Bidder Discounts and Target Premia in Takeovers*

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Abstract

On news of a takeover, the sum of the stock-market values of the firms involved often falls, and the value of the acquirer almost always does. Does this mean that takeovers do not raise the values of the firms involved? Not necessarily. We set up a model in which the equilibrium number of takeovers is constrained efficient. Yet, upon news of a takeover, a target's price rises, the bidder's price falls, and, most of the time the joint value of the target and acquirer also falls.

1 Introduction

On news of a takeover, the share price of the target firm usually rises sharply, while that of the acquiring firm usually falls. The joint value may or may not rise. Surveying the field, Andrade, Mitchell and Stafford (2001) report that since 1973 target premia were 20 or 30 percent, acquirer discounts were minus 3 or 4 percent, and that the joint value shows no clear pattern. They conclude (p. 118) that "the fact that mergers do not seem to benefit acquirers provides a reason to worry ...[that mergers do not raise value]." To explain such evidence Shleifer and Vishny (2001) have assumed that investors are irrational and Roll (1986) has assumed that managers use takeovers to extend their empires at the expense of the shareholder. The evidence about the bidder discount and joint discount has been taken to imply that takeovers often just redistribute rents from acquirers to their targets or that they even destroy rents.

McCardle and Viswanathan (MV)(1994) offer a model where mergers always lead to private gains for both parties, and yet where bidder discounts and target premia do arise. They model a duopoly with one potential entrant whose entry cost is unknown; the entrant can come in as a third firm, or it can acquire one of the incumbents in

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which case it does not pay the entry cost. A takeover bid reduces the bidder's stock price because it signals a high entry cost. The target premium arises because a takeover signals that the number of producers will be two, not three, so that market price will be higher.

We add to MV in three ways. First, in a competitive model we show that mergers are not just privately, but also socially efficient. Second, we derive simple formulas not just for the discounts and premia, but also for the joint discount which MV do not deal with. And, third, our analysis seems to cover a much wider body of mergers because (*i*) MV do not allow horizontal mergers (the two incumbents would like to merge, but antitrust prevents this), and yet these account for about half of all mergers in the 1990s – Andrade *et al.* (2001, Table 1), (*ii*) In MV, only one firm has the option to enter, and yet the recent merger waves in the Airlines and Telecommunications industries were accompanied by lots of new entry, (*iii*) Target premia are bigger for small firms whose disappearance makes little difference to industry capacity (Akbulut and Matsusaka 2003), suggesting that imperfect competition has little to do with explaining target premia.

In contrast to MV, Holmes and Schmitz (1990) have a competitive model in which good managers acquire firms from good developers of new ideas. They stress, as we also do, that good projects and good managers are complements in production, but they do not consider stock-market issues, being interested more in transfers of small businesses.

Plan of paper.—Section 2 presents the model and examines some of its implications. Section 3 contains the welfare result. Section 4 discusses some of the key assumptions and Section 5 concludes the paper.

2 Model

At the outset firms differ in the quality, x, of their management. Each firm then draws a project and the quality, z, of projects, too, differs over firms. Some good managers end up with bad projects and vice versa. Takeovers then serve to shift the good projects from bad managers to good managers. A firm's output is

$$xz. \tag{1}$$

Thus the quality of a project, z, and the firm's ability to implement it, x, are complements. Among firms, $x \geq 0$ is distributed according to the cumulative distribution function $F(x)$. Projects are either good or useless: $z \in \{0, 1\}$. A fraction λ of projects is good, and the fraction $1 - \lambda$ is useless.

A firm cannot change the quality of its management. It can, however, acquire another firm and manage its project. A manager can handle only one project. If a firm (x, z) buys firm (x', z'), it then uses its own management, x, and the project, z', of the firm that it has acquired. The output of the merged entity will be

$$xz'. \tag{2}$$

To an acquirer, then, only the target's z' matters. It drops its own, useless project, and lets go the target's manager.

Shareholders are risk neutral and they hold on to their shares until the firm pays its dividend and liquidates or until it is bought by another firm. A manager acts in the shareholder's interest: He puts the firm up for sale if (and only if) the payment exceeds his firm's stand-alone dividend; he buys another firm if (and only if) net of the payment, the dividend of the new entity exceeds his firm's stand-alone dividend.

