similar properties.

FOR A NUMBER OF years, defensive strategies have been used in takeover battles; yet they remain controversial. Proponents of defensive strategies maintain that they increase the ability of target management to extract a higher price for target shares. Opponents of such strategies, while generally conceding this point, argue that resistance reduces the probability of takeover and, therefore, target shareholders are worse off overall.¹ Existing empirical work has been unable to resolve this issue since the effect of defensive strategies on the value of target firms is inconclusive. (See Jensen and Ruback (1983) and Jensen and Warner (1988).)

In this paper we show how discriminatory value-reducing defensive strategies (VRDS), which make the takeover more difficult for some bidders than for others, enable the target manager to get a higher price for target shares. Some well known strategies belonging to the class of VRDS are crown jewel sales, lock-up options, litigation, purchase of assets that make the target undesirable for some bidders, and direct conditional cash payments to a particular bidder, giving it an advantage over others.² We also show that, in many cases, the mere threat of using VRDS enables the target manager to get a higher offer from a bidder.

To illustrate the basic idea, we use a variant of the model introduced in Fishman (1988). We assume that there are two potential bidders, each of whom can generate a different (and independent) amount of synergy gain by acquiring

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¹ These arguments have been raised by Easterbrook and Fischel (1981) and Gilson (1982). The former also argue that defensive strategies serve only to redistribute synergy gains between targets and bidders and, thus, do not affect social welfare. Another argument against defensive strategies is based upon concerns that managers can abuse them to remain entrenched. We discuss these issues in Sections III and IV.

² A more detailed description of these strategies is given in Sections I and V.

a particular target. The acquisition is carried out through a tender offer, and each acquirer has to incur both search and bidding costs before making its first bid for the target.

If a target manager is unable to use VRDS, an opening bidder can reduce competition for the target with a "low" preemptive bid. However, when the target manager can use VRDS, the opening bidder is forced to preempt with a higher bid. This is because, with VRDS, the target manager can reduce the value of the target to this bidder by a greater amount than to other bidders. This discriminatory reduction makes it more profitable for potential bidders to enter and compete with the opening bidder as they now expect to outbid it. Thus, the opening bidder needs to bid higher to reduce the incentive of the target to use VRDS against it. As a result, target shareholders gain even when their manager does not actually employ VRDS.

When VRDS do get employed, the target's stock price reaction can be either positive or negative depending on what additional information is released to the market. This reaction, though, is not the total effect of VRDS because it does not include the component which is capitalized into the target's price when the manager gets the *ability* to use VRDS. Accordingly, empirical studies, based on the targets' stock price reaction at the point of adoption of resistance strategies, may not be measuring the total effect of such strategies.

The results of this paper do not apply to all VRDS observed in practice. The ones considered here are 1) discriminatory, so that they reduce the value of the target to some bidders more than to others, and 2) expensive to redeem, as otherwise the target has an incentive to withdraw them once competition has developed.³ A number of existing defenses appear to fit these criteria, and we provide some examples of takeover contests in which such VRDS have been used. However, some defenses, such as recent poison pills, do not possess these characteristics and, thus, do not work like the strategies considered here.⁴

This paper is related to Shleifer and Vishny (1986), in which greenmail is used to eliminate existing competition to make it more profitable for other bidders to search. Our approach differs since VRDS do not eliminate existing bidders but induce them to make higher bids for the target. Also, unlike the defenses considered in their paper, VRDS can be used as threats. In addition, we look at some social welfare implications of VRDS.

³ If the second bidder suspects that the target will withdraw the VRDS once it bids, it will not compete at all. In this respect, observed VRDS may distinguish between the adoption of a VRDS and its triggering. Adoption occurs whenever a target management introduces them into the firm's charter. Since at this point they can be redeemed cheaply, they are not yet a credible threat. Triggering takes place when some prespecified exogenous event occurs, causing the management to take action to reduce the value of some bidder or bidders. This action is usually irreversible.

⁴ Poison pills have become widely used defensive strategies since 1984. (See Malatesta and Walking (1988) and Ryngaert (1988).) They differ from VRDS in that they are usually not discriminatory and are usually inexpensive to redeem. Even the ones designated as discriminatory by Ryngaert (1988) are not discriminatory in the sense of VRDS. Unlike VRDS, where discrimination is against a specific bidder/bidders, poison pills are bad for any acquirer who exceeds a prespecified shareholding limit. Also, after a poison pill is triggered, the value of the target is the same (though reduced) for all bidders. VRDS, on the other hand, retain the discrimination after use. Similarly, discriminatory buy-back of stock is not a VRDS. Once the buy-back is completed, the remaining value of the firm is the same for all future bidders. For details see Kamma et al. (1988).

Unlike Giammarino and Heinkel (1986), we assume private value synergies and also allow bidders to change their bids. However, we support their conclusion that target shareholders gain from a VRDS-like strategy that they call a “white knight arrangement.”

Harris and Raviv (1988) and Stulz (1988) look at a different class of defenses which work through their effect on target managers’ voting rights. In Harris and Raviv, the manager affects the choice between a proxy fight and a tender offer through changes in capital structure and the resultant changes in his or her voting power. Stulz looks at how the target manager’s bargaining power can be increased by giving him or her a higher ownership stake. For instance, he shows that, when the supply of shares is upward sloping, the manager can force the acquirer to make a higher bid for the target by repurchasing some outstanding shares. The approach of these two papers emphasizes the relationship between the manager and shareholders, while we look at the effect of VRDS strategies on the nature and level of competition.

Like us, Hirshleifer and P’ng (1988) demonstrate that, with costly bidding, the English auction may not result in the target getting the value of the second highest bidder less its bidding costs. They also show that under certain circumstances the expected takeover price is higher when a competing bidder’s costs are high rather than low. However, they do not consider the target’s ability to use VRDS to increase competition among bidders.

In related empirical work, Dann and DeAngelo (1988) look at the effect of defensive restructuring on targets’ share price and report a significantly negative reaction. This price reaction has implications for our analysis, as some of the restructuring strategies considered by them (antitrust litigation and purchase and sale of assets) are VRDS, and suggests that target shareholders get hurt from their use. In contrast, Jarrell (1985) studies the effect on target firms of litigating against bidders and comes to a different conclusion. He shows that over 75% of targets that take bidders to court are finally acquired and, on average, at significantly higher premiums than contained in initial bids. Since litigation is a VRDS, this study suggests that such defenses are good for target shareholders. Though these two papers are not exactly comparable, our paper provides a possible explanation that reconciles these apparently contradictory results about the effect of using VRDS.

