

Adverse Selection in Acquisitions of Small Manufacturing Firms: A Comparison of Private and Public Targets

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ABSTRACT. This study investigates acquisitions of small manufacturing firms and compares private and public targets. We develop the argument that private targets tend to involve higher transaction costs in the presence of adverse selection problems than their public counterparts. Consistent with predictions, the empirical evidence indicates that bidders choose to acquire public rather than private targets when acquiring young firms and when engaging in inter-industry transactions. Acquirers also tend to avoid private targets that have significant intangible assets and have not signaled the value of these resources through other means such as collaborative agreements. The results shed light on the benefits of being public and the decision-making criteria employed by acquiring organizations.

1. Introduction

Small businesses have long been recognized as a major source of change within industries. They tend to have higher founding rates, faster and more variable growth, and a greater propensity to fail than established firms (Evans and Leighton, 1986). Research also concludes that smaller firms have a higher likelihood of becoming takeover targets

than larger firms (e.g., Levin and Aaronovitch, 1981; Palepu, 1986; Mulherin and Boone, 2000), yet relatively little systematic research has been devoted to the study of the acquisition of small businesses.

Small businesses have been neglected in M&A studies in part because this stream of research has not devoted attention to privately-held companies and how they differ from public targets. Throughout the past two decades, one of the chief purposes of M&A studies has been to understand how different acquisition motives influence firm performance (e.g., Andrade et al., 2001). As a result, the M&A literature tends to use datasets that sample public companies, and this work implicitly assumes that conclusions drawn from large, public companies apply equally well to small, private ones. However, given the substantial qualitative differences between public and private companies, the validity of this assumption may be problematic. Drawing conclusions from samples of public targets potentially undermines the generalizability of the interpretations and weakens the external validity of the evidence (Berk, 1983).

In fact, recent research provides initial evidence suggesting that the implications of M&A deal structures do vary across private and public targets. Chang (1998), for instance, found that for privately held target firms, the method of payment has a completely different effect on the bidding firm's stock returns. For example, bidders acquiring privately-held targets experience a positive average abnormal return in stock offers. This contrasts the negative average abnormal return documented for bidders using stock to acquire public targets. Recent work has also reported that contingent earnouts, which specify

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future variable payments to the target firm based on the achievement of performance objectives, are more likely to be used in an acquisition if the target is a private company (Datar et al., 2001). While these studies provide insights into specific financial instruments in M&A, they do not focus on acquisitions of public and private companies *per se*, nor do they examine the more fundamental differences underlying acquisitions of public and private firms.

This study seeks to extend prior research on acquisitions in two ways. First, we focus on acquisitions of small manufacturing firms in particular. Previous research has used various proxies for entrepreneurial status such as firm size, firm age (Begley, 1995; Zahra et al., 2000), growth rates (Johnson, 1990; Begley, 1995), and so forth, but there is no consensus on this definitional issue. We collected data from the Securities Data Corporate (SDC) database and focused on targets in the manufacturing sector (i.e., SICs 2000–3999) that were acquired during the 1996–1999 timeframe. The sample is further screened by the criterion that the target firm has less than 500 employees, the cutoff value employed by the U.S. Commerce Department (e.g., Roy and Simpson, 1981).

Second, we investigate essential differences between private versus public targets in order to understand their underlying differences and the appropriateness of pooling them together or focusing on only public targets in M&A research. Specifically, we suggest that assessing a target's value can pose significant difficulties for buyers (e.g., Akerlof, 1970), and this is often the case when the target is small and private. The core proposition is that when such valuation difficulties are manifest, bidders are more likely to pursue public targets, for which these problems are comparatively less severe. Purchasing small targets is often problematic in general because small businesses are difficult to locate as exchange partners (Deeds et al., 1999) and small businesses tend to find it more difficult to signal their business prospects to investors (e.g., McConnell and Pettit, 1984; Becchetti and Trovato, 2002). We develop the argument that these problems are less significant for public, rather than private, firms due to the greater information disclosed on them and the signals attached to being publicly traded.