Events occur in five stages:

1. A continuum of firms forms. Based on its x (which is public knowledge) a firm sells at $p(x)$.
2. The firm privately observes z.
3. The firm may enter the takeover market as a buyer or a seller. It can stay out of the takeover market if it wishes to, i.e., it can repel an unwanted bid.[1] If it does enter the market as a seller, the firm may disclose its z at a cost c. Disclosure (if any) must be thruthful.
4. The takeover market clears at the price q. This market is Walrasian in that firms take prices as given and there are no out-of-equilibrium transactions.
5. The firm pays its dividend and liquidates.

2.1 Stage-3 actions and Stage-4 prices

We will show later that unless c is extremely large, the unique equilibrium is one in which the low-x firms with good projects are taken over by the high-x firms with bad projects. We illustrate this equilibrium in Figure 1, and describe it below.

Equilibrium.—Key to equilibrium is a pair of real numbers, x_0, and x_1, where $x_0 < x_1$. These two numbers divide the set of x's into three regions – top, middle, and bottom. Targets come from the bottom region, acquirers from the top region. Firms from the middle region stay out of the takeover market. We start describing the equilibrium with an account of the Stage-3 actions and Stage-4 prices of the firms in each region.

The bottom region – $x \leq x_0$.—If such a firm draws $z = 1$, it discloses that fact. This is the North-West region in Figure 1. It becomes a takeover target and sells

[1] Of all takeover bids, only 8.3% of all bids are hostile and only 4.4% eventually succeed (Andrade *et al.,* 2001). We do not explain such mergers.

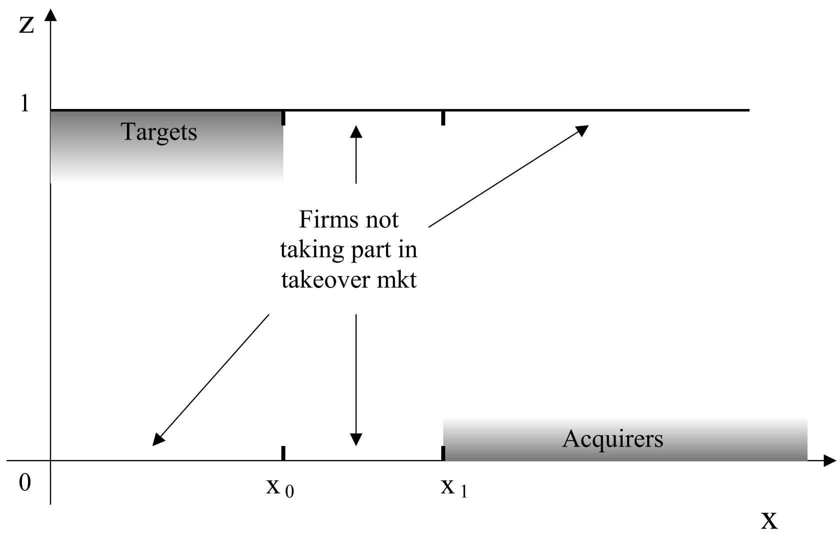

Figure 1: The initial endowments among firm types

at the price q. All targets sell at the same price. Firm x_0 is indifferent between disclosing z and securing a payoff of $q - c$, and not disclosing and managing its own project and securing a payoff of x_0. That is,

$$q - c = x_0. \tag{3}$$

If a firm from this region does not disclose its z, the market rationally infers that it is a $z = 0$ firm. The Stage-4 price of such a firm is zero. To sum up, then, in the bottom region, a firm's Stage-4 price is q if $z = 1$, and it is zero if $z = 0$.

The middle region – $x \in (x_0, x_1)$.—Such a firm does not disclose its z and it does not bid for other firms. The market infers nothing from its inaction. If such a firm has $z = 1$, it can guarantee its shareholders more than $q - c$, and it would refuse (and successfully repel) any takeover bid at the price q. If, on the other hand, such a firm has $z = 0$, buying another firm at the price q would leave it with a negative net payoff. Thus, if a firm from this region did not refuse a takeover bid, it would reveal itself to be a "lemon". Thus no one bids for firms in this region and their Stage-4 prices, λx, are the same as their Stage-1 prices.

