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TAKEOVERS AND THE DYNAMICS OF INFORMATION FLOWS

Gilles Chemla

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Gilles Chemla, University of British Columbia and CEPR

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Centre for Economic Policy Research
90–98 Goswell Rd, London EC1V 7RR, UK
Tel: (44 20) 7878 2900, Fax: (44 20) 7878 2999
Email: cepr@cepr.org, Website: www.cepr.org

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ABSTRACT

Takeovers and the Dynamics of Information Flows*

This Paper analyses the effect of a possible takeover on information flows and on the terms of trade in business relationships. We consider a long-term relationship between a firm and a privately-informed stakeholder, a buyer for example. In our model, takeovers both increase the surplus from trade and enable the firm to extract a potentially higher share of the surplus from the buyer. The possibility of a takeover that leaves the buyer with a higher (lower) rent than the incumbent manager increases (decreases) the buyer's willingness to reveal their valuation. We suggest a number of testable predictions on the performance of takeover targets and trade credit.

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Keywords: buyer, disclosure, information, price, takeovers and value

Gilles Chemla
Sauder School of Business
University of British Columbia
2053 Main Hall
Vancouver
British Columbia, V6T 1Z2
CANADA
Tel: (1 604) 822 8490
Fax: (1 604) 822 8521
Email: gilles.chemla@commerce.ubc.ca

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1 Introduction

The recent literature that analyzes the effect of takeovers on stakeholders has focused primarily on moral hazard issues, with a particular emphasis on the ideas that takeover threats create value by disciplining managers and workers, and that they can reduce value by leading managers to act myopically and by restricting the possibilities to enter into implicit contracts with stakeholders¹. The formal analysis of all these effects on stakeholders within the firm suggests that these effects share many similarities with those on stakeholders outside the firm, and particularly on the firm's trading partners. However, it is not clear that moral hazard is an important problem in a number of business relationships, e.g. a seller-buyer relationship. Even when moral hazard creates substantial problems, these problems may be affected by other problems such as asymmetric information. Can takeover threats have real effects in the absence of moral hazard? In this paper, we address the effect of takeover threats on asymmetric information problems. We point out that being a (either short-term or long-term) takeover target affects the informational flows and the terms of trade in a long-term relationship.

In our setup, we rule out any moral hazard issues. We assume instead that the only issue is asymmetric information between the firm and its stakeholders. Specifically, in the presence of a takeover threat, (i) privately known parameters of stakeholders are modified, and (ii) the possibility for the firm to extract rents may be altered. Hence, takeovers and takeover threats affect the incentives of stakeholders to reveal information as well as the amount of rents that can be captured from them. This allows us to derive empirical pre-

¹See, among others, Grossman and Hart (1980), Scharfstein (1988), Stein (1988), Grinblatt and Titman (2001, ch. 20), Shleifer and Summers (1988), and Chemla (2003a).

dictions on the effects of takeover threats (that do not convey any particular information) on pricing strategies and on information flows within and across firms by considering a long-term relationship between an uninformed firm that is a potential takeover target and a privately informed one².

Formally speaking, such relationships are characterized by issues that can be captured in terms of dynamic adverse selection problems. In particular, in the case of a non durable good, these relationships lead to the celebrated ratchet effect: The actions taken at the beginning of the relationship reveal information that the previously uninformed party will use in subsequent contract offers to increase his profit at the expense of the informed party. Hence, the informed party may be reluctant to reveal this information early if the uninformed party does not induce him to do so credibly, which is often costly to her. Inducing information revelation thus requires that contract offers by the uninformed party be subject to the constraint that the informational rent when information is not revealed is lower than the payoff to the informed party if he chooses not to reveal his type. For instance, a worker may refuse to reveal a high productivity because he expects that this would lead the manager to ask for more demanding performance requirements in the future. A buyer facing several consecutive buying decisions is reluctant to pay a high price at the beginning of the relationship as he expects that the seller, after learning that the buyer is willing to buy the good at a high price, will subsequently choose a higher price. In both cases, the profit to the firm is reduced because of the informed party's long term strategy.

²Asymmetric information may also be regarded as a proxy for rent extraction in, say, the problem of a dynamic monopoly that tries to extract rents from buyers distributed on a traditional demand curve. From this viewpoint, the possibility of a takeover that is expected to affect pricing strategies will affect the firm's ability to engage in price discrimination.

This paper investigates how these problems are affected by the possibility of a takeover. The takeover affects the relationship between an initially uninformed firm and a privately informed buyer in two ways. On the one hand, the bidder creates value by increasing the buyer's valuation. On the other hand, it can increase the fraction of the surplus that the firm will obtain, and decrease the fraction of the surplus that will be left to the buyer. These two effects are meant to capture and to combine two ingredients that are central to the literature on the real effects of takeovers: Value creation and wealth transfer at the expense of stakeholders. The higher valuation increases the surplus that goes to the buyer, which increases his incentive to disclose information to the firm. This enables the firm to charge a higher separating price in the first period. On the other hand, high bargaining power allows the firm to appropriate a higher share of the surplus and increases the benefit from the information revealed by the buyer in subsequent periods. Since information revelation is more harmful to the buyer, the firm must cut the price offered to the buyer in order to induce him to reveal his information. This price can become so low that the firm is better off not inducing the buyer to reveal his information with certainty. Overall, takeovers that create significant value favor information disclosure, while wealth-transferring takeovers make information disclosure more costly.

Existing contributions on takeovers that involve asymmetric information generally consider asymmetric information between the target firm's management and the bidder and/or shareholders (Hirshleifer, 1996). Most of them focus on information revelation *via* the takeover and its characteristics (see, e.g., Fishman, 1989, Eckbo, Giammarino and Heinkel, 1990, Brown and Ryngaert, 1991, and Nagarajan, 1995). In our setup, the asymmetry of information

is between the target firm and its stakeholders, rather than between the target firm and the bidder.