The paper is organized as follows. After an

overview of background literature, we present the theoretical arguments and research hypotheses, which apply concepts from information economics (e.g., Akerlof, 1970; Spence, 1974) to the setting of external corporate development (Reuer and Koza, 2000). A discussion of the empirical findings follows a description of the research design, which appears in a subsequent section. The study is based on a sample of over nine hundred private and public small manufacturing firms that were acquired between 1996 to 1999. Our findings are consistent with the view that public targets become more attractive relative to private firms when would-be buyers confront valuation challenges due to information asymmetries in the acquisition process. Specifically, we find that buyers tend to prefer public targets over private targets when acquiring younger businesses. Moreover, firms are willing to acquire private targets in their core business, but in noncore domains the stock market appears to be useful as a means of screening potential targets that the acquirer would otherwise find more difficult to assess. Furthermore, firms are more willing to acquire public targets that have significant intangible resources than equivalent private firms. We suggest and find that strategic alliances may be alternative vehicles to mitigate the effects of information asymmetry accompanying the target's intangible resources. A discussion of the implications of our findings and new avenues for research concludes.

2. Background literature

A large literature in various disciplines and applied areas has focused on corporate acquisitions (e.g., for a recent review, see Andrade et al., 2001). Researchers interested in the impact of target characteristics on acquisition patterns have used a variety of approaches, and we highlight three streams of research that are particularly relevant to this study. The first is concerned with modeling the likelihood of acquisition based on firm characteristics. The second examines the implications of information asymmetry for M&A markets. The third investigates the potential implications of going public on the transfer of control rights in M&A markets.

Firm characteristics and the likelihood of acquisition

Numerous theoretical and empirical studies have been conducted in order to understand why acquisitions occur and how they affect bidders and targets (e.g., Bradley et al., 1983; Andrade et al., 2001). To disentangle various motives for corporate acquisitions, one research stream empirically examines the likelihood of acquisition by identifying salient characteristics of target and acquiring firms. Since most studies have found that the gains from acquisitions tend to accrue to targets, identifying target firms' characteristics and modeling the takeover likelihood could potentially be a profitable arbitrage strategy. Early research was aimed at developing models for the likelihood of M&A, and this work concluded that there were distinctive characteristics of target and acquiring firms in terms of their financial ratios, so it was possible to construct a predictive model (e.g., Simkowiz and Monroe, 1971; c.f., Palepu, 1986). This stream of research sought to distinguish targets from non-targets rather than to differentiate private and public targets, however.

Information asymmetry and corporate acquisitions

Other M&A studies have noted that information asymmetry may have a significant impact on the likelihood and performance implications of acquisitions. Research has found that under conditions of asymmetric information, firms can benefit from contingent forms of consideration such as stock payments (Eckbo et al., 1990), that firms lengthen their negotiations in acquisitions subject to valuation problems (Coff, 1999), and that firms may gain from using joint ventures instead of M&A in order to stimulate credible information revelation through the joint ownership of assets (Balakrishnan and Koza, 1993). We develop the argument that different forms of acquisitions, in particular those involving private versus public targets, are more or less subject to these problems, in part due to the interdependence between equity markets and the market for corporate control, as suggested below.

IPOs and control rights transfers

Scholars have noted that information asymmetry is not only evident in corporate acquisitions, but that it also has implications for transfers of control rights through the use of IPO markets. While financial economics research on IPOs has largely focused on potential challenges to the efficiency of capital markets due to potential anomalies such as underpricing, hot issue markets, and the long-run underperformance of newly-public companies (e.g., Ibbotson et al., 1988; Allen and Faulhaber, 1989), emerging findings also suggest that IPOs have implications for M&A markets since newly-public firms exhibit a higher propensity of being acquired (e.g., Pagano et al., 1998; Field and Mulherin, 1999). In the words of one investment banker, entrepreneurs can use the IPO process as a way of "teeing up" a company for sale (Rock, 1994). In short, the going public event may be seen as part of a larger M&A process (Reuer and Shen, 2003, forthcoming).