The top region – $x \geq x_1$.—Acquirers come from this region if they have drawn $z = 0$. This is the South-East region in Figure 1. Such a firm buys a discloser from the first region thereby raising its own output and dividend from zero to x; and its Stage-4 price is $x - q$. The lowest-quality bidder x_1 is indifferent between bidding (and getting a payoff of $x_1 - q$), and managing its own project (and getting zero), so that

$$q = x_1. \tag{4}$$

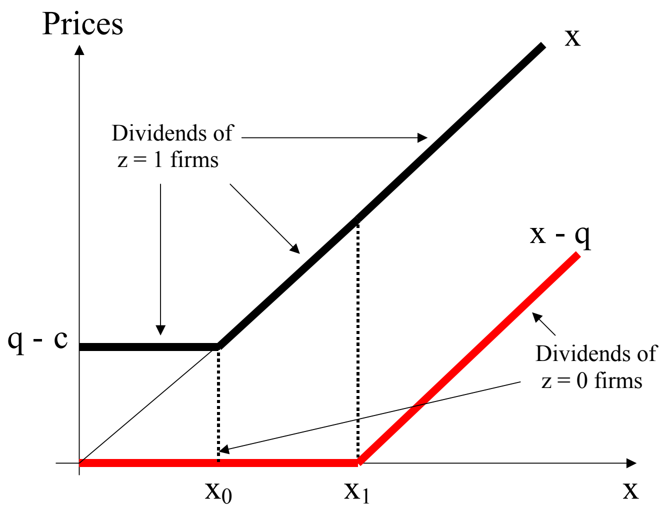

Figure 2: How Equilibrium Dividends Depend on x and z

If it does not bid, this signals to the market that the firm's $z = 1$, and its Stage-4 price is x. The $z = 0$ firms could secure a higher Stage-4 price if they refrained from bidding, but that would deliver a zero dividend to its shareholders who are following a "buy and hold" strategy. To sum up, then, in the top region, a firm's Stage-4 price is x if $z = 1$, and $x - q$ if $z = 0$.

Figure 2 shows the shareholders' equilibrium payoffs, which depend on x and on z. Without takeovers, the $z = 1$ firms would pay a dividend of x (i.e., the 45^0 line), and the $z = 0$ firms would be paying their shareholders a dividend of zero (i.e., the horizontal axis). Takeovers make both targets and acquirers strictly better off.

Market clearing.—The Stage-4 price of the targets, q, must clear the takeover market, supply of certified targets must equal demand for them:

$$\lambda F(q - c) = (1 - \lambda)(1 - F[q]). \tag{5}$$

2.2 Discounts and premia

Discounts and premia are calculated by comparing Stage-4 prices to Stage-1 prices.

Stage-1 prices.—For firms in the middle region the Stage-1 prices are the same as the Stage-4 prices, namely, λx. In the two other regions, a firm's Stage-1 price is a weighted sum of the prices it will fetch at stage 4, the weights being the probabilities of z being zero and one. The stage-1 prices are:

$$p(x) = \begin{cases} \lambda(q - c) & \text{if } x \leq x_0, \\ \lambda x & \text{if } x \in (x_0, x_1), \\ \lambda x + (1 - \lambda)(x - q) & \text{if } x \geq x_1. \end{cases} \tag{6}$$

At Stage 4, all targets trade at a premium over their Stage-1 prices, and all bidders trade at a discount. We measure the premia and discounts as percentages of Stage-1 prices $p(x)$.

The target premium.—From (6), the premium is

$$\frac{(q-c)-p(x)}{p(x)}=\frac{(1-\lambda)(q-c)}{\lambda(q-c)}=\frac{1-\lambda}{\lambda},$$

and it is the same for all targets. The target premium is high when good projects are scarce and when, as a result, a disclosure that $z=1$ is especially good news. Target premia average about 0.2, and so the relevant value seems to be $\lambda \approx 0.83$.

The bidder discount.—Conversely, the bidder discount is high when good projects are plentiful and when, as a result, the revelation of $z=0$ that is implicit in a firm's decision to acquire another, is especially *bad* news. The discount is smaller for the high-x bidders because all bidders pay the same price, q, but the high-x bidders benefit more. The *absolute value* of bidder's discount, i.e., the fraction of value lost upon announcement, is

$$\delta(x)\equiv\frac{\lambda q}{x-(1-\lambda)q}.$$

From (4) $x_1=q$, and so $\delta(x_1)=1$; the marginal bidder loses *all* of his value. As x rises, the discount steadily shrinks and converges to zero as x gets large.