Our results are consistent with empirical papers that document that takeovers lead targets to increase output prices following an increase in market power (Kim and Singal, 1993) or in leverage (Chevalier, 1995, Phillips, 1995). However, these empirical papers (1) do not distinguish between the change in capital structure and the change of corporate control; (2) they examine the effect of takeovers on product market prices by focusing on competitors; and (2) they are mostly silent on the effects of takeover threats. In this paper, we investigate the effect of takeover *threats* on the dynamics of pricing strategies when there is no change in capital structure³. We further discuss a number of other empirical predictions on the real effects of takeover threats, managerial turnover, pricing strategies, and trade credit.

Section 2 sets the model. Section 3 first presents the impact of rent sharing on information disclosure and on the terms of trade. Section 4 analyzes how takeovers that can both create value and transfer wealth from the buyer to the bidder affect information flows and transaction prices. Section 5 discusses alternative interpretations for some assumptions in our model, as well as applications to, and empirical predictions on, the performance of takeover targets, pricing decisions, and trade credit. Section 6 concludes.

³In analyzing the effect of financial transactions on information revelation in dynamic adverse selection problems, this work is in line with Chemla and Faure-Grimaud (2001) who show how a high debt level enabled a non informed party to induce a privately informed one (with whom it is engaged in a long-term relationship) to reveal it at a lower cost. Due to the possibility of liquidation associated to a high debt level (even when renegotiation is allowed), the informed party is led to reduce the attention it pays to the future informational rents from refusing to reveal information today.

2 The Model

2.1 The Product Market

A firm F can produce and sell one unit of a non durable good to a buyer in both periods 1 and 2. The buyer has private information about his valuation v that can take values V_L or V_H , with $V_H > V_L > 0$, under the incumbent manager I . Initially, it is common knowledge that $v = V_H$ with probability λ_1 .

The production cost is 0. As in standard adverse selection problems (e.g. Maskin and Riley, 1984), we assume that the firm is better off selling the good at price V_H with probability λ_1 than selling it at price V_L with probability 1, i.e. $\lambda_1 > \bar{\lambda} \equiv V_L/V_H$. For simplicity, we restrict the analysis to short term contracts unless otherwise specified⁴. The discount factor is denoted δ .

2.2 The Takeover

For simplicity, the incumbent manager is assumed to maximise shareholder value. After the stage 1 product market decisions, the relationship between the firm and the buyer can be affected by a takeover that has the following characteristics:

- The stage 2 buyer's valuation under the bidder, B , is bv , where $b > 1$.
In other words, the buyer's valuation for the good is higher under B 's management than under I 's management, and the bidder's valuation for the firm is higher than I 's.
- The takeover affects the way the surplus is shared between the firm and the buyer. Specifically, if a stage 2 product-market transaction takes

⁴Renegotiation constraints would have long term contracts exhibit dynamic adverse selection problems (Laffont and Tirole, 1993).

place, the buyer gets a fraction $1 - \alpha_I$ of the surplus under the incumbent manager, and a fraction $1 - \alpha_B \neq 1 - \alpha_I$ if the takeover took place. Fractions α_I, α_B are common knowledge.

- In order to takeover the firm, B must incur a fixed cost $C > 0$ in addition to the price he pays to the incumbent owner(s).

One possible interpretation behind these probabilities is that the takeover affects the following simple bargaining game. With probability $\alpha_d, d \in \{I, B\}$, called the manager's bargaining power, the manager makes a take-it-or-leave-it offer to the buyer. With probability $1 - \alpha_d$, the buyer makes a take-it-or-leave-it offer to the manager. The reasons why the bidder may have higher bargaining power may include a higher concentration in ownership structure and a more rigorous management (see Habib, 1997, and Jarrell et al, 1988) after the takeover. A higher ownership concentration is likely to increase the firm's bargaining power, since a larger shareholder benefits more from a favorable bargaining outcome and is, therefore, prepared to allocate more resources to negotiation. Alternatively, a takeover may increase market power, whether it is a horizontal merger (see, e.g. Kim and Singal, 1993) or a vertical merger (Rey and Tirole, 2002, and Chemla, 2003b), and hence make the buyer's outside options less attractive. On the other hand, the bidder may be less informed about some specificities of the target firm, which is likely to leave the buyer with more rents⁵. Section 5.1 argues that this assumption that the buyer appropriates different fractions of the surplus under the incumbent manager and under the bidder can also be interpreted as differences in stochastic valuations

⁵When a takeover does not affect market power, but decreases marginal costs of production, it may be the case that a takeover is followed by a decrease in prices. For instance, if the firm faced a traditional downward sloping demand curve, a decrease in the marginal cost would be followed by a decrease in prices.

or in abilities to write a full-commitment long term contract. Note that our specification is convenient as it applies directly to the impact of takeovers on both pricing strategies and industrial relations.

In this model, we rule out any inefficiency in the takeover bid. Hence, the nature of the merger bid does not affect the analysis, as it does not affect the probability of success of the takeover. Specifically, the price at which I sells his shares to B does not affect the analysis. Empirical evidence suggests that the surplus usually goes to the shareholders of the target firm (Jarrell et al, 1988), which is consistent with the assumption that the incumbent manager has all bargaining power vis-à-vis the bidder. One reason for this is that, during the takeover of a publicly listed firm with dispersed ownership, free-riding target shareholders may appropriate all the surplus created by the takeover (Grossman and Hart, 1980)⁶.