The paper is organized as follows. In Section I we provide an example of how VRDS work in a simple full-information setting, and we give some real life illustrations. In Section II, we show the effectiveness of VRDS under asymmetric information about bidders’ value and then solve for the equilibrium payoffs to the target with and without VRDS. Section III illustrates situations in which VRDS are employed. We introduce entry costs for the first bidder in Section IV and analyze their effect on target shareholders’ and social welfare. In Section V we provide examples of defensive strategies that have VRDS characteristics. A conclusion follows.

I. Definitions and Examples of Observed VRDS

Consider a situation in which a target can generate synergy gains when acquired. There are two potential acquirers, each of whom can generate different and

independent amounts of synergy gains by taking over the target. The target is acquired via a tender offer, and an acquirer has to incur a cost of making the acquisition. This cost results from payments to investment bankers, raising the necessary capital, preparing and making an opening bid, etc. At this stage, we assume that this cost is incurred at the time of making the opening bid.⁵ We later show that extending the model to include other types of costs does not alter the conclusions of this paper.

To capture the main intuition about the nature of the problem and how it is resolved through VRDS, we start with a simple full-information model. Suppose a bidder who can generate synergy gains of R_1 by acquiring a target makes a tender offer for it. We refer to this bidder as bidder 1. Suppose another bidder (bidder 2) can generate a smaller amount of synergy gains, R_2 , by taking over the target and must incur a cost, c , of making a bid. If competition occurs, the outcome is determined through an English auction such that the highest value acquirer buys the target for the value of the second highest bidder. Since $R_1 > R_2$, bidder 2 realizes that if it bids it will bear the cost of bidding without any chance to win. Therefore, bidder 2 does not bid and bidder 1 wins with its opening bid. Anticipating this reaction by bidder 2, bidder 1 makes a bid equal to the existing market price (or an infinitesimal premium over it). This is enough to win since target shareholders cannot do better. Thus, the target is bought for a zero premium.

Now, suppose the target manager has the ability to use VRDS. With them, he or she can reduce bidder 1's synergy gains to below R_2 while leaving those of bidder 2 unchanged at R_2 . The sequence of events is as follows. After bidder 1 makes an opening bid, the market learns about bidder 2's synergy gains, R_2 . At this point, bidder 1 can raise its bid and the target either sells at the new bid or imposes a VRDS against bidder 1 and reduces its synergy gains.⁶ If bidder 1's bid is less than $R_2 - c$, the target reduces its value to just below $R_2 - c$ and lets bidder 2 win for a bid of $R_2 - c$. Realizing this possibility, bidder 1 will make a bid of $R_2 - c$ and prevent the use of VRDS. Consequently, the mere threat of VRDS helps the target get a higher bid from the opening bidder.

Note that, to be credible as threats, VRDS must be expensive to redeem. If bidder 1 can pressure the target into withdrawing the VRDS, it will do so after bidder 2 bids and thus prevent the target from triggering the VRDS by outbidding bidder 2. Knowing this, bidder 2 will not compete, and this will make the VRDS ineffective.

Some examples of observed VRDS are crown jewel defenses, private litigation, lockups, and buying assets to cause anti-trust problems or make acquisitions more or less difficult for certain bidders. In crown jewel defenses, the target usually gives one of the bidders an option to buy a valuable asset of the target at

⁵ This assumption permits us to use the English auction as the solution concept for the competitive case. We do not believe that this assumption is particularly restrictive. For example, in Berkovitch and Khanna (1987), we analyze the case in which the outcome is not necessarily determined through the English auction. There, the target is also permitted to enter into a negotiated deal with the acquirer, through the use of VRDS. The outcome of this game is similar to the one here.

⁶ For ease of analysis we assume that the target manager, who perfectly represents shareholders in our model, decides whether the shareholders will tender their shares.

a bargain price, on the condition that it competes for the target. The option is exercisable only in the event that this bidder loses to another bidder. Such a VRDS reduces the value of the firm for all bidders other than this bidder and is not redeemable. Another VRDS in the form of an option is when the target gives one of the bidders the right to buy target stock at below market price in the event that this bidder is unable to buy the target. This also gives the bidder an advantage over other bidders. Acquiring an asset which will probably cause anti-trust problems for a particular bidder is also discriminatory and expensive to redeem. It is discriminatory since it forces the bidder to sell some assets at short notice to avoid litigation and is expensive to redeem because it requires resale of the asset by the target. Private litigation is obviously discriminatory, as is acquiring new assets which help or hurt some acquirers more than others. We return to a discussion of the different types of VRDS in Section V.

In this paper we concentrate on the role of VRDS in promoting competition for the target. This role is different from scenarios in which the target and the bidder face a bilateral monopoly over the division of the synergy gains. In these scenarios, resistance strategies may increase target gains by improving its bargaining position. (See, for example, Stulz (1988).) Though these aspects are undoubtedly important, we do not deal with them for tractability reasons.

In the following sections, we show that the basic results are robust when the model is extended to include asymmetry of information and some different assumptions about the type of entry costs. These extensions also yield additional results about VRDS.

II. VRDS under Asymmetric Information

We now relax the assumption that bidders' synergies are common knowledge and assume that each bidder's synergy is known only to itself and can be one of two types: low or high (L or H). We denote a bidder's type by the subscript L for low and H for high. The probabilities of the two types are r and q , respectively, and are common knowledge. After bidder 1 makes a bid, bidder 2 has to incur a cost, c , to participate.⁷ Once it incurs the cost, it participates in an English auction against bidder 1. The cost to bidder 2 provides bidder 1 an incentive to bid high (in some situations) in an attempt to prevent bidder 2 from competing for the target. We now analyze the bidding strategies that will be adopted in equilibrium by the different types of bidder 1.

Some of the outcomes can be discussed right away. If $r(H - L) < c$, then bidder 2 does not compete if it is unable to infer bidder 1's true type from the opening bid, i.e., in a pooling equilibrium. In this situation, 1_L is able to freeze out 2_H with a low bid. This is because bidder 2 makes positive gains only when it is 2_H and bidder 1 is of type L . Consequently, if bidder 2 is unable to identify bidder 1's type, its expected gain is $r(H - L)$. Since this gain is less than c , bidder 2 will not enter the auction. In this scenario, VRDS improve target payoffs by forcing

⁷ In this section, we do not explicitly introduce the participation cost of bidder 1 into the model. In this respect, this section, like Fishman (1988), concentrates on the game that takes place subsequent to bidder 1's opening bid.