The values combined.—The target's x's do not affect their prices at any stage. Therefore only the acquirer's x affects the sum of the two firms' Stage-1 and Stage-4 prices. Relative to the sum of the two firms' ex-ante values, the ex-post "joint" value of the merged firm is

$$J(x)=\frac{x-c}{q(2\lambda-1)+(x-\lambda c)}, \tag{7}$$

an expression that is relevant for $x\geq x_1$ only. The right-hand side of (7) is less than unity when $\lambda=1/2$ and it is even smaller when $\lambda>1/2$ because $q>0$. For $\lambda\geq 1/2$, the joint values drop:

Proposition 1 *(Joint values). For all $x>x_1$,*

$$J(x)<1 \text{ if } \lambda>1/2. \tag{8}$$

Proof. By (3) and (4), $x>x_1$ implies that $x>c$. Condition (8) is seen to be sufficient for the claim. It is not necessary, for it holds for some $\lambda\leq 1/2$ when $c>0$. ■

For $\lambda\geq 1/2$ and any c, $J(x)$ is strictly increasing in x, i.e., the drop is smaller for the high-x firms. Moreover, $J(x)$ is lower when λ is high. This is because the larger

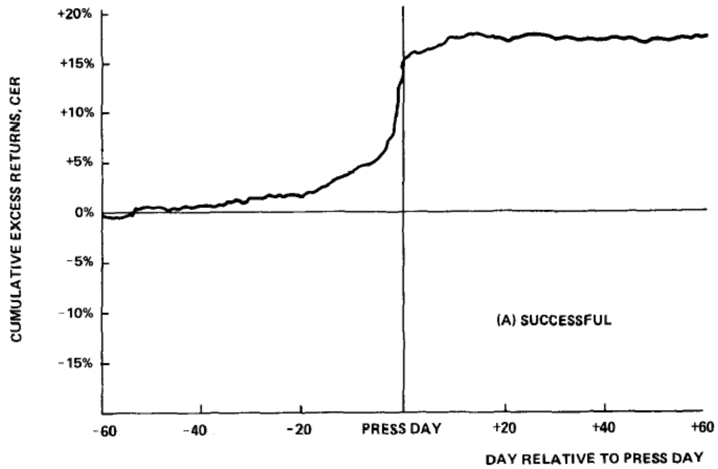

Figure 3: Average cumulative excess returns for 211 targets: 60 days before to 60 days after the press day in the period 1962 to 1976 – Figure 1 of Asquith (1983)

is λ, the bigger (relative to *ex-ante* beliefs) is the disappointment in a firm that *ex post* finds itself in the pool of bidders. [2]

2.2.1 The timing of the target premium

In the model, a firm certifies that its $z = 1$, and then it is taken over. 'Certification' is, in fact, the due diligence process which starts several months before the first bid, and continues after that and until the deal closes. In Figure 3 we reproduce Figure 1 of Asquith (1983) which describes the evolution of the target premium around the "press date" – the day when the financial press first reports a merger bid. The horizontal axis is in trading-day units.[3] We emphasize the following:

1. Most of the target premium is in place by the press date.

[2] A referee suggested the following explanation for why $J(x)$ is decreasing in λ: Re-write (7) as

$$\frac{(x-q)+(q-c)}{\lambda x+(1-\lambda)(x-q)+\lambda(q-c)+(1-\lambda)0}.$$

The Stage-1 value of a high-x firm is $\lambda x+(1-\lambda)(x-q)$. When λ is high, this is close to the Stage-4 outcome with no acquisition, i.e., λx. It falls to $x-q$ with acquisition. The Stage-1 value of a low-x firm is $\lambda(q-c)$. When λ is high, this is close to the Stage-4 outcome with an acquisition, i.e., $q-c$. Thus, when λ is high, the value of the low-x firm rises only a little, whereas the value of the high-x firm falls by a lot.

[3] Similar evidence is in (Jensen and Ruback (1984 pp. 14-15), Schwert (1996 esp. Figure 1) and Andrade et al. (2001 p. 110).

2. Negotiations go on beyond the first bid up to a year or longer. In deals that go through (about 2/3 in Asquith's sample do), targets' prices rise further, but for deals that fail, the target's premium disappears.

In light of our model we would interpret Fact 1 as embodying the market's reaction to news about the target's z that due diligence generates, and that partially leaks out before the first bid. Most often, disclosure is made privately to the bidder(s) because none of the parties wants the target's competitors to learn about the target's business plans and trade secrets. (Gray *et* al. 1990, Table 4). Occasionally, a target discloses widely so as to attract higher bids, as when, e.g., TRW, the automotive and defense group, announced it would share "non-public information" with other companies, including Northrop whose first bid it had rejected (Larsen and Nicoll 2002). Fact 2 we interpret as the result of further news about z uncovered by continuing due diligence. Overall, this evidence suggests that certification largely (but not fully) precedes the first bid, and that successful certification is indeed necessary for a takeover deal to succeed.