2.3 Timing, Equilibrium, and Objectives

The timing is as follows:

- In period 1, the manager and the buyer bargain over a price corresponding to the sale of one unit of the good. If both parties agree, the transaction takes place according to the terms of the agreement. Otherwise, both parties get 0. Then, the bidder decides whether or not to take over the firm.
- In period 2, the manager and the buyer bargain over a new price. If no agreement is found, both parties get 0. Otherwise, the production and sale take place according to the terms of the agreement.

⁶Among other possibilities, bidders can overcome the free-rider problem and make up for the takeover cost by buying a block of shares before the takeover, by capturing non-monetary benefits, or by dealing with risk-arbitrageurs (Grinblatt and Titman, 2001).

A Perfect Bayesian Equilibrium is characterized by i) a sequence of prices $\{p_1, p_2\}$ offered by the manager and prices $\{w_1, w_2\}$ offered by the buyer. A sequence of decisions by the buyer and the manager, respectively, to accept these offers or not. We denote by $x_t^i(p_t)$ the probability that the buyer of type $i \in \{l, h\}$ accepts an offer p_t ($t = 1, 2$); ii) a probability distribution defining the manager's beliefs about the buyer's valuation that is consistent with equilibrium strategies and that uses the Bayes' rule. These beliefs are represented by λ_1 in period 1 and by $\lambda_2(I)$ in period 2, where I is the information obtained at the end of period 1, i.e. either w_1 , or $x_1 = 0$ (rejection of an offer p_1), or $x_1 = 1$ (i.e. p_1 is accepted); and iii) a decision by the incumbent manager to offer a price for a takeover and a decision for the bidder to accept it or not.

When the buyer makes a take-it-or-leave-it offer, he offers $w_1 = w_2 = 0$, i.e. the firm's reservation price, and the firm obtains no rent. Hence, the buyer's objective function boils down to

$$\pi_B = \begin{cases} x_1^i(p_1)(v - t_1) + (1 - \alpha_I)\delta x_2^i(p_2)(v - t_2) & \text{if there is no takeover} \\ x_1^i(p_1)(v - t_1) + (1 - \alpha_B)\delta x_2^i(p_2)(v - t_2) & \text{if there is a takeover} \end{cases} \quad (1)$$

The incumbent manager's objective can be written

$$\pi_M = \begin{cases} \alpha_I[x_1^i(p_1)t_1 + \delta x_2^i(p_2)t_2] & \text{if there is no takeover} \\ \alpha_I x_1^i(p_1)t_1 + z & \text{if there is a takeover} \end{cases} \quad (2)$$

where z is the transfer from the bidder to the firm's incumbent owner(s), if there is a takeover. Finally, the bidder's objective is $\max\{-z - C + \alpha_B \delta x_2^i(p_2)t_2, 0\}$.

3 The Effect of Rent Sharing on Prices and The Dynamics of Information Flows

We first analyze the impact of bargaining on the buyer's decision to reveal information and on the firm's pricing strategy. We proceed by backward induction.

When the firm makes a period 2 offer, the buyer of type $i \in \{l, h\}$ accepts any offer $p_2 \leq v_i$ and turns down any other offer. Hence, the firm offers $p_2 = V_H$ if $\lambda_2 V_H > V_L$ and $p_2 = V_L$ otherwise, where $\lambda_2(p_1)$ is the probability that $i = h$ knowing that p_1 was rejected.

A low valuation buyer will only accept a period 1 price offer p_1 that is lower than V_L . In contrast, a high valuation buyer accepts offer p_1 if, and only if, his rents if he accepts it, i.e. $V_H - p_1$, are at least as high as the rents he foregoes by not mimicking a low valuation buyer. The latter rents equal the probability that I makes the price offer times the present value of the expected difference in valuations, i.e. $\delta\alpha_I(V_H - V_L)$ (the appendix provides more information on this). Hence, a high valuation buyer accepts with probability 1 a price offer that is lower than or equal to

$$\hat{p}_1(\alpha_I) = V_H - \delta\alpha_I(V_H - V_L). \quad (3)$$

This separating price is higher than V_L so that the low valuation buyer turns down the offer, but it is lower than V_H so that the high valuation buyer is induced to accept the offer. The price that induces the high valuation buyer to reveal his information with probability 1 is an increasing function of both V_L and V_H . The higher V_L , the lower the difference $V_H - V_L$, and the lower the expected rents that the high valuation buyer gives up by disclosing his valuation. This increases the first period price that the incumbent manager

can charge to induce the buyer to purchase the good with probability 1. The reason why the price increases in V_H is that an increase in V_H increases the benefit from purchasing the good in period 1 than it increases the rents that have to be offered to the buyer to induce him to purchase the good in period 1. If we distinguish between the high valuations in period 1 and in period 2, then the separating price increases in the first period high valuation and decreases in the second period high valuation.

The separating price is a decreasing function of α_I , the incumbent manager's bargaining power in period 2. The higher I 's bargaining power in period 2, the more likely I to make an offer in period 2, and the higher the high valuation buyer's expected benefit from mimicking a low valuation buyer. This makes it more costly for the incumbent manager to induce information revelation in period 1.