Several recent theoretical works have similarly noted that the going public decision may have implications for future transfers of control rights in firms. Ellingsen and Rydqvist (1997), for instance, developed a model suggesting that acquiring firms can use the stock market to screen target firms under conditions of information asymmetry. On the sell side, Zingales' (1995) model suggests that the firm can use a two-stage sale in order to maximize its total proceeds by relying on the capital market to auction off cash flow rights, and the market for corporate control to negotiate the sale of private benefits of control. Mello and Parsons' (1998) model reaches a similar conclusion, but it emphasizes the information the owner obtains regarding the value of the firm by going public. These models identify potential benefits of going public as well as costs of remaining private, yet empirical research is needed to determine if being public in fact has implications for the efficiency of acquisitions. Because small businesses are often difficult to locate as exchange partners (Deeds et al., 1999) and often find it challenging to signal their business prospects (e.g., McConnell and Pettit, 1984; Becchetti and Trovato, 2002), it is of particular interest to situate an analysis of acquisitions within the context of small targets.

3. Theory and hypotheses

Companies need to evaluate carefully the opportunities for creating value through acquisitions. Valuation of exchange partners is often difficult when transacting partners face adverse selection problems arising from information asymmetry between a seller and buyer. Akerlof's (1970) classic study of the market for lemons in product markets is instructive, and under certain circumstances it may also be in operation in M&A markets as well. For instance, an entrepreneur with superior information about the value of the firm will be reluctant to sell above-average assets if he or she cannot credibly convey this information and thereby obtain a reasonable price. Bidders discount their offer prices as a consequence, and the average quality level of acquisitions will be lower in equilibrium. Given the incentives for misrepresentations on the part of target firms, the possibility of adverse selection arises and in turn leads to inefficiencies due to more information gathering and extensive negotiations as well as due to the failure of firms to consummate attractive deals. Note that the focus of Akerlof's (1970) model is on information asymmetries between bidders and targets, not among competing bidders (e.g., Barney, 1988). This later type of information asymmetry is important in M&A markets in determining the value appropriated by the acquiring firm because disclosures of sources of value to other bidders raise the price paid for the target's assets. Thus, would-be acquirers prefer lower information asymmetry vis-à-vis a target to reduce *ex ante* transaction costs, and higher information asymmetry with other potential targets to limit competition for the target's assets.

As discussed below, the level of asymmetric information between targets and acquirers hinges upon the would-be buyer's ability to understand the value of the combined business as well as the type of resources being acquired on the sell side. More specifically, we suggest that the target firm's age, industry of operation, intangible assets, and investments in signaling through collaborative agreements affect the bidder's valuation challenges and the associated *ex ante* transaction costs of an acquisition.

Firm age

Newly founded organizations will tend to exhibit higher uncertainty and higher degrees of information asymmetry than established firms due in part to resource and institutional constraints. Resource shortages often impede young companies from committing to their employees and building trustworthy relationships with customers and suppliers (Stinchcombe, 1965). Young companies are also thought to lack reliability and accountability in their organizational routines and performance (Hannan and Freeman, 1989). Institutional constraints for young companies can include a lack of legitimacy, which arises due to the lack of support from relevant organizations (e.g., Baum, 1989) or due to segmentation in the market for interorganizational relationships (Carter and Manaster, 1990; Podolny, 1993). These factors suggest that it will be difficult to assess the value of younger firms due to greater uncertainties associated with such transactions as well as the difficulties such firms face in credibly conveying their value to potential investors.

The valuation difficulties associated with the acquisition of young companies will tend to be lower for public targets, however. This is because information disclosure regulations and observable stock prices help buyers calibrate their bids. The presence of a resale market for shares of public firms further reduces the downside risk of an acquisition. Consistent with these arguments, evidence exists that information disclosure reduces the dispersion of investors' forecast errors (Simon, 1989) and that restricted stock is discounted 25–45 percent relative to unrestricted stock (Pratt, 1989).