2.3 Existence and uniqueness of equilibrium

For most parameter values of interest, equilibrium is unique and it is a separating equilibrium in that targets are all of type $z = 1$.

Definition.—A separating equilibrium consists of three real numbers (x_0, x_1, q) with $x_0 \leq x_1$, for which (3), (4) and (5) hold.

Let $x_{\min}$ be the smallest and $x_{\max}$ the largest value of x in the support of F. If the range of x is larger than c, such a separating equilibrium with a positive number of takeovers will exist.

Proposition 2 *(Only one Separating Equilibrium Exists). If* (i) $0 < \lambda < 1$, (ii) $c < x_{\max} - x_{\min}$, *and* (iii) x *has strictly positive density on* $[x_{\min}, x_{\max}]$, *then takeovers occur and* $q \in (c, x_{\max})$ *uniquely solves*

$$\lambda F (q - c) = (1 - \lambda) (1 - F [q]) . \tag{9}$$

Proof. Eq's (3), (4), and (5) imply (9). It remains to be shown that, for each λ and c, (9) has a unique solution for q. This follows in 2 steps: By (i) and (ii), at $q = x_{\max}$ the RHS of (9) is zero, whereas the left-hand side is strictly positive. At $q = c$ the opposite is true. By (iii) the LHS of (9) is continuous and strictly increasing in q whereas the RHS is continuous and strictly decreasing. Hence, exactly one intersection exists. ■

Figure 4 illustrates the equilibrium. It plots the two sides of (9). The left-hand side, $\lambda F (q - c) \equiv S (q)$ is the supply of targets forthcoming at the price q, while the right-hand side, $(1 - \lambda) (1 - F [q]) \equiv D (q)$, is the demand for targets at that price. The equilibrium price, q^E, is unique.

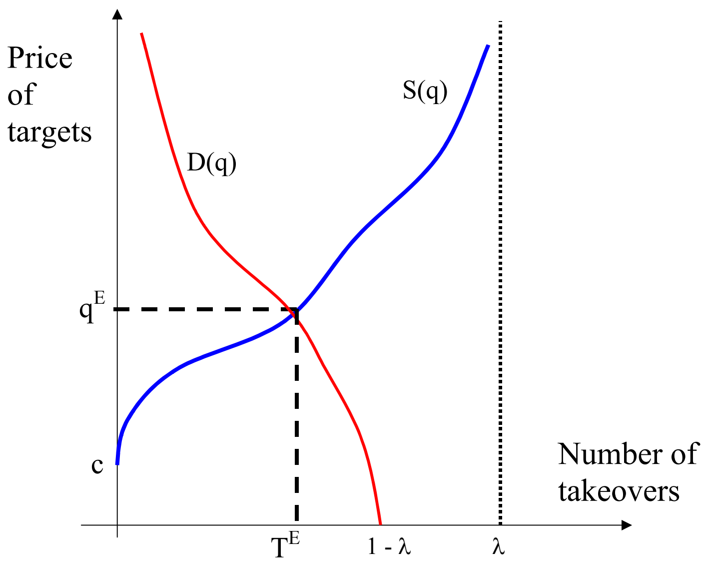

Figure 4: Supply and Demand for Targets

The equilibrium that Figure 4 describes has every target disclosing, and there is just one equilibrium of that type. When c is below a critical number, the separating equilibrium is the only kind of equilibrium that can exist:

Proposition 3 *(Equilibrium is Unique). If*

$$c < (1-\lambda)\, F^{-1}\left(\frac{1-\lambda}{2-\lambda}\right). \tag{10}$$

no other equilibria exist.

Proof. Only $z = 1$ firms would ever disclose, and therefore for any x,

$$E\,(z \mid x, \text{ and no disclosure}) \leq \lambda. \tag{11}$$

Suppose there exists a type of firm, call it x^T that does not disclose a $z = 1$ project for sure. That is, a fraction of the x^T type firms does not disclose their good projects and yet suppose that they are takeover targets. For a buyer of type x, expected revenue from acquiring this target is $E\left(z \mid x^T \text{ and no disclosure}\right) x$. If, on the other hand, firm x^T were instead to disclose, it would yield revenue of x to that same buyer. The additional expected revenue would, according to (11), be at least $(1-\lambda)\, x$. This would exceed the cost of disclosure if