The buyer may also be tempted to adopt a mixed strategy if $p_1 > \hat{p}_1$. In that case, the period 1 price is accepted with probability $\lambda_1 x$. When λ_1 increases, the probability that the high period 1 price is accepted increases as well. This increases the attractiveness of the semi-separating scenario to the firm. After deriving this semi-separating outcome and comparing the firm's expected payoff resulting from this latter strategy from the former separating strategy, we obtain

Proposition 1 : *There exists $\hat{\lambda}_1(\alpha_I) \in (\bar{\lambda}, 1]$ such that the equilibrium is separating with $p_1 = V_H - \delta\alpha_I(V_H - V_L)$ when $\lambda_1 \leq \hat{\lambda}_1(\alpha_I)$ and the equilibrium is semi-separating otherwise. $\hat{\lambda}_1$ satisfies*

$$\hat{\lambda}_1(\alpha_I) = \frac{V_L + \delta\alpha_I\bar{\lambda}(V_H - V_L)}{V_L + \delta\alpha_I(V_H - V_L)}. \quad (4)$$

Proof: See Appendix. □

It appears that $\hat{\lambda}_1(\alpha_I)$ decreases in α_I . This can be explained as follows: Bargaining power has several conflicting effects on the firm's payoff. On the one hand, a high bargaining power gives the firm a high probability to make an offer p_1 and hence to appropriate a higher share of the surplus created. On the other hand, it leads the firm to decrease the first period price in order to induce the high valuation buyer to reveal his information. In other words, it makes information revelation more costly. But when its (first period) bargaining power decreases, the firm is less likely to have the opportunity to induce the buyer to reveal his information. When the first period offer is made by the buyer, the firm's offer in period 2 equals V_H (as in the static case). Since the second effect does not arise in the semi-separating scenario, an increase in α_I favors a semi-separating outcome rather than a fully separating one. Overall, the firm is still better off with a higher bargaining power, i.e. with a higher share of a lower payoff.

Finally, when both V_L and V_H grow at the same rate from period 1 to period 2, the buyer's willingness to reveal information is higher. Growth emphasizes the benefit of period 2 transactions, and favors period 1 information disclosure. It is also immediate to check that the firm may now benefit from not having a bargaining power that is too high. This is consistent with the conventional wisdom that the "working atmosphere" is better in growth firms, as their stakeholders expect to benefit more from a higher expected surplus, while mature firms tend to cut costs, reduce their stakeholders' rents, and experience less communication among different parties.

4 The Impact of Takeovers on Information Flows

The decision to takeover the firm depends on the expected product market payoff in period 2. At the beginning of period 2, the manager expects a profit $\alpha_d \max\{\lambda_2 V_H, V_L\}$, with $d \in \{I, B\}$. Given the cost C associated with a takeover, B will takeover the firm if, and only if

$$(b\alpha_B - \alpha_I)\delta \max\{\lambda_2 V_H, V_L\} > C \quad (5)$$

Recall that the possible beliefs to the manager in period 2 are that the buyer's type is h with probability

- either $\lambda_2 = 0$ or $\lambda_2 = \bar{\lambda}$: The firm's expected profit then equals the low valuation;
- $\lambda_2 = \lambda_1$: The expected profit in period 2 is then $\alpha_I \delta \lambda_1 V_H$ if there is no takeover and $b\alpha_B \delta \lambda_1 V_H$ after a takeover.
- $\lambda_2 = 1$: The expected profit is then $\alpha_I \delta V_H$ if I keeps control and $b\alpha_B \delta V_H$ after a takeover.

Denote $\Delta\alpha \equiv b\alpha_B - \alpha_I$. Clearly, if $C \geq \Delta\alpha \delta V_H$, taking over the firm would not be profitable to I . There is no takeover threat and the equilibrium on the product market is determined as in the previous section. If $C < \Delta\alpha \delta V_L$, the takeover takes place whatever the buyer's type and whatever the equilibrium in the product market. We restrict our analysis to the more interesting case where B 's decision to takeover the firm depends on the equilibrium on the product market, i.e. $\Delta\alpha \delta V_L \leq C < \Delta\alpha \delta V_H$. This implies that there is a takeover only if $\lambda_2 = \lambda_1$ and if $\lambda_2 = 1$. In this range, we may still want to

distinguish between the cases $\Delta\alpha\delta V_L \leq C < \Delta\alpha\lambda_1\delta V_H$ where the takeover takes place when $\lambda_2 = \lambda_1$, i.e., after an offer from the buyer in period 1, and $\Delta\alpha\lambda_1\delta V_H \leq C < \Delta\alpha\delta V_H$, where the takeover only takes place when $\lambda_2 = 1$. It is easy to see that these two cases affect information revelation similarly when the firm makes the first period offer. Without loss of generality, we can restrict ourselves to the case:

$$\Delta\alpha\delta\lambda_1 V_H \leq C < \Delta\alpha\delta V_H \quad (6)$$

Clearly, the period 2 strategies are similar to those of the previous subsection. The low valuation buyer's decisions on the product market are not modified compared to that of the previous subsection.

However, the high valuation buyer's response to an offer p_1 is modified. This buyer expects that revealing his information will trigger a takeover. To make him reveal his type with probability 1, the price offered by the firm in period 1 must now satisfy

$$V_H - p_1 + \delta(1 - \alpha_B)bV_H > \delta\alpha_I(V_H - p_2'(\lambda_2(x_1 = 0))) + \delta(1 - \alpha_I)V_H. \quad (7)$$

Hence, we obtain

Proposition 2 *The price chosen by the firm in order to induce the buyer to reveal his valuation with probability 1 satisfies*

$$\tilde{p}_1(\alpha_I, \alpha_B, b) = V_H + \alpha_I\delta V_L + [b(1 - \alpha_B) - 1]\delta V_H \quad (8)$$

The separating price now increases with α_I and decreases with α_B . The intuition behind this is simple. Revealing information triggers a takeover, but

not revealing information prevents the takeover. When the firm makes the price offer in period 2, the second period informational rent that the buyer obtains if he did not disclose information previously is $\delta\alpha_I(V_H - V_L)$. On the other hand, the takeover increases the rent that the buyer obtains when he makes the period 2 price offer in period 2, but it decreases the probability that he will make such an offer.