Acquiring public targets can also mitigate the effects of information asymmetry associated with younger firms. Going public can be viewed as a signaling mechanism that discriminates high from low quality firms (Spence, 1974). High quality small businesses, for example, can underprice their newly-public issues as a way of signaling their healthy quality and differentiating themselves from low quality counterparts (e.g., Allen and Faulhaber, 1989). Private firms, by contrast, will find it more difficult to credibly convey their value since they lack the benefits of the equity market as a screening device and tend to be more subject to resource and institutional constraints.

Consequently, the likelihood that target firms are public rather than private is negatively related to target's firm age.

Hypothesis 1: The younger an acquired firm, the more likely it is publicly held rather than private.

Inter-industry transactions

Research has found that acquisitions in new lines of business are particularly problematic for several reasons (e.g., Hopkins, 1987; Singh and Montgomery, 1987). Relative to intra-industry transactions in which the firm can use its existing routines and rely on the knowledge base it has developed in its core business (Levitt and March, 1988), in inter-industry acquisitions the firm is less knowledgeable about the target firm's business. Thus, in inter-industry transactions, opportunities for misrepresentation of target firm resources will be greater since the target firm has significantly better information about its resources and prospects than the buyer operating in another industry. Bidders will therefore face a higher likelihood of adverse selection in inter-industry transactions than in intra-industry deals (Balakrishnan and Koza, 1993). However, as argued earlier, we suggest that the problems associated with asymmetric information will not be equivalent for public and private targets.

Specifically, public targets will be less sensitive to information asymmetry for reasons paralleling those offered above. For example, regulations requiring financial reporting according to generally accepted accounting principles directly reduce information asymmetry for public firms, and share prices in stock markets can incorporate heterogeneous information about assets. It has been suggested that share prices offer performance information that cannot be extracted from the firm's current or future accounting data (Holmstrom and Tirole, 1993). As noted above, targets can also use the process of going public to signal their value (e.g., Allen and Faulhaber, 1989), and bidders can rely on the stock market to screen attractive targets from less attractive ones (Ellingsen and Rydqvist, 1997).

Hypothesis 2: An acquired firm is more likely to be publicly held rather than private for an

inter-industry transaction than for an intra-industry transaction.

An alternative argument for why firms might avoid acquiring private firms in inter-industry transactions is risk aversion. If the variance in returns to acquiring a public firm are smaller than those of a private target, a risk-averse CEO may prefer public to private targets in inter-industry transactions to avoid downside risks in inter-industry deals. However, in his seminal paper, Akerlof (1970) shows that markets might fail because one party has private information and therefore has an incentive to misrepresent value since the target cannot efficiently screen targets. Thus, the above prediction does not depend upon the assumption of risk aversion on the part of acquiring firms. In order to test this hypothesis conditional upon the level of uncertainty, we incorporate a control for uncertainty into the model specification.

Intangible assets

The level of asymmetric information hinges perhaps most directly upon the nature of the resources to be acquired. For example, information about the value of undifferentiated physical assets can be conveyed relatively easily, so valuation problems will be relatively low for the acquisition of such resources. By contrast, adverse selection will tend to be more serious for acquisitions of firms with substantial intangible assets because financial data may provide little information regarding the true value of these resources, and the quality of such resources is difficult to codify and verify. This increases the likelihood of *ex ante* misrepresentations by managers of target firms. Uncertainties about what resources can and cannot be transferred *ex post* are greater, so the synergies obtainable through the combination are more difficult to appraise when intangible resources are involved.

We suspect that the problems associated with asymmetric information due to the target's intangibles are likely to be lower for public targets than privately-held firms for several reasons. First, to some extent public markets can directly reduce asymmetric information. Firms going public face information disclosure requirements for registra-

tion and subsequent listing, and the equity market serves to place a price on the firm. The aggregated information and collective judgment of investors may help buyers calibrate their bids (Hellwig, 1980). Second, the screening function of equity markets helps discriminate high from low quality firms (e.g., Ellingsen and Rydqvist, 1997). Third, investment bankers and other institutions involved in equity markets can certify the quality of participating firms because the repeated nature of investment bankers' business encourages them to refrain from opportunism and build up their reputational capital (e.g., Beatty and Ritter, 1986). To the extent that being public can reduce asymmetric information directly or mitigate its effects by offering signaling opportunities and screening mechanisms, this can reduce buyers' downside risks and can enhance the efficiency of the M&A market for public targets.