1_H to make a high opening bid to prevent the target from using VRDS against it.⁸ We now analyze the alternative scenario where

$$r(H - L) > c. \quad (1)$$

In addition, we make the assumption that the bidding cost is smaller than the synergy generated by the low type bidder; i.e.,

$$c < L. \quad (2)$$

Assumption (2) is not restrictive because we can extend the model to include more types of bidder 2s and consider only those with synergy greater than c .

If bidder 1 is of type L , it will bid $b(L)$, which is between zero and L , and, if it is of type H , it will bid $b(H)$ between zero and H . Bidder 2 observes the bid and tries to infer bidder 1's type. There are many possible sequential equilibria in this case. We concentrate on the sensible equilibria according to the intuitive criterion used in Kreps (1984) and Cho and Kreps (1987).⁹

This criterion can be explained in our model as follows. Suppose a set of strategies and beliefs constitutes an equilibrium such that, given the beliefs and strategies of each player, no player has the incentive to deviate from the prescribed strategy. Now, suppose 1_H makes an off-equilibrium bid. Suppose that, given its equilibrium payoffs, 1_L does not find it optimal to mimic this off-equilibrium bid, regardless of how the target and bidder 2 interpret the bid. Also, suppose that 1_H is better off making this off-equilibrium bid, compared to the equilibrium bid, if the target and bidder 2 believe that it must be 1_H to make this bid. In this case, according to the intuitive criterion, the target and bidder 2 must indeed believe that the bid is made by 1_H , and the original equilibrium breaks down. A "sensible" equilibrium is one which does not break down for the above reasoning.

In a separating equilibrium, 1_L bids zero, as it does not have to bid higher to signal its type. Also, in order for 1_L not to have an incentive to mimic the bid of the high type, $b(H)$, 1_H 's bid must be high enough so that 1_L prefers to stay with a bid of zero. For this the following condition must hold:

$$L(1 - q) \geq L - b(H) \Rightarrow b(H) \geq qL, \quad (3)$$

where $L(1 - q)$ is the expected gain of the low type when it bids zero, while $L - b(H)$ represents its profits when it imitates the high type and prevents competition. This leads to the following proposition.

PROPOSITION 1: *The unique equilibrium bids with sensible beliefs are as follows. The low type bidder 1 (1_L) bids zero, while the high type (1_H) opens with a bid of qL . If bidder 2 is a low type (2_L), it does not compete, and, if it is the high type (2_H), it competes only if the opening bid is below qL .*

⁸ It is straightforward to show that VRDS improve target shareholder welfare in the event that $r(H - L) < c$. In the case of a separating equilibrium, the analysis is exactly as in Section II. Therefore, we need to analyze only the pooling equilibria. Without VRDS, there is a continuum of pooling equilibria where both 1_L and 1_H bid $b \in [0, qL]$, and the belief system is that any bid below b is made by 1_L : 2_H enters whenever it sees a bid below b . From the target's point of view, the best equilibrium in this set is when $b = qL$, which is the payoff to the target under Proposition 1. The equilibrium with VRDS is the same as in Proposition 2, and the result follows.

⁹ This notion also motivates Banks and Sobel (1987) and Grossman and Perry (1986).

Proof: See Appendix.

In the above equilibrium, the target's expected return is qL . If a bid of zero is observed, then 2_H , knowing that it faces 1_L , enters the auction and wins with a bid of L . This happens with probability of rq . If a bid of qL is observed, no competition develops and bidder 1 wins for sure. This happens with probability q , the probability that bidder 1 is of the high type. Thus, the target's expected return is $rqL + q^2L = qL$.

To analyze the effect of VRDS on the target's payoff, we now permit the target manager to use a VRDS, p , against bidder 1 to reduce its value by that amount and give bidder 2 an opportunity to win and make positive profits. This changes the game as follows. After bidder 1 bids, the target gets to decide the amount of VRDS. In the event that the target puts a positive VRDS, bidder 1 is permitted to change its bid. Incorporating this possibility is important as the value of the target is now reduced for it. After bidder 1 makes the new bid, bidder 2 may pay the entry cost and compete.

We now show that, when the target manager can use VRDS, the bids of Proposition 1 do not constitute an equilibrium. Suppose 1_H bids qL as before. If the target adopts VRDS of size $p = c$ against it, its value gets reduced to $H - c$.¹⁰ Now, 2_H finds it profitable to enter as it recovers its bidding costs by winning with a final bid of $H - c$. Therefore, qL is not the best bid if the target finds it profitable to respond with VRDS. The expected payoff to the target from using $p = c$ is $q(H - c)$ and, without using VRDS, is qL . Since, by (1), $q(H - c) > qL$, the target will use $p = c$ in response to a bid of qL . Thus, this bid is not an equilibrium bid for 1_H . The appropriate bid for 1_H is one which ensures that the target does not do better by employing VRDS. Since the target's payoff from employing VRDS of size c is $q(H - c)$, if the opening bid is $q(H - c)$ or higher, the target will not employ VRDS. This discussion leads to the following proposition.

PROPOSITION 2: *With VRDS, the unique equilibrium bids are as follows:*

1. *If $rL - c < 0$, 1_H bids $q(H - c)$, 1_L bids zero, the target sets $p = 0$, and 2_H enters if it observes a bid of zero.*
2. *If $rL - c > 0$, 1_H bids $\max(q(H - c), L - c)$, 1_L bids $L - c$, the target does not employ VRDS in equilibrium, and 2_H enters if it observes a bid of $L - c$.*

Given this equilibrium, target shareholders do better when the manager can use VRDS.

Proof: See Appendix.

Proposition 2 shows that the preemption by a high type first bidder increases from qL to $q(H - c)$ or higher. In addition, a low type first bidder makes a preemptive bid whenever there is a high probability that the competition will come from another low type bidder. This is because, if 1_L bids zero, the target finds it profitable to employ VRDS of size c against it to induce competition from a low type second bidder. Therefore, target shareholders benefit from the ability

¹⁰ The VRDS of size $p = c$ is enough to ensure that bidder 2 is compensated for its bidding costs. The target does not gain by using a higher p .

of the manager to use VRDS because of both higher preemption by 1_H and possible preemption by 1_L .