The separating price equals the first period valuation minus the overall expected rent that is affected by the prospect of the takeover. It is higher than $\hat{p}_1(\alpha_I)$ if $b > \frac{1}{1-\alpha_B}$ and lower than $\hat{p}_1(\alpha_I)$ otherwise. The separating price is higher than that in the previous subsection if the buyer benefits more from the increase in valuation after the takeover than he loses by having a low bargaining power. Overall, the buyer benefits from revealing information if the takeover increases his valuation substantially. However, he loses if the bidder's higher bargaining power affects the payoff to the buyer more than the increase in valuation.

After analyzing the mixed strategy, we thus obtain:

Proposition 3 *If $\delta b(V_H - V_L - \alpha_B V_H) > V_L + \delta(V_H - V_L) - \delta\alpha_I V_L$, then the separating equilibrium is unique. Otherwise, there exists $\tilde{\lambda}_1(\alpha_I, \alpha_B, b) \in (\bar{\lambda}, 1]$ such that the incumbent manager chooses the separating price $\tilde{p}_1(\alpha_B, \alpha_I, b)$ when $\lambda_1 \leq \tilde{\lambda}_1(\alpha_I, \alpha_B, b)$ and a semi-separating price V_H otherwise. The takeover takes place with probability λ_1 if $\lambda_1 \leq \tilde{\lambda}_1(\alpha_I, \alpha_B)$ and with probability $\frac{\lambda_1 - \bar{\lambda}}{1 - \bar{\lambda}}$ otherwise. $\tilde{\lambda}_1$ satisfies*

$$\tilde{\lambda}_1(\alpha_I, \alpha_B) = \frac{V_L + \delta V_L(b\alpha_B - \alpha_I) + \alpha_I \delta \bar{\lambda}(V_H - V_L)}{V_L - (b-1)\delta(V_H - V_L) + \delta(b\alpha_B V_H - \alpha_I V_L)} \quad (9)$$

Proof: See Appendix. □

When b is high enough, the period 2 benefit of period 1 information disclosure is so high that the firm always wants to elicit information from the buyer. This, or a sufficiently low α_B , favors a separating equilibrium on the product market⁷ Not only the prospect of a takeover leads the manager to change its separating price when $\lambda_1 < \tilde{\lambda}_1(\alpha_I, \alpha_B)$, but also it affects the range where the manager chooses a semi-separating price.

Corollary 1 $\tilde{\lambda}_1$ increases with α_I and in b , and it decreases with α_B .

The threshold $\tilde{\lambda}_1(\alpha_I, \alpha_B)$ is higher than $\hat{\lambda}_1(\alpha_I)$ if b is high enough and if α_B is low enough. However, as b goes close to 1 and α_B becomes significantly higher than α_I , the separating price goes down, and the semi-separating equilibrium becomes more likely.

A takeover creates value by increasing the buyer's valuation, but it may also create value by leading to a separating equilibrium in cases where the equilibrium would have been semi-separating without the prospect of a takeover. On the other hand, the possibility of a takeover may be socially costly when it induces I to choose a semi-separating price while he would have chosen a separating in an environment without takeovers. Indeed, a semi-separating price leads the high valuation buyer to buy the good in period 1 only with some probability lower than 1 while he would have bought it with probability 1 with a separating price.

Corollary 2 *A takeover can create value not only by increasing the buyer's valuation, but also by favoring a separating equilibrium when the increase in*

⁷In our setting, the separating payoff does not depend on α_B because the effect of α_B on the separating price compensates exactly the additional rent to the firm in period 2 following information revelation and a takeover.

value is high enough. But when the increase in the buyer's valuation is small, the prospect of a takeover can reduce value by restricting the probability of a trade in period 1.

Finally, it should be noted that since the buyer appropriates a fraction $1 - \alpha_B$ of the increase in his valuation, some value-increasing takeovers do not take place. Indeed, a takeover creates value in period 2 if $\delta(b - 1)[\lambda_2 V_H + (1 - \lambda_2)V_L] > C$. Hence, there may be a hold-up problem that is created by the buyer's rents and that will prohibit value-creating takeovers.

5 Applications and Extensions

5.1 Stochastic Bidder's Valuation and Imperfect Commitment

In this section, we discuss two alternatives to model the differences between the incumbent manager and the bidder. Instead of a combination of a different valuation and different bargaining powers, the differences between the incumbent manager and the bidder could arise from a (stochastic) bidder's valuation and from a model where α_I and α_B would arise as different abilities to stick to a full-commitment long-term contract.

A deterministic bidder's valuation and a take-it-or-leave-it price offer made by the firm to the buyer is a special case in our analysis ($\alpha_I = \alpha_B = 1$). The takeover occurs only when the bidder's valuation is higher than the incumbent manager's. In this case, the takeover can only benefit the buyer through a lower separating price in period 1. There can be no takeover that hurts the buyer.

This need not be the case with a stochastic bidder's valuation and a take-it-or-leave-it offer from the period 2 manager. Specifically, assume that the

valuation is higher than v , or that $b > 1$, with probability θ , and that it is lower than v , or that $b < 1$, with probability $1 - \theta$. The bidder's valuation is realised after the second period price offer is made, but before the buyer accepts or rejects this offer. Then an analysis similar to that in section 4 indicates that following a takeover the possible period 2 prices are $E(b)V_H$ and $E(b)V_L$ instead of bV_H and bV_L . Hence, the buyer accepts the price offer when $b > 1$, but he rejects it when $b < 1$, and then there is no trade despite the fact that the buyer's valuation is positive. As in section 4, the buyer can obtain a rent through a reduced period 1 separating price. In other words, the probability θ plays a role similar to the bargaining power in our model. The main difference with our model is that unless the firm has the default option to sell the good at price V_L to another buyer the stochastic valuation then creates an inefficiency when the buyer's valuation is lower than the price charged by the bidder. With such a default option, however, the results are identical to ours.