$$c < (1-\lambda)\, x. \tag{12}$$

To derive (10) we calculate a lower bound for x. We do so from the market-clearing condition. Since x is a buyer, he cannot be below the lowest-quality buyer whom we denote by x^B. Then all $x \geq x_B$ are also buyers since they have even more to gain than x^B from an acquisition. Thus the demand for targets is $(1-\lambda)\left[1-F\left(x^B\right)\right]$. The supply of targets is at most $F\left(x^B\right)$. Therefore $F\left(x^B\right)$ exceeds the demand for targets, i.e.,

$$F\left(x^B\right) \geq (1-\lambda)\left[1-F\left(x^B\right)\right],$$

which implies that

$$x^B \geq F^{-1}\left(\frac{1-\lambda}{2-\lambda}\right),$$

i.e., (10). ■

Is (10) *likely to hold in practice*?—In condition (10) $F^{-1}\left(\frac{1-\lambda}{2-\lambda}\right)$ is the value of x at the $\frac{1-\lambda}{2-\lambda}$'th percentile of the distribution of x. Since x exceeds the stage-1 capitalization, $p(x)$ of the type-x firm, (10) is likely to hold unless λ is close to unity. Now, from the target premium we estimated that $\lambda \approx 0.83$ in which case (12) would read

$$c < (1-\lambda)\, x^B \approx (0.17)\, x^B,$$

and x^B exceeds the capitalization of the buyer.

Empirically, however, $\frac{c}{x^B}$ seems to be much lower than that. Gray *et* al. (1990, Table 1) report 33 indicators of project quality that firms disclose. New products, major capital expenditures and major patents are some of the leading items. The main component of c in this kind of disclosure is that the firm's competitors may gain from the knowledge. It is hard to measure directly, but we may infer the magnitude of this component of c from M&A breakup fees which are put in place so as to deter the bidder from stealing the idea. Those fees are about 3% of deal value (*The Deal*, March 2, 2003, p. 38). Also, as noted above, due diligence normally takes place privately which helps keep these indirect costs of disclosure small. As for more direct components of c, advisory fees (what buyers pay for outside expertise) are only about 0.2 of a percent of deal size (*The Deal* February 17, 2003, p. 41). In terms of our model, this would mean that a rough upper bound for c would be about 4% of deal size.[4] In other words, (10) would hold even if c were about three or four times larger than it seems to be in practice.[5]

2.4 Welfare

Our welfare measure is net aggregate output, Y. If agents could not recontract from the Stage-2 random assignment of z to x, aggregate output would be $\lambda\mu_x \equiv$

[4] And, deal value is, as a rule, well below the capitalization of the buyer, which itself must be below x^B.

[5] Moreover, (10) is a sufficient condition only. In the case where $F(x)$ is uniform on $[x_{\min}, x_{\max}]$, one can show that uniqueness is guaranteed if $c < (1-\lambda)\, x_{\max}$, i.e., if $c < (1-\lambda)\, F^{-1}(1)$. So, uniqueness is guaranteed for any c if $x_{\max}$ is large enough.

$\lambda \int_0^\infty x dF(x)$. With takeovers, however, output net of disclosure costs becomes

$$Y = \lambda \mu_x + (1-\lambda) \int_{x_1}^{\infty} x dF - \lambda \int_0^{x_0} (c + x) \, dF. \tag{13}$$

This is how much could be produced if, at a cost c, the planner could truthfully elicit all the $z = 1$ projects from firms with $x < x_0$, and reassign them to firms with $x > x_1$. It turns out that the equilibrium maximizes Y with respect to x_0 and x_1, subject to the resource constraint

$$\lambda F(x_0) = (1-\lambda) [1 - F(x_1)].$$

Proposition 4 *(Equilibrium Maximizes Y). The equilibrium allocations maximize Y. Moreover, when $c \in (0, x_{\max} - x_{\min})$,*

$$\frac{dY}{dc} = -\lambda F(x_0) < 0.$$

Proof. The Lagrangian is

$$\mathtt{L} = Y + \theta \{\lambda F(x_0) - (1-\lambda) [1 - F(x_1)]\}.$$

The first-order conditions are

$$-(c + x_0) + \theta = 0,$$

and

$$-x_1 + \theta = 0.$$

The second-order derivatives with respect to x_0 and x_1 are negative and the cross partials are zero. Therefore $\mathtt{L}$ is globally strictly concave in the vector (x_0, x_1). Combining the two conditions and observing that the constraint must hold proves the first claim. The second claim then follows from the envelope theorem. The strict inequality follows from Proposition 1 (eq. [9]) by which $F(x_0) > 0$. ■

So, if the planner must pay c for every discovery of a $z = 1$ firm, then the equilibrium also maximizes aggregate output net of disclosure costs, much as one would expect based on Figure 4. In this sense, then, equilibrium is constrained efficient.