The above analysis can easily be extended to include a richer set of cost functions. For example, suppose that bidder 2 has to bear some search costs in order to learn its type. Let its search costs be c_1 and its bidding costs be c_2 . In this case, the equilibrium without VRDS remains unchanged since 1_H still has to bid qL to reveal its type and preempt 2_H .

However, when the manager can use VRDS, the minimum amount that induces bidder 2 to search and incur bidding costs if it is type 2_H is $p = c_2 + c_1/q$. This p ensures it non-negative profits since it gains p only when it is 2_H (i.e., with probability q), while its expected costs are $c_1 + qc_2$. Consequently, the analysis of Proposition 2 can now be repeated with $p = c_2 + c_1/q$ instead of $p = c$. In particular, the bid by 1_H is now $q(H - c_2 - c_1/q)$, under the assumption that c_1 , c_2 , and q are such that this bid is above qL .¹¹ We utilize this cost structure in Section IV.

III. Implications of Using VRDS

The analysis of the previous sections shows how the ability to use VRDS improves target shareholder welfare. By extending Section II, we now demonstrate when VRDS may actually be used.

In order for VRDS to be observed in equilibrium, some additional “noise” must be introduced into the model. This noise may or may not be related to the uncertainty about the bidders’ synergy gains described in Section II. However, the source of this additional noise is important because it determines the direction of the target’s stock price reaction to an observed VRDS. Below, we provide two examples of the effect of additional uncertainty. The first source of uncertainty is about the cost of using VRDS and results in a positive price reaction to observed resistance. The second source of uncertainty is whether the target management is using VRDS to increase shareholders’ value or to remain entrenched at the shareholders’ expense. With this uncertainty the resulting price reaction is negative.

It must be emphasized that the price reaction to an observed VRDS, whether positive or negative, measures only a portion of the total effect of VRDS. The rest of the effect is capitalized into stock prices at the time the target acquires the ability to use VRDS. That is, while the ability to use VRDS affects all firms by changing the nature of the game, the additional information released on actual use is specific only to the particular acquisition. In such a setup, it is possible that, even when a target’s stock price moves down on its using a VRDS, its shareholders are better off overall because of defensive strategies.

Therefore, it may be inappropriate to attempt to measure the effectiveness of VRDS through estimates of targets’ stock price reaction to observed VRDS. A more suitable test is one that also accounts for the price reactions to exogenous events, such as changes in law and landmark court decisions, that potentially affect the manager’s ability to use VRDS.

¹¹ If we maintain the assumption that under pooling bidder 2 finds it optimal to learn its type, i.e., $rq(H-L) - qc_2 - c_1 > 0$, the bid by 1_H is above qL .

A. When Market Reaction to Using VRDS is Positive

In the previous sections we assume that the target can use VRDS costlessly. It is probably more realistic to assume that the target has to incur some cost for using VRDS. Accordingly, whenever a target uses VRDS against a specific bidder, its value falls for all bidders by the amount of this cost. The reduction in target value has two components. One is the reduction of its value to a specific bidder, denoted by p as before, and the other is the loss in value to all bidders, denoted by x .

In our model, the target has no reason to reduce its value to all bidders. Thus, as opposed to p , the level of x is not a decision variable for the target. It simply represents the costs that the target cannot avoid.¹² To make the model empirically relevant, we assume that x is different across targets, and its exact value is not known to bidders. Bidders know only that x has a continually differentiable cumulative distribution function $F(x)$ and density $f(x)$ over the range $[0, \infty)$.

For simplicity, the takeover contest evolves as in Section II, and we concentrate only on the case $rL - c < 0$ of Proposition 2. First, bidder 1 makes a bid; then the target decides whether to use VRDS; and then bidder 2 decides whether to bid. Clearly, if 1_H bids $q(H - c)$ as before, the target has no reason to use VRDS. However, if it bids below $q(H - c)$, then whether the target uses VRDS against it depends on the cost of using them. Given the possibility that VRDS may not get used, the bidder could open with a lower bid and risk having VRDS used against it.

Let bidder 1's bid be denoted by $b(i)$, $i = L$ or H . If $b(H)$ is below $q(H - c)$, then only those targets with $x < q(H - c) - b(H)$ gain by using VRDS of size $p = c$. Consequently, if $b(H) < q(H - c)$, the probability of observing VRDS is $F(q(H - c) - b(H))$.

Given this decision rule of the target, 1_H chooses b so as to maximize its expected gains. His or her optimal choice is given by the solution to

$$\max_b [1 - F(X(b))](H - b) + r(H - c) F(X(b)) \quad (4)$$

subject to

$$b \geq qL,$$

where $X(b) = q(H - c) - b$. The first term represents 1_H 's expected gains if no VRDS are used against it, and the second term is its expected gain if VRDS are used against it (as it then wins only against 2_L). This maximization is subject to the constraint that the low type does not mimic the high type, i.e., $b \geq qL$.

The first-order condition for an interior solution for (4) is

$$-1 + F(X(b)) + (H - b) f(X(b)) - r(H - c) f(X(b)) = 0,$$

which gives

$$b = qH + rc - \frac{1 - F(X(b))}{f(X(b))}. \quad (5)$$

¹² For example, litigation involves lawyer's fees, firm's resources, etc. This is the common loss denoted by x . The bidders, however, are still discriminatingly affected by the firm's action. For this example, the bidder taken to court will suffer more reduction in value than other bidders.

The term $\frac{1 - F(X(b))}{f(X(b))}$ is the inverse of the hazard rate.¹³ Since, in general, this expression depends on b , (5) gives an implicit solution for b . However, we can still identify the condition under which VRDS will be observed in equilibrium.

For convenience, we denote the inverse of the hazard rate by $h(x)$. For (5) to hold, b must be below the corner solution, $q(H - c)$. Therefore, in order to observe VRDS in equilibrium,

$$qH + rc - h(x) < qH - qc,$$

which reduces to

$$(q - r)c < h(x). \quad (6)$$

Since $h(x)$ is positive, (6) holds whenever $q < \frac{1}{2}$. Thus, VRDS are observed whenever the probability of a high type bidder 2 is low enough. The intuition is that, whenever q is small, the returns to bidder 1 from preemption decrease since the risk of competition is smaller. Therefore, it is more willing to take the risk of letting the target employ VRDS.