The ability to commit to a long-term contract with some probability is another alternative way of interpreting our model that also leads to identical results. It is well-known that such a contract is generally not-renegotiation-proof (Laffont and Tirole, 1993), but the firm may have an imperfect ability to commit by making renegotiation difficult or costly.

In our model, a full-commitment contract leaves the buyer with no rent in year 2: Following the rejection of a period 1 price offer to the buyer, the firm does not update its beliefs and charges the same period 2 price as in the static case (Baron and Besanko, 1984), that is a price equal to the high valuation. When the firm cannot commit, we are back to our model with $\alpha_I = \alpha_B = 1$, i.e. the cases where the firm makes take-it-or-leave-it offers to the buyer. Hence,

the buyer can only appropriate a rent through the possibility that the firm will not be able to commit through a long term contract. Again, denoting α_I and α_B the probabilities that the incumbent manager and the bidder are unable to commit to the long term contract leads to results that are formally equivalent to ours⁸.

5.2 How Do Takeover Targets Perform?

The theory of disciplinary takeovers states that managers, or more generally stakeholders, have to engage in value-creating actions in order to discourage a bidder from taking over the firm and taking this value-creating action⁹. One problem with the moral hazard model without asymmetric information that is often used (typically based on Grossman and Hart, 1980), the stakeholders work hard to prevent a takeover, and the takeover takes place when the firm's poor performance is due to bad luck rather than low effort. However, considering an adverse selection problem (potentially combined with a moral hazard problem) can lead to results where the low performance due to stakeholders' low type triggers a takeover.

Our results further suggest that the target firm's performance before the takeover may be affected by the takeover threat. In our model, the expectation of a wealth-transferring takeover reduces the stakeholders' willingness to reveal information, and it increases the cost of inducing information disclosure.

⁸In this second alternative again, the expected surplus created may be altered unless the firm is assumed to have the default option to sell the good to another buyer at price V_L . Without such a default option, the surplus is not created if the buyer turns out to have a low valuation.

⁹It should be noted that the disciplinary takeover argument may also be undermined by stakeholders' entrenchment. When stakeholders are entrenched, it may be costly for a bidder to engage in actions that will create more value than the incumbent manager. Takeover threats may precisely encourage the stakeholders to engage in some irreversible investment that make them entrenched. This may worsen the firm's performance instead of improving it.

On the other hand, when stakeholders expect to benefit from a takeover, they are less reluctant to disclose information. This suggests that an expected disciplinary takeover leads the firm to underperform, which may in turn prompt the takeover. However, the prospect of a takeover that is meant to create operating synergies may well lead the firm to perform better.

Existing tests on the performance of takeover targets (Agrawal and Jaffe, 2003) generally do not distinguish between these hypotheses. They do not distinguish either the hypotheses that some targets may underperform because they are poorly managed or because takeover threats undermine the incentives within the organization. For this purpose, it would be interesting to test whether long-term takeover rumours (and potentially the nature of these rumours) tend to improve or to worsen the performance of potential target firms.

Our results lead to other predictions that cannot easily be derived through a model based on moral hazard only. In a model with asymmetric information, when the target firm's stakeholders expect a takeover to be followed by a strategy that leaves them with fewer rents, their outside options become more attractive. Hence, the threat of such a takeover may lead them to leave the target firm. This is consistent with the casual observation that some firms that are subject to takeover threats tend to experience substantial managerial turnover, and particularly the departure of some of their "best" managers to competing firms. The examples of Apple and a number of banks have been widely documented in the business press, but apart from Mikkelson and Partch who provide partial support for this we are not aware of any academic work on the effect of takeover threats on managerial turnover.

5.3 Suppliers and Trade Credit

The literature on the real effects of takeover threats has generally focused on workers and managers. This creates a difficulty, because the employment relationship is subject to many contingencies that may interfere with tests on the real effects of takeover activity. Tests on the effect of takeovers on trade partners may well be less noisy. Arguably, it is difficult to track down input prices, but it should be possible to analyze the effect of takeovers on supplier-buyer relationships through the stock price reaction of (closely) vertically related firms after the announcement of a takeover, and especially through trade credit.

Most theories of trade credit rely on asymmetric information models (Smith, 1986, Lee and Stowe, 1993, Petersen and Rajan, 1997, Frank and Maksimovic, 1999, etc.). In particular, they point out that trade credit affects the firm's ability to price discriminate. Our paper is in line with this argument, and it further suggests that the prospect of a takeover may affect the terms of trade credit. We are not aware of any empirical paper that tests the effect of takeover activity on trade credit.

Most trade credit contracts are typically short-term contracts that offer a grace period at a very low, or even zero, interest rate (Frank and Maksimovic, 1999). In our paper, trade credit at a low interest rate may be a way for firms to give away rents to the buyer in order to encourage him to disclose his valuation. Hence, a takeover that is expected to benefit (resp. hurt) the buyer may well lead to less (resp. more) favorable terms in the trade credit contract. This in turn decreases (resp. decreases) the attractiveness of trade credit compared to standard credit. We then predict that the possibility of such a takeover will decrease (resp. increase) the fraction of trade credit to

financing from financial creditors.

6 Concluding Remarks

This paper has examined the interactions between a takeover threat and the dynamics of pricing strategies and information flows both across and within organizations. We pointed out that takeovers may have real effects even in the absence of any moral hazard problem. In particular, they may affect the way information flows among stakeholders. In addition, asymmetric information may enhance the effects of takeover threats on incentives.