As $c \to 0$, x_0 and x_1 tend to the same value, call it x^* which solves the equation

$$\lambda F(x) = (1-\lambda)(1 - F[x]),$$

Letting x^* denote the optimum and simplifying,

$$F(x^*) = 1 - \lambda. \tag{14}$$

so that the number of projects reassigned, $\lambda F(x^*)$, is just $\lambda(1-\lambda)$. This is also the first-best level of takeovers because this is what a planner could attain if he had knowledge of the z's without having to bear the disclosure costs.

The welfare properties of equilibrium seem to be unrelated to the change in the joint total value of the bidder and the target (Proposition 2) – takeovers are *always* associated with a level of output that exceeds $\lambda\mu_x$ regardless of what $\delta(x)$ and $J(x)$ happen to be. This is because without aggregate risk, all future welfare gains from reassignment are already included in $p(x)$.

2.5 Other implications

Productivity-enhancement.—A takeover raises the joint output of the two firms by an amount $x_A - x_T$ where x_A is the acquirer's x and x_T is the target's x. This agrees with findings by McGuckin and Ngyen (1995) and Schoar (2000) that the productivity of the target's plants rises (in this case from x_T to x_A) while that of the acquirer's plants falls (in this case from z to zero as the project is abandoned). Lichtenberg and Siegel (1987), Maksimovic and Phillips (2001) and Harris, Siegel, and Wright (2002) all find that mergers raise productivity. Martin and McConnell (1991) find that the likelihood of the target's manager losing his job (about 10% in normal times) rises by a factor of 4 or 5 after a takeover.

Acquisitions and Q.—Here, too, projects move from low-Q firms to high-Q firms. By a firm's Q we mean the ratio of the Stage-1 market value of the firm, $p(x)$, to the replacement value of its 'capital'. Recall that a firm cannot replace its x, only its z, and so we think of the firm's tangible capital as its z – this is what a firm can 'replace'. Let p_z denote the Stage-1 replacement cost of an unscreened z. Then the Stage-1 Q is defined as

$$Q(x) = \frac{p(x)}{p_z}.$$

Since p_z is common to all firms, we have

Proposition 5 *Acquirers have higher Q's than do the targets.*

Proof. From (6), for $x < x_0$, $Q(x) = \frac{1}{p_z}\lambda(q-c)$. But (6) and (4) imply that $Q(x_1) = \frac{1}{p_z}\lambda q$. That is, the lowest-$Q$ acquirer has at least as high a Q as does any target. And, since Q is strictly increasing in x for $x > x_1$, the same is true for any acquirer. ■

Since Q is increasing in x, this translates into the statement that joint gains should be higher and joint losses smaller for mergers in which $Q_A - Q_T$ is high. Andrade *et al.* (2001) and Jovanovic and Rousseau (2002) find that acquisitions tend to be made by high-Q firms. Lang, Stulz, and Walkling (1989) and Servaes (1991) find that the mergers that create the most value are those between high-Q bidders and low-Q targets, which is consistent with Proposition 5.

Comparative statics with respect to c, λ, and F.—The conditions of Proposition 2 provide clues to how the solution changes when the parameters change. Condition (*ii*) requires that there be enough dispersion in the x's. Condition (*i*) requires that there be dispersion in the z's; if all firms had the same-quality projects (which would happen if $\lambda = 0$ or $\lambda = 1$), again there would be no takeovers. The equilibrium number of takeovers is therefore non-monotonic in λ. Finally, takeover activity declines with c. Formally, differentiation of (9) reveals that

$$\frac{\partial q}{\partial \lambda} < 0 \qquad \text{and} \qquad \frac{\partial q}{\partial c} > 0. \tag{15}$$

When λ is high, there are more good projects in total and the demand for targets falls relative to their supply and, hence, so does q. On the other hand, when it costs more to disclose quality, the price of targets will rise so as to reflect that fact. Eq's (4) and (15) imply that

$$\frac{\partial x_1}{\partial \lambda} < 0 \qquad \text{and} \qquad \frac{\partial x_1}{\partial c} > 0, \tag{16}$$

so that the number of takeovers, $(1 - \lambda)[1 - F(x_1)]$ decreases with c. Eq's (3) and (15) imply that

$$\frac{\partial x_0}{\partial \lambda} < 0, \qquad \text{and} \qquad \frac{\partial x_0}{\partial c} < 0, \tag{17}$$

this latter because we just established that the number of takeovers, which also equals $\lambda F(x_0)$, decreases with c.