To complete the analysis, note that the decision of a low type bidder 1 is similar to that in Section II, as it still opens with a bid of zero. Thus, the above discussion can be summarized as follows.

PROPOSITION 3: *Target shareholders benefit from being able to use VRDS even when they are costly. In addition, if (6) holds, VRDS are implemented in some situations rather than used only as threats. Under the assumptions of this section, the use of VRDS leads to a positive price reaction for the target.*

B. When Market Reaction to Using VRDS is Negative

A scenario which leads to a negative reaction is when the market believes that the target management is using VRDS for entrenching itself. We have not considered agency problems so far since we believe that, if management entrenchment is the only reason for VRDS to exist, they will be banned by the shareholders. Accordingly, we have attempted to identify a positive role for them in the earlier sections. However, once a positive role for VRDS exists, an inefficient manager can exploit them for entrenchment purposes. The extent of exploitation is of course dependent upon the ability of shareholders to monitor the manager's actions. If ineffective monitoring exists, then managers can use defensive strategies to retain their jobs.

VRDS are probably not the defensive strategies managers would like to use for remaining entrenched. Instead, nondiscriminatory defensive strategies would be more suited since they can eliminate all bidders. However, when some amount of monitoring exists, the manager would like to use those strategies that enable it to get entrenched without being identified (with certainty) as an inefficient manager. The following example shows how the model with costly VRDS can be extended to incorporate this kind of agency problem.

¹³ The hazard rate, $f(x)/(1-F(x))$, represents the probability of failure at time x , given no failure up to that time. In our model, it is the probability of observing VRDS for some X , given that they have not yet been observed for a lower X (resulting from a higher bid).

Suppose bidder 1 bids as in Section III.A. Also suppose that the target manager believes that, if taken over by this bidder, it will be worse off than if taken over by bidder 2. In this case the manager can mimic the behavior of a target with a low cost for implementing VRDS and use VRDS against bidder 1, even when it is not in the best interest of shareholders. This behavior will decrease the average positive reaction to the use of VRDS and, if monitoring is costly enough, can even make it negative. However, the threat of VRDS, independent of the manager's motives, still forces bidder 1 to make a high opening bid. Consequently, there is a tradeoff between an increase in value with no entrenchment and the value loss when entrenchment exists. Obviously, the better the monitoring the higher the gains from VRDS.

IV. The Usefulness of VRDS When Bidder 1 Has Entry Costs

In the previous sections we analyzed the effect of VRDS after bidder 1 bids. We now consider the impact of VRDS on bidder 1's decision of whether to search and then whether to bid. Since VRDS reduce the expected return to a bidder from making a tender offer, they could result in lowering the search and bidding activities of an opening bidder. This can result in a reduction in the total number of tender offers observed and, thus, hurt both target shareholders' and social welfare.

In an ongoing debate, Easterbrook and Fischel (1981) argue that the possible loss in the number of tender offers dominates the benefits from VRDS and, thus, target shareholders are worse off with defensive strategies.¹⁴ On the other hand, Gilson (1982) argues that the additional competition generated through defensive strategies after a tender offer dominates the negative effect of the loss in potential tender offers. Furthermore, Easterbrook and Fischel (1981) and Schwartz (1986) claim that from a social point of view the arguments against defensive strategies appear to be even stronger. The positive effect of resistance strategies for the target shareholders (after a tender offer) simply reflects a redistribution of synergy gains from bidders to targets.

While we do not attempt to solve this issue here, we can make the following contribution to the debate. If VRDS are used only in the way so far discussed in this paper (to make bidders compete), society is worse off with VRDS. However, even when there are no VRDS, the amount of search by potential bidders is suboptimal from a social viewpoint. We later show that the amount of socially beneficial search actually increases when targets use VRDS for the (different) purpose of compensating a bidder for its search and/or bidding costs.

To discuss these points, we define social gains as the sum of the gains to all agents in the market and consider the model with both search costs (c_1) and bidding cost (c_2). To relate our paper to the debate we need to assume that bidder 1 also has search and bidding costs. This permits us to incorporate its decision about whether to search and/or bid.

¹⁴ They assume that the benefits from VRDS result from increased competition for the target. As our paper demonstrates, VRDS can increase the payoff to target shareholders by using the threat of competition more effectively and without necessarily increasing actual competition.

We take Easterbrook and Fischel's argument to its extreme by assuming that the search costs of bidder 2 get reduced to zero once bidder 1 bids. (This captures the public good aspect of the opening bid, that it reduces search costs for all other bidders.) With this assumption, once bidder 1 bids, its search and bidding costs are sunk, while bidder 2 faces only bidding costs. Thus, after an opening bid is made, the analysis becomes identical to Section II.

For the purpose of comparison, we concentrate on the case $rL - c_2 > 0$ of Section II, in which 1_H bids $q(H - c_2)$ and 1_L bids $L - c_2$. When bidder 1's bidding costs are also taken into account, 1_L does not bid. By bidding $L - c_2$, 1_L incurs the cost of c_2 while expecting to get only rc_2 since it recovers c_2 only if it faces 2_L . However, if bidder 1 is 1_H , it still bids $q(H - c_2)$ as its expected gains from bidding are $H - q(H - c_2) - c_2 = r(H - c_2) > 0$.

Before analyzing the effect of VRDS on bidder search, we note that VRDS can have a deterrence effect with only bidding costs. Since 1_L does not make a tender offer, whenever bidder 1 is of type L there is social loss of $L - c_2 > 0$. However, for target shareholders the outcome is ambiguous. With VRDS their expected gain is $q(q(H - c_2))$, while without VRDS their expected gain is $q^2L + qrL$. Therefore, they are better off with VRDS whenever $q(H - c_2) > L$ and worse off otherwise.

We now consider the effect of VRDS on the search decision of bidder 1. With VRDS, bidder 1's expected gain from search (before it knows its type) is given by

$$V_w = q(H - q(H - c_2)) - c_1 - qc_2 = qr(H - c_2) - c_1. \quad (7)$$

The term $q(H - q(H - c_2))$ is the expected profit from search as the winning bid is $q(H - c_2)$, while $c_1 + qc_2$ is the expected cost for bidder 1. Without VRDS, its expected gain from search is given by

$$V_{wo} = q(H - qL) + r^2L - c_1 - c_2, \quad (8)$$

where the first two terms represent its expected gain and the others its cost.