Hypothesis 3: The greater an acquired firm's intangible assets, the more likely it is publicly held rather than private.

Collaborative agreements

Given that going public is expensive and that acquirers may pay higher control premia for purchasing public targets, the question arises whether alternative vehicles exist for small businesses to address valuation problems associated with their intangible resources. For instance, warranties, hostages, and insurance provide remedies to failures in many product markets otherwise subject to adverse selection, though such institutions are not developed for many one-time decisions made by organizations such as divestiture.

Strategic alliances are an alternative form of organizational investment discussed in the literature on external corporate development that are thought to redress adverse selection in the market for firm resources. Alliances permit firms to pool together resources that are difficult to value on a piecemeal basis, avoid the transfer of ownership rights and a terminal sale, and are able to be terminated at lower exit cost. Repeated contracting and the threat of termination can promote information revelation, and such relationships afford opportunities for first-hand experience with the resources in question (e.g., Balakrishnan and

Koza, 1993). Not only can alliances reduce information asymmetries directly for actual collaborators, they can also attenuate the effects of asymmetric information for other would-be acquirers. More specifically, under the assumption that taking on alliance partners will be more difficult for lower quality firms, alliance investments may provide signals that help potential buyers differentiate attractive and unattractive targets (Stuart et al., 1999). We therefore posit that alliances will reduce valuation problems for private targets with significant intangibles:

Hypothesis 4: For an acquired firm with significant intangible assets, the likelihood that it is publicly held rather than private is negatively related to its investment in strategic alliances.

4. Methods

Sample

In order to test the hypotheses developed above, a sample of corporate acquisitions of public and private targets was developed. We used the M&A module of the Securities Data Corporate (SDC) database to obtain a sample of targets in the manufacturing sector (i.e., SICs 2000–3999) that were acquired during the 1996–1999 time period. The sample was comprised of firms acquired by U.S. bidders, and LBO firms were excluded.

The sectoral distribution of the public and private acquisitions appears in Table I. The percentage of public target firms averages 46.5 percent and ranges from 31.9 to 100 percent for the industries considered. Several studies have reported significant industry clustering in acquisition activities in the 1960s, 1980s, and 1990s (e.g., Mitchell and Mulherin, 1996; Mulherin and Boone, 2000) and have therefore concluded, that economic change such as deregulation is a major source of the observed restructuring activity (e.g., Andrade et al., 2001). Our data show that not only does industry clustering exist in public acquisitions and acquisitions overall, but that significant patterns exist across industries for acquisitions of public versus private targets. For the industries with more than 100 transactions in total, the industries with a majority of acquisitions involving

TABLE I
Sectoral distribution of public and private targets^a

I Industry (SIC)	II Public (%)	III Private (%)	IV Percent public	V Total (%)
Food and kindred products (20)	153 (4.9)	269 (7.5)	36.3	422 (6.3)
Tobacco products (21)	14 (0.5)	6 (0.2)	70.0	20 (0.3)
Textile mill products (22)	61 (2.0)	44 (1.2)	58.1	105 (1.6)
Apparel (23)	83 (2.7)	75 (2.1)	46.9	177 (2.3)
Lumber and wood products (24)	43 (1.4)	77 (2.1)	35.8	120 (1.8)
Furniture and fixtures (25)	68 (2.2)	70 (1.9)	49.3	138 (2.1)
Paper and allied products (26)	70 (2.2)	77 (2.1)	47.6	147 (2.2)
Printing and publishing (27)	35 (1.1)	0 (0)	100.0	35 (0.5)
Chemicals and allied products (28)	423 (13.5)	329 (9.1)	56.3	752 (11.2)
Petroleum refining (29)	18 (0.6)	0 (0)	100.0	18 (0.3)
Rubber and plastics (30)	81 (2.6)	173 (4.8)	31.9	254 (3.8)
Leather (31)	31 (1.0)	12 (0.3)	72.1	43 (0.6)
Stone, clay, glass, and concrete (32)	46 (1.5)	86 (2.4)	34.8	132 (2.0)
Primary metals (33)	113 (3.6)	153 (4.2)	42.5	266 (4.0)
Fabricated metal products (34)	128 (4.1)	263 (7.3)	32.7	391 (5.8)
Industrial and commercial machinery and computer equipment (35)	497 (15.9)	559 (15.5)	47.1	1056 (15.7)
Electronic and electrical equipment (36)	540 (17.3)	577 (16.0)	48.3	1117 (16.6)
Transportation equipment (37)	168 (5.4)	202 (5.6)	45.4	370 (5.5)
Measuring, analyzing, and controlling instruments (38)	467 (14.9)	460 (12.7)	50.4	927 (13.8)
Miscellaneous manufacturing (39)	89 (2.9)	171 (4.7)	34.2	260 (3.9)
Total	3128 (100)	3603 (100)	46.5	6731 (100)