A comparison between asymmetric information and moral hazard models can be drawn. The existing literature on the real effects of takeovers (based on moral hazard) shares a number of features in common to the effects that were developed in this paper. For instance, the argument that takeover threats prevent firms from entering implicit contracts (Shleifer and Summers, 1988, and Chemla, 2003a) relies on an effect on stakeholders' incentives to invest in a way that is parallel to the stakeholder's incentive to disclose information in our model. Similarly, it is possible to derive results close in spirit to the disciplinary takeover argument (Grossman and Hart, 1980, and Scharfstein, 1988), whereby a takeover threat induces stakeholders to reveal information. As in moral hazard models, though, this would require a specification where not disclosing information increases the payoff to the bidder.

Apart from relying on different mechanisms than moral hazard models, an asymmetric information framework may be more appropriate for seller/buyer relationships. Such relationships may well be more appropriate to test real effects of takeover threats than relationships between shareholders, managers and workers, mostly because labor contracts may include many contingencies that

are widely independent of takeover activity. Asymmetric information models can help derive a number of empirical predictions that cannot be easily derived from moral hazard models and that can be tested on vertical relationships. For instance, takeovers may affect the dynamics of pricing strategies, trade credit, and stakeholder turnover.

APPENDIX

Proof of Proposition 1:

Since the firm offers the price p_2 with probability α_I and gets 0 otherwise, its expected profit equals $\alpha_I \delta \max\{\lambda_2(p_1)V_H, V_L\}$.

The buyer's period 1 offer will not reveal information about his valuation, and hence it will not affect the firm's second period expected payoff. Therefore, whatever its type, the buyer makes an offer $w_1 = 0$. This implies that $\lambda_2(w_1) = \lambda_1$ and that the firm's expected profit in period 2 is then $\alpha_I \delta \lambda_1 V_H$.

Since the firm's period 2 offer is never lower than V_L , a low valuation buyer cannot expect any additional surplus if he does not reveal its private information. Hence he will accept any period 1 price offer p_1 lower than V_L and he will turn down any other offer. A high valuation buyer accepts offer p_1 if, and only if, his rents are at least as high as if he were mimicking a low valuation buyer. He accepts the manager's offer with probability 1 if, and only if, $\{p_1, p_2, w_2\}$ satisfy

$$\begin{aligned} V_H - p_1 &+ \alpha_I \delta (V_H - p_2(x_1 = 1)) + (1 - \alpha_I) \delta (V_H - w_2) \\ &\geq \delta [\alpha_I (V_H - p_2(x_1 = 0)) + (1 - \alpha_I) (V_H - w_2)]. \end{aligned} \quad (10)$$

When p_1 satisfies this condition, the high valuation buyer accepts with probability 1 and if such $p_1 > V_L$ the low valuation buyer rejects the offer with probability 1. The firm's belief ex post is then $\lambda_2 = 1$ if the buyer accepts the offer and $\lambda_2 = 0$ if he rejects it, i.e. the equilibrium is fully separating. Hence, $p_2(\lambda_2(x_1 = 1)) = V_H$ and $p_2(\lambda_2(x_1 = 0)) = V_L$. Since $w_2 = 0$ in all cases, the

separating price offered by the firm in period 1 equals

$$\hat{p}_1(\alpha_I) = V_H - \delta\alpha_I(V_H - V_L). \quad (11)$$

Let now consider the case where the firm offers a price higher than \hat{p}_1 . In this case, only semi-separating equilibria where the high valuation buyer randomizes may exist. In equilibrium, the high valuation buyer must be indifferent between accepting and rejecting an offer p_1 . If we denote $\sigma_2 = Prob\{p_2 = V_L\}$, this requires $V_H - p_1 = \delta\sigma_2\alpha_I(V_H - V_L)$ ¹⁰. Such an equilibrium also requires that the firm be indifferent between choosing $p_2 = V_L$ and $p_2 = V_H$ ¹¹. Hence, the probability x that a high valuation buyer accepts to buy at price p_1 in period 1 must satisfy $\lambda_2 V_H = V_L$, with λ_2 following the Bayes' rule

$$\lambda_2 = \frac{\lambda_1(1-x)}{\lambda_1(1-x) + (1-\lambda_1)} = \frac{V_L}{V_H} = \bar{\lambda}, \quad (12)$$

which implies that $\lambda_1 x = (\lambda_1 - \bar{\lambda})/(1 - \bar{\lambda})$. If the high valuation buyer rejects the offer, the expected payoff to the firm in period 2 is $\delta\alpha_I[\sigma_2 V_L + (1-\sigma_2)\bar{\lambda}V_H] = \delta\alpha_I V_L$. Since this profit does not depend on the offered price, which in turn does not affect x , the firm makes the highest first period offer that the high valuation buyer may accept, i.e. $p_1 = V_H$. This price corresponds to $\sigma_2 = 0$ ¹².

Hence, the pooling, separating and semi-separating payoffs to the firm can be written

¹⁰If the LHS were higher than the RHS, the high valuation buyer would choose to reject the offer p_1 . Hence, no information would be revealed and the firm would choose $p_2 = V_H$ with probability 1, which would drive the RHS to 0. This result would be consistent for no $p_1 \leq V_H$. If the RHS were strictly higher than the LHS, the high valuation buyer would choose to accept the offer with probability 1, which would induce the firm to choose $p_2 = V_L$ with probability 1. This result is incompatible with the assumption that $p_1 > \hat{p}_1$.

¹¹If $p_2 = V_H$ with probability 1, then for all $p_1 < V_H$ the buyer is strictly better off revealing his private information in period 1. If $p_2 = V_L$ with probability 1, then (since $p_1 \leq \hat{p}_1$) the buyer would be better off not revealing his information in period 1.