Since $V_{wo} > V_w$, search yields higher expected returns for bidder 1 when there are no VRDS. Consequently, whenever $V_{wo} > 0$ but $V_w < 0$, a bidder does not search with VRDS but searches without.¹⁵ In this case, valuable acquisitions are lost because of VRDS, and there are both social losses and losses to target shareholders. This result supports Easterbrook and Fischel's claim that resistance reduces social welfare.

While we cannot say much about the extent of social loss due to the above reasoning, we wish to draw attention to a neglected aspect of defensive strategies, namely that they can also be used to compensate a bidder for its search costs. For this, we first show that the market is inefficient even without VRDS. This is because, when bidder 1's bid reduces search costs for subsequent bidders, a positive externality is generated. Thus, the expected social benefit from a bidder's search, V_s , is given by

$$V_s = qH + r^2L + rqH - c_1 - c_2 - rqc_2. \quad (9)$$

The first two terms in (9) are the expected social synergy gains when bidder 1 is

¹⁵ We thank an anonymous referee for pointing out this possibility.

the higher value bidder. The third term represents the expected gains when bidder 2 is the higher value bidder, and the remaining terms represent the expected costs. Since V_s exceeds V_{wo} , the social value from search is higher than the value that bidder 1 can capture without VRDS. Therefore, in certain situations no search will take place even when search is beneficial for society.

The above "market failure", due to the externality the bid creates, suggests another role for VRDS: that they may be used to compensate the first bidder for its activity. So far we have concentrated on using VRDS as compensation for only bidder 2. However, once bidder 1 does not find it profitable to search or bid, we can think of compensating it in a similar manner. Consider the case with VRDS, in which "bidder 1" has searched and found its synergies to be L . Instead of not bidding, it can approach the target and offer the following deal. The target will compensate bidder 1 by an amount of c_2 if it bids $L - c_2$. This compensation can be paid from the existing assets of the target through, for instance, a lock-up.¹⁶ Thus, if bidder 1 wins, it gets the target for $L - c_2$ and recovers its bidding costs. If it is outbid, it still gets c_2 from the lock-up. Therefore, in both cases it is compensated for its bidding cost.¹⁷ The target also benefits from this contract. If bidder 1 wins, the target gets the bid, $L - c_2$. (The lock-up is now meaningless since bidder 1 becomes the owner of the target's assets anyway.) If bidder 1 loses, the target gets the winner's bid, which is at least $L - c_2$. Note that the value of the target's assets are reduced to bidder 2 by c_2 . Therefore, if bidder 2 wins for a bid of $L - c_2$, it pays the amount of the bid plus c_2 .

The above agreement is a VRDS since it reduces the value of the target (by c_2) only to bidder 2. However, it is different from VRDS we have analyzed so far as it requires some communication and/or negotiation between the target and the bidder. Berkovitch, Bradley, and Khanna (1989) show that, in the presence of such agreements, defensive strategies can lead to more search and increased social welfare.

V. Empirical Examples of VRDS

In this section we give a list of observed cases of VRDS that possess discriminatory and nonredeemability characteristics. This list consists of some randomly collected cases from the *Wall Street Journal* and from Dann and DeAngelo (1988).¹⁸ These take the form of crown jewel defenses, private litigation against the raider, antitrust litigation, acquiring or disposing of assets which affect different bidders to different extents, direct conditional cash payments to one bidder, etc. Firms use these strategies either singly or in combinations. These cases highlight the important role VRDS play in many takeover battles.

Examples of crown jewel defenses are Marathon Oil, St. Regis', and Revlon; examples of antitrust legislation are Marshall Field and Co. and Burlington

¹⁶ As discussed in Section I, a lock-up is a contract under which the target gives a bidder the right to buy some assets at below market price in the event that this bidder loses in an auction. Examples are crown jewel defenses, giving of stock options at below market price, etc.

¹⁷ Note that 1_H does not want to mimic this behavior because by doing so it cannot preempt entry by 2_H .

¹⁸ In writing this section, we benefitted greatly from the inputs provided by Harry DeAngelo.

Industries; examples of private lawsuits are General Steel Industries and St. Joe Minerals Corporation; examples of buying an asset to make themselves less attractive for a particular raider or more attractive for other raiders are St. Joe Minerals Corporation, General Steel Industries, and Marshall Field and Co.; and examples of direct conditional cash lock-ups are Burlington Industries and Revlon. The VRDS have been highlighted wherever they occur in these cases.

A. Burlington Industries Inc.

On April 8, 1987, Asher Edelman and Dominion Textile Inc. jointly amassed a 4.9% stake in Burlington. In response, Burlington's stock price closed at \$53.75, up \$5.75. On April 27, this partnership made a proposal to acquire all of Burlington at \$60 a share (i.e., for a total price tag of \$1.51 billion). Burlington Industries requested a *preliminary injunction* against the hostile tender offer. The suit alleged that the offer was based on inside information and violated antitrust and securities laws. This was a discriminatory VRDS against the partnership because, if the verdict were to go against them, they would lose more than any other bidder. The partnership then made a tender offer for an increased bid of \$67 per share or a total of \$1.83 billion. A group led by Morgan Stanley and Co. appeared as a rival for Burlington, and competition occurred resulting in Morgan Stanley and Co. buying the firm for a bid of \$78 per share or a total of \$2.16 billion. An important part to this acquisition was that Morgan Stanley and Co. was given a *lock-up* in the form of "breakup fees" by Burlington which would give it \$25 million in cash if its bid did not succeed. Since, in all likelihood, this lock-up was conditional on Morgan Stanley making a serious bid for Burlington, it worked like a discriminatory VRDS. Some sources on the street attributed the defeat of the partnership to the presence of the breakup fees since they would have added to the cost of the winning bid made by anyone other than Morgan Stanley.

B. General Steel Industries Inc.

Walco National Corporation purchased a significant minority position in General Steel. General Steel *acquired* Gruendler Crusher and Pulveriser Co. for a significant monetary stake and cash as it expected Walco to make a tender offer for General Steel and this was expected to make the acquisition less attractive (VRDS). General Steel also brought *litigation* against Walco's controlling shareholder for alleged lavish lifestyle and furthering of political interests at Walco's shareholders' expense (VRDS). A federal judge sided with General Steel, and Walco agreed not to pursue General Steel, which was then taken over by Lukens Steel Co.