^a Percentages may not sum to 100 due to rounding.

public targets are as follows: textile mill products (58.1%); chemicals and allied products (56.3%); and measuring, analyzing, and controlling instruments (50.4%). By contrast, the incidence of acquisitions involving private targets appears to be higher in industries such as rubber and plastics (68.1%); fabricated metals (67.3%); and stone, clay, glass, and concrete (65.2%).

To focus on the impact of valuation problems on the means by which small firms are acquired, the dataset was further screened by the size of the target firm. The number of employees was used as an indicator for the size of the firm, where those firms with less than 500 employees were selected. This cutoff value for small firms corresponds to the one used by the U.S. Commerce Department (e.g., Roy and Simpson, 1981). Data on firm size were obtained from SDC, Compustat, and Standard and Poors. After accounting for missing data, 923 acquisitions were available for analysis, 457 of which involved public targets. Additional details on the sample are contained in the results section.

Model specification

The basic structure of the multivariate model used to differentiate public and private targets is as follows:

$$\begin{aligned} \text{Public target} = & \beta_0 + \beta_1 \text{Firm Age} + \\ & \beta_2 \text{Inter-industry Transaction} + \\ & \beta_3 \text{R\&D Intensity} + \beta_4 \text{Strategic Alliances} \\ & + \beta_5 \text{R\&D Intensity} \times \text{Strategic Alliances} \\ & + \gamma \text{Controls} + \epsilon. \end{aligned} \quad (1)$$

The five explanatory variables – Firm Age, Inter-industry Transaction, R&D Intensity, Strategic Alliances, and the interaction between R&D Intensity and Strategic Alliances – incorporate adverse selection problems arising from information asymmetries as well as the role of alliances in signaling the value of intangible assets. While our objective was to develop a parsimonious model to compare acquisitions of public and private targets, we introduced controls that might be related to the type of acquisition as well as to the key theoretical variables. Specifically, we

included controls for the percentage of a target firm's shares being acquired (i.e., Equity Stake), the number of firms in the target's industry (i.e., Industry Incumbents), fixed effects for bidding firms' industries, and the uncertainty of the industry in which the target firm operates (i.e., Industry Uncertainty). The measurement of the variables and the motives for the firm- and industry-level controls are taken up below.

Measures

Public target. As described earlier, we determined whether the target firm was publicly held or a private concern. Therefore, Public Target equals one if the target was a public firm, and zero if the target was a private firm when the acquisition occurred. Given the binary nature of the dependent variable, equation (1) was estimated using logistic regression. Data for this variable were obtained from the M&A module of the SDC database.

In light of findings in the finance field that newly-public firms exhibit a higher incidence of being acquired than other firms (Pagano et al., 1998), we also constructed a multinomial logit model that differentiates newly public firms from firms that have been acquired after being public for some time (i.e., 3 years). With the exception of the inter-industry transaction variable, which is significant for the late public firms but not the newly public firms, the same interpretations held for all of those variables presented below for the binomial models differentiating private and public targets. However, a Hausman test for the independence of irrelevant alternatives (IIA) indicated that the two categories of public targets are not independent.