These results match some empirical observations. (*i*) Bidders are in fact typically larger than the targets. In our model, $p(x)$ is increasing in x, and therefore the stage-1 capitalization of buyers exceeds that of targets. (*ii*) Eq. (10) implies that takeover activity rises as c falls or as the dispersion of x rises. The latter is measured by the dispersion in Q. In the time series merger waves take place when the cross-firm dispersion of Q is high (Figure 8 of Jovanovic and Rousseau 2002). (*iii*) Merger waves tend to occur after industry deregulation or technological shock (Andrade *et al.* 2001).

3 Discussion: Why takeovers, and not markets for x or for z?

In the model takeovers allocate good projects to the best managers. But is there no cheaper way to achieve this? The cost c may be small relative to q, but it is high in absolute terms, and it is natural to ask if markets for managers or for project-rights would not be a more efficient way of accomplishing the same end result.

Markets for x.—A firm's x may denote the quality of its entire management team in which case it is costly to assemble from scratch, as Prescott and Visscher

(1980) have stressed. In our model, however, it would be desirable for x to move, if it could be done more cheaply than c. Managers do in fact move from firm to firm, but hardly ever "en masse" as a team. There are two reasons for this. One is the cost of coordinating any geographical move for all but the smallest management teams. The other stems from the likelihood that members of the team will behave non-cooperatively in bargaining with the new employer. The quality may be publicly known, but the input of each member may be private information. In a similar setting, Mailath and Postlewaite (1990) show that a team will not easily move to a more profitable location, especially when the team is large. In a setting similar to ours, Matsusaka (2001) views a firm as consisting of its organizational capabilities transferable across products and industries. Gort, Grabowski, and McGuckin (1985) show evidence that when management finds itself with spare capacity, it looks for takeover targets instead of dispersing. Even without this team-capital effect, it is costly for a firm to let its managers go because they might take with them some trade secrets. Non-compete clauses, deferred compensation, and non-vested inside ownership stakes are all ways in which firms try to prevent their managers from leaving. Kaplan and Stromberg (2003) report that it is common for VCs to include non-compete and vesting provisions that make it more expensive for the entrepreneur to leave the firm. They document that non-compete clauses and vesting are common in VC-backed ventures. In Table 2, they report non-compete clauses in 70% of the cases and vesting of manager stock in 41% of the cases.

Markets for project-rights, z .—Team capital also hampers trade in project rights: A project is worth more if some of the workers that developed it remain with the project. E.g., bank A may wish to acquire bank B's loan portfolio which fits well with bank A's products. Bank B's loans are worth more if bank B's loan officers continue to oversee them. Bank B can therefore extract a higher price for its loans if, instead of selling the loans alone, it invites a full-fledged takeover. This should be especially true in human-capital intensive projects. Indeed, z can be thought of as human capital or geographical location, while x is the organization capital. If by human capital we mean client relationships, knowledge of the specific location and project, etc. it helps explain why it has to be a firm and not a project acquisition. A marketing division, a good brand image, a network of clients, all these cannot be transferred without the sales people that developed them.

Examples of high z projects that were obtained through acquisition by firms with high x.—Three recent examples are the acquisitions of IXnet by Global Crossing, of IXC by Cincinnati Bell (now Broadwing) and of Teleport Communications Group by AT&T. Each target had developed a new technology: IXnet developed Extranet, a connectivity network that allowed financial firms to transmit data and voice information and to access financial data through a single connection. IXC was the leading new generation fiber network carrier providing telecommunications services. TCG owned TCG CERFnet, the award-winning unit of TCG dedicated to Internet and data services. The acquirers, on the other hand, were firms with access to huge markets (Global Crossing) or with experience in developing and marketing bundled services (Cincinnati Bell and AT&T), or what we call high x. More generally, it is widely thought that Pfizer and Microsoft have consistently acquired promising young businesses, essentially to get hold of their projects.

4 Conclusion

Takeovers are a large and growing part of economic activity, and one would hope that they raise the profits of the firms involved in them and that they raise welfare more generally. The prevalence of bidder discounts and, especially, of joint discounts, has raised doubts that the takeover market works efficiently. The concern has been, especially, that takeovers are driven by managerial empire building and the quest for market power. This paper has proposed a competitive model in which takeovers are efficient, both privately and socially. The model has stressed the efficiency-enhancing reallocative role of takeovers and shown that it is consistent with the prevalence of bidder discounts and even of joint discounts.

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