C. Marathon Oil

Mobil Oil made a tender offer for 68% of Marathon Oil for \$85 per share in cash, with the remainder to be acquired with Mobil's debentures valued at \$85 per share, in a second step merger. In response Marathon Oil granted United

States Steel an *option* which gave USS the right to purchase ten million authorized but unissued Marathon shares (approximately 17% of Marathon's outstanding stock) for \$90 per share (VRDS). This option was valid at any time between the commencement of USS's tender offer for 51% of Marathon Common at \$125 per share and the completion of the second stage merger for \$100 per share. This option was a discriminatory VRDS as it disadvantaged Mobil because if Mobil were to up the bid it would have to do it for 17% more shares than USS. To further ensure USS's success, Marathon gave USS an option to purchase its *crown jewel*, the Yates Oil Field, at a low price of \$2.8 billion (VRDS). The option was exercisable only if USS's offer were unsuccessful and a third party acquired control of Marathon.

D. Marshall Field & Co.

In response to Carter Hawley Hale's attempted takeover, Marshall Field acquired five department stores in Seattle and other locations in the Pacific Northwest. Marshall Field then brought an *antitrust suit* against Carter Hawley Hale on grounds that a merger would unlawfully reduce competition in the Seattle and Chicago retail markets (VRDS). Shortly thereafter, Marshall Field *announced plans* to expand in Houston and other southern markets in which CHH was an established competitor (VRDS). CHH unilaterally withdrew its offer. Several years later, Marshall Field was successfully acquired by Batus Inc.

E. Revlon

When Pantry Pride made a \$47.50 per share offer for Revlon, Revlon agreed to be taken private by Forstmann Little for a sweetened offer of \$57.25. In return for the sweetened offer, Revlon granted Forstmann Little *the right* to buy its vision care and national Health Laboratories units for a bargain price of \$425 million (VRDS). These assets were valued at between \$600 and \$700 million. Pantry Pride got this lock-up invalidated in court and bought Revlon for \$58 per share. Forstmann Little not only lost out on Revlon, but the feeling on the street was that it was unlikely to make good on a *secondary lock-up* which promised Forstmann Little \$25 million dollars in the event that it was unable to buy Revlon. As long as this lock-up was conditional on Forstmann Little making a negotiated bid for Revlon, it was a discriminating VRDS.

F. St. Joe Minerals Corp.

Seagram Co., the big Canadian liquor concern, made an offer to buy St. Joe Minerals Corp. for \$2.03 billion. *St. Joe took Seagram to court* for failing to disclose "a long history of illegal political payments, federal tax and liquor law violations" (VRDS) and also put its 92% interest in Can Del Oil Ltd. up for *sale* (VRDS). The strategy was to make itself more attractive to non-Canadian suitors who would otherwise find themselves in conflict with the Ottawa government's goals of increasing domestic control of energy. When challenged, a federal judge permitted St. Joe to continue with the sale. St. Joe sold Can Del to a Canadian

firm and agreed to be acquired by Fluor Corporation. Seagram withdrew its offer, and St. Joe was successfully acquired by Fluor for \$2.73 billion.

G. St. Regis'

In August 1984, Rupert Murdoch, who at the time owned a 5.6% stake in St. Regis' Corporation, a packaging and forest products company with interest in insurance and energy, expressed interest in buying a 50.1% stake in the company through an unsolicited offer between \$50 and \$55. Around that time St. Regis' acquired a 9.9% interest in Colonial Penn Group Inc., a Philadelphia-based insurance concern. The timing of this move was viewed on the street as a defensive maneuver against Rupert Murdoch. This move was a discriminatory VRDS against Mr. Murdoch since his being a foreigner was expected to be viewed more unfavorably by the Insurance Commissions. As it turned out, a state court in Omaha, Nebraska issued a temporary restraining order against Mr. Murdoch, barring him from acquiring more than a 10% interest in St. Regis'. A similar action was taken by the Florida Insurance Commission. Soon after, Champion International Corps. agreed to acquire St. Regis' Corporation through a tender offer for \$55.50 a share for as much as 60% of St. Regis' common. To cement the transaction, St. Regis' agreed to sell the company's "*crown jewel*," its printing paper division, to Champion for a bargain price of \$750 million in cash and notes in the event that another bidder acquired 50% or more of the company. This too was a discriminatory VRDS against Mr. Murdoch as St. Regis' was now worth more to Champion than to him. Mr. Murdoch did not proceed with his tender offer.

VI. Conclusion

In this paper we analyze resistance strategies that work by reducing the value of synergy gains for some bidders and show how these strategies improve target shareholder welfare. Some members of this class are crown jewel defenses, litigation, lock-ups, direct cash payments, and buying or selling of assets which may be desirable or undesirable for some bidders. Recent poison pills are not a member of this class.

The most obvious implication for empirical research is that value-reducing defensive strategies (VRDS) work also as threats. Therefore, it may be inappropriate to attempt to measure their effectiveness through estimates of targets' stock price reaction to observed VRDS. If the important variable is the manager's ability to use VRDS, then most of the effect may be capitalized before they are actually used. A more suitable test may be one based on, for example, exogenous changes in the ability of the target to be able to use VRDS if needed. Some obvious examples are changes in law and landmark court decisions which change the market's perception about the ability of the manager to use VRDS effectively. Also, since VRDS are more effective with more competition, events which cause an increase in competition should also result in higher value for potential targets.

In most of our analysis, we assume that there are no agency costs. However, management can exploit VRDS or other defensive strategies for entrenchment

purposes. Nevertheless, because VRDS can be observed and monitored, the extent to which the manager can misuse them depends on the cost of monitoring. The lower this cost, the higher will be the benefit to target shareholders. We are unable to say which effect dominates and to what extent. However, we provide an explanation as to how defensive strategies can improve target shareholders' wealth and, thus, add another dimension to the debate about the role of resistance by target managers.