Explanatory variables. Firm age was used as the first explanatory variable to provide an inverse indicator of valuation problems. The age of the targets was measured as the difference between the time of the acquisition and the time of the target's founding, stated in years. Data were obtained from SDC, Compustat, and Standard and Poors for the calculation of this measure.

Another proxy we used for information asymmetries between target firms and acquirers is based on their industries of operation. In its primary

business, the acquirer is better able to value potential targets because it tends to be more familiar with such firms as well as their technologies, employees, and other resources. By contrast, valuation problems will tend to be more severe when the firm acquires targets operating in other industries. Inter-industry Transaction was measured as an indicator that is assigned a value one if the primary businesses of the acquirer and target differ at the 3-digit SIC level; otherwise, it is given a value of zero. Data for this variable were obtained from SDC.

Finally, we used the intangible assets of the target firm's industry as another proxy for the asymmetric information confronting potential acquirers. Specifically, the R&D intensity of the target firm's industry provides a measure of selling parties' intangible assets and the *ex ante* valuation challenges would-be acquirers confront. We measured R&D Intensity as the ratio of R&D expenditures to sales for the year prior to the divestiture. Data for this variable were obtained from the National Science Foundation's *Research and Development in Industry*.

Given that R&D intensity is a narrow measure of firms' intangibles that take the form of technological know-how, we employed a second measure that provides a broader proxy for intangibles. The measure we used is a direct estimation of intangible assets as reported by SDC and Compustat. The value of intangible assets is defined to be the "value of assets having no physical existence, yet having substantial value to the firm, including goodwill, patents, trademarks, copyrights, franchises, and costs in excess of net book value of businesses acquired, as of the date of the most recent financial information prior to the announcement of the transaction." Since not every company's value of intangible assets is available, we used an industry average as a complementary proxy for intangible assets. When this measure was used instead of R&D intensity, the interpretations presented below for the R&D measure continued to hold.

To measure a target firm's investment in strategic alliances, we used the SDC database to count the number of alliances formed by the firm. The SDC database includes collaborative agreements such as equity joint ventures; minority purchases; R&D contracts; joint manufacturing,

marketing, or supply agreements; and licensing and value-added resale agreements as strategic alliances. Data on these alliances were assembled over all years since 1986, the year the database first began tracking alliances. Since the time window for the M&A deals studied is from 1996 to 1999, alliances prior to 1986 are less likely to be important signals. Prior research tends to use 4- to 10-year windows in calculating firms' investments in alliances (e.g., Anand and Khanna, 2000; Kale et al., 2002), so the time window we used was judged to be of sufficient length to cover the possible signaling effects of a firm's strategic alliances.

Because strategic alliances with partners of different sizes may provide different signals of the firm's quality, we distinguished a firm's alliance partners by their size. Alliances with small firms may provide weaker signals than alliances with larger companies, so we disaggregated the strategic alliance measure into alliances with small and large firms, using the same cutoff value of 500 employees. However, a likelihood ratio test indicated that we could not reject the null hypothesis of equivalent effects across these two classes of alliances (i.e., $\chi^2 = 2.06$, n.s.), which suggests that the more aggregate measure of alliance investment is satisfactory.

Control variables. In addition to the theoretical variables discussed above, several additional regressors were incorporated into the specification to control for other firm- and industry-level effects on the buy and sell side. First, we introduced a control for the percentage of the target firm's equity being acquired in the acquisition process (i.e., Equity Stake). On the one hand, low equity stakes might be expected to be more likely to accompany acquisitions of private targets than public targets due to the fact that the former suffer from the lack of transparent market prices and greater risk. On the other hand, the greater ownership concentration in private firms may require larger stakes to obtain control (Demsetz and Lehn, 1985). Data for this variable were obtained from SDC. In order to examine further the potential influence of deal characteristics, we included a control for transaction value for those acquisitions with such data available, but this variable proved insignificant in all models.