¹²In other words, since the firm leaves the buyer with no rent in period 1, the fact that the buyer must be indifferent requires that it does not leave him any rent in period 2 either.

$$\begin{aligned}
\pi_0^s &\equiv \alpha_I[\lambda_1(\hat{p}_1 + \alpha_I\delta V_H) + (1 - \lambda_1)\alpha_I\delta V_L] + (1 - \alpha_I)\alpha_I\delta\lambda_1V_H \\
&= \alpha_I[\lambda_1V_H + \alpha_I\delta V_L] + (1 - \alpha_I)\alpha_I\delta\lambda_1V_H \tag{13}
\end{aligned}$$

$$\begin{aligned}
\pi_0^{ss} &\equiv \alpha_I[\lambda_1x(p_1 + \alpha_I\delta V_H) + (1 - \lambda_1x)\alpha_I\delta V_L] + (1 - \alpha_I)\alpha_I\delta\lambda_1V_H \\
&= \alpha_I\left[\frac{\lambda_1 - \bar{\lambda}}{1 - \bar{\lambda}}V_H(1 + \alpha_I\delta) + \frac{1 - \lambda_1}{1 - \bar{\lambda}}\delta\alpha_IV_L\right] + (1 - \alpha_I)\alpha_I\delta\lambda_1V_H. \tag{14}
\end{aligned}$$

where superscripts s and ss mean separating and semi-separating, respectively. Since $\lambda_1 > V_L/V_H$, the pooling payoff that the firm would obtain if it did not try to learn the type of the buyer in period 1, $\pi_0^p \equiv \alpha_I[V_L + \delta\lambda_1V_H] < U_0^s$. A comparison of the separating and the semi-separating utilities yields the result. \square

Proof of Proposition 3:

If the buyer plays a mixed strategy, the firm's expected profit in period 2 is, as in the preceding subsection, equal to δV_L . The pooling, separating and semi-separating payoffs to the firm satisfy

$$\begin{aligned}
\pi_F^p &= \alpha_I(V_L + \alpha_I\delta\lambda_1V_H) \\
\pi_F^s &= \alpha_I[\lambda_1(\tilde{p}_1 + b\alpha_B\delta V_H) + (1 - \lambda_1)\alpha_I\delta V_L] + (1 - \alpha_I)\alpha_I\delta\lambda_1V_H \\
&= \alpha_I[\lambda_1(V_H + (b - 1)\delta V_H) + \alpha_I\delta V_L] + (1 - \alpha_I)\alpha_I\delta\lambda_1V_H \\
\pi_F^{ss} &= \alpha_I[\lambda_1x(V_H + b\alpha_B\delta V_H) + (1 - \lambda_1x)\alpha_I\delta V_L] + (1 - \alpha_I)\alpha_I\delta\lambda_1V_H \\
&= \alpha_I\left[\frac{\lambda_1 - \bar{\lambda}}{1 - \bar{\lambda}}V_H(1 + \delta\alpha_Bb) \right. \\
&\quad \left. + \frac{1 - \lambda_1}{1 - \bar{\lambda}}\alpha_I\delta V_L\right] + (1 - \alpha_I)\alpha_I\delta\lambda_1V_H. \tag{15}
\end{aligned}$$

As before, the pooling payoff is dominated by the separating payoff. The

separating payoff is higher than the semi separating one if, and only if,

$$[\lambda_1(V_H + (b-1)\delta V_H) + \alpha_I \delta V_L] > \frac{\lambda_1 - \bar{\lambda}}{1 - \bar{\lambda}} V_H (1 + b\delta\alpha_B) + \frac{1 - \lambda_1}{1 - \bar{\lambda}} \alpha_I \delta V_L \quad (16)$$

leads to

$$\tilde{\lambda}_1(\alpha_I, \alpha_B, b) = \frac{V_L + \delta V_L(b\alpha_B - \alpha_I) + \alpha_I \delta \bar{\lambda}(V_H - V_L)}{V_L - (b-1)\delta(V_H - V_L) + V_H b \delta \alpha_B - \alpha_I \delta V_L}. \quad (17)$$

The derivatives with respect to α_I , α_B , and b can be written

$$\begin{aligned} \frac{\partial \tilde{\lambda}_1}{\partial \alpha_I} &= \delta V_L \frac{\bar{\lambda}(b-1)\delta(V_H - V_L) + (1 - \bar{\lambda})V_L}{[V_L - (b-1)\delta(V_H - V_L) + V_H b \delta \alpha_B - \alpha_I \delta V_L]^2} > 0 \\ \frac{\partial \tilde{\lambda}_1}{\partial \alpha_I} &= -\delta b \frac{(1 - \delta\alpha_I)V_L(V_H - V_L) + V_L(b-1)\delta(V_H - V_L) + V_H \alpha_I \delta \bar{\lambda}(V_H - V_L)}{[V_L - (b-1)\delta(V_H - V_L) + V_H b \delta \alpha_B - \alpha_I \delta V_L]^2} < 0 \\ \frac{\partial \tilde{\lambda}_1}{\partial \alpha_I} &= \frac{\delta V_L \alpha_B [V_L - (b-1)\delta(V_H - V_L) + V_H b \delta \alpha_B - \alpha_I \delta V_L]}{[V_L - (b-1)\delta(V_H - V_L) + V_H b \delta \alpha_B - \alpha_I \delta V_L]^2} \\ &+ \frac{\delta [V_H(1 - \delta\alpha_B) - V_L] [V_L + \delta V_L(b\alpha_B - \alpha_I) + \alpha_I \delta \bar{\lambda}(V_H - V_L)]}{[V_L - (b-1)\delta(V_H - V_L) + V_H b \delta \alpha_B - \alpha_I \delta V_L]^2} > 0 \end{aligned}$$

□

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