Appendix

Proof of Proposition 1: We first show that no pooling equilibrium exists. Any pooling equilibrium can exist only for a bid between 0 and L . Consider a pooling bid below qL . From the above discussion, whenever $r(H - L) > c$, 2_H enters for any pooling equilibrium, while 2_L does not. Therefore, the best strategy for 1_L is to bid zero. Thus, the only possible pooling is a bid of zero. This is an equilibrium if bidder 2 believes that any deviation from this equilibrium is done by 1_L . This belief system is not sensible in the sense of Kreps' (1984) intuitive criterion as 1_H can deviate in such a way that 1_L will not find it profitable to mimic. To show this, consider a bid of $qL + e$. 1_L prefers to bid zero in preference to this bid even if bidder 2 will infer its type to be H upon bidding this bid. This is because a bid of zero yields rL for 1_L , while bidding $qL + e$ yields $rL - e$. However, if bidder 2 considers $qL + e$ to be bid by 1_H , 1_H finds it profitable to bid it (for small enough e) as its expected gains from a bid of zero, rH , are smaller than from a bid of $qL + e$, i.e., $H - qL - e$. Therefore, no pooling bid below qL exists.

Given this discussion, it is also clear that no pooling equilibria above qL exist as 1_L prefers to bid zero.

A separating equilibrium where 1_H bids higher than qL , say $qL + e$, can exist if bidder 2 interprets every bid below $qL + e$ as a bid made by the low type. However, such a belief system is unreasonable in the sense that 1_L is worse off bidding above qL even if it is taken to be of type H . Therefore, again using the intuitive criterion, we assume that, if bidder 2 observes a bid above qL , it believes that it has been made by 1_H , and, if it observes a bid below qL , it believes that with a high enough probability it faces 1_L . This gives a unique equilibrium where 1_H bids qL and 1_L bids zero. For this equilibrium to hold, it remains to be shown that, for 1_H , bidding qL and revealing itself to be of type H is preferable to bidding zero. If 1_H bids zero, 2_H competes, and 1_H makes expected profits of $(H - 0)(1 - q) = H - qH$, which are less than its profits under separation, $H - qL$.

Proof of Proposition 2:

Case 1: Assume $rL - c \leq 0$. The equilibrium strategies and beliefs are as follows. 1_H bids $q(H - c)$; 1_L bids zero; the target employs $p = c$ for any bid between qL and $q(H - c)$ and $p = 0$ otherwise. 2_H enters whenever it observes a bid below qL or whenever $p = c$. The belief system of the target and bidder 2 is as follows: a bid less than qL is made by 1_L , and a bid above qL is made by 1_H . The fact that 1_H 's bid is $q(H - c)$ rather than qL is explained in the text. The target does not employ $p = c$ against a bid of 0 because $rL - c < 0$. This condition

ensures that the payoff to the target from using $p = c$, $r(L - c) + q(H - L - c)$, is lower than the payoff from using $p = 0$, $q(H - L)$. Using the same argument as in Proposition 1, it can now be shown that this is the unique reasonable equilibrium for this case.

Case 2: $rL - c > 0$. In this case, if 1_L bids anything below $L - c$, the target finds it profitable to employ $p = c$ and induce 2_L to enter. (See explanation in case 1 above.) Therefore, 1_L will bid at least $L - c$ in equilibrium. Now for a separating equilibrium to exist, 1_L must not find it optimal to imitate 1_H . Since a bid of $L - c$ yields $r(L - L + c) = rc$ to 1_L , it must follow that $rc \geq L - b$, where b is what 1_H bids. Thus, 1_H must bid at least $L - rc$. If $q(H - c) \geq L - rc$, 1_H will bid $q(H - c)$ as discussed in Proposition 1. However, if the reverse holds, then 1_H bids $L - rc$ and the following is the unique reasonable separating equilibrium:

- (i) 1_H bids $\max \{q(H - c), L - rc\}$; 1_L bids $L - c$.
- (ii) The target uses $p = c$ if the bid is below $L - c$ or if it is between $L - rc$ and $q(H - c)$ in the case $q(H - c) > L - rc$. In all other cases, $p = 0$.
- (iii) 2_H enters if the bid is below $L - rc$ and if $p \geq c$.
- (iv) The belief system is as follows: any bid below $L - rc$ is made by 1_L , and any bid above it is made by 1_H .

It is easy to see that, in both cases, target shareholders are better off with VRDS.

We now show that no pooling equilibrium with sensible beliefs is possible. Two cases need to be considered. The first is a pooling of zero, which occurs when the target does not use a VRDS for this pooling. The other case is a pooling bid above zero, which prevents the use of VRDS. The target uses VRDS under pooling if, given a pooling bid b , its payoff from using VRDS exceeds its payoff from not using VRDS, i.e.,

$$r\left(L - \frac{c}{r}\right) + qrL + q^2\left(H - \frac{c}{r}\right) \geq q^2H + qrL + rb. \quad (A1)$$

The left-hand side of (A1) represents the payoff for the target from using $p = c/r$, which is the minimal VRDS needed to induce 2_L to enter. (2_H enters anyway.) The right-hand side is the payoff from not using a VRDS. The pooling bid is now $\max\{0, b_p\}$, where b_p is the solution for (A1) as an equality and is given by

$$b_p = L - \frac{c}{r} - \frac{q^2}{r^2}c. \quad (A2)$$

Case 1: $b_p \leq 0$. The unique pooling equilibrium possible is a bid of zero, as explained in Proposition 1. Now, 1_L 's payoff in equilibrium is rL . Therefore, it does not mimic any bid above qL , no matter what the belief system is. However, if 1_H bids $q(H - c) > qL$, and it is believed to be 1_H , its payoff is $H - q(H - c) = rH + qc$. This payoff is greater than rH , the payoff it gets under a pooling of zero. Therefore, this equilibrium cannot hold.

Case 2: $b_p > 0$. In this case, the pooling bid is b_p . Under this equilibrium, 1_L 's

payoff is $r[L - b_p] = c + \frac{q^2}{r}c$. Therefore, 1_L does not mimic any bid above $L - c - \frac{q^2}{r}c$. 1_H 's payoff, in equilibrium, is $r(H - b_p) = r(H - L) + c + \frac{q^2}{r}c$. On the other hand, if 1_H bids $\max\left\{q(H - c), L - c - \frac{q^2}{r}c\right\}$ and is believed to be 1_H , its payoff is greater than under pooling. Under the bid $q(H - c)$, the result follows from the fact that $b_p > 0$, and, under a bid of $L - c - \frac{q^2}{r}c$, its payoff is $H - L + c + \frac{q^2}{r}c$. Therefore, this equilibrium breaks down under Kreps' criterion. Q.E.D.

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