At the target firm level, we also incorporated a control for the direct effects of alliances since we are interested in testing the interaction between alliance investments and intangible resources. Inclusion of the control for alliances is also motivated based on the observation that firms enter into alliances to achieve high growth (Dutta and Weiss, 1997) and on findings showing that firms tend to go public following a period of expansion (Pagano et al., 1998). Prior research has also found that firms with alliances tend to go public sooner and obtain higher IPO valuations (Stuart et al., 1999).

At the industry level, we first introduced a control for the number of firms in the focal firm's industry (i.e., Industry Incumbents). Potential buyers experienced in the same line of business as the seller tend to be in a better position than others to make such judgments concerning the value of the acquisition. Thus, when the number of firms in an industry increases, the set of potential acquirers for which information asymmetries are low also tends to increase as will the spatial dispersion of firms in the industry. However, profit opportunities due to concentration and the resulting entry barriers can stimulate acquisitive entries (e.g., Yip, 1982). Data for this variable were obtained from the U.S. Census Bureau and the Office of Advocacy of the Small Business Administration. In order to address potential industry effects on the buy side, fixed effects were included for bidding firms' industries at the 2-digit SIC level.

Finally, we included a control for target industry uncertainty to address the predictability of demand as well as product-market conditions potentially shaping firms' investments in internal development projects and external alliances (Eisenhardt and Schoonhoven, 1996). Industry uncertainty was calculated as a measure of the volatility of net sales in each industry using regression analysis over the five-year time period 1992-1996 (e.g., Dess and Beard, 1984). The specification used to develop the proxy for industry uncertainty was as follows:

$$\text{Industry Sales} = \gamma_0 + \gamma_1 \text{Year} + \epsilon. \quad (2)$$

Industry uncertainty was then measured as the standard error of the slope parameter divided by the mean of industry sales. Data required for

estimating the industry-specific regressions and calculating the proxy for industry uncertainty were obtained from Compustat.

5. Results

Table II presents descriptive statistics and a correlation matrix for the sample. The average age of the sampled firms is approximately 39 years. Forty-four percent of the deals are inter-industry transactions, and the average percentage of shares being acquired is 89 percent. The average number of alliances formed by the sampled firms is 0.19. Comparisons of public and private firms using two-sample t-tests revealed that private firms tend to be older ($p < 0.05$), be situated in lower R&D intensity industries ($p < 0.001$), and have fewer strategic alliances (both $p < 0.001$).

The correlation matrix indicates modest correlations among most of the variables. Reflecting the use of alliances to exploit a firm's existing capabilities or to tap into others' skills in the presence of contractual hazards (e.g., Mowery et al., 1998), small firms situated in R&D intensive industries tend to be more actively engaged in collaborative agreements with others ($p < 0.001$). Similar to Dutta and Weiss (1997), no relationship is evident between industry uncertainty and firms' investments in alliances, despite arguments that alliances provide firms with needed flexibility in such settings (e.g., Kogut, 1991). Contrary to what has been observed in some single-industry research (e.g., Stuart et al., 1999), older firms tend to have fewer alliances ($p < 0.05$) and are situated in industries where R&D intensity is low ($p < 0.001$).

This relationship seems to contradict the liability-of-newness argument that young firms lack necessary resources and social relations to build up alliances with other firms (Stinchcombe, 1965) and have lower innovation capability (Sorensen and Stuart, 2000), but it is consistent with the liability-of-obsolescence argument (Baum, 1989).

Although the correlations among the regressors are generally low, inclusion of the interaction between R&D intensity and strategic alliances in the multivariate model resulted in a maximum variance inflation factor (VIF) of 22.0, which is above the rule-of-thumb threshold value of 10 used to indicate multicollinearity problems in regression models (Neter et al., 1985). To alleviate concerns of multicollinearity, the variable R&D Intensity was standardized prior to forming the interaction term, which reduced the maximum VIF to 2.1.

Estimation results from models using these transformed variables appear in Table III. Model I presents a baseline specification consisting of the controls. Model II augments this model with the direct effects of the theoretical variables, and Model III represents the full model incorporating the interaction effect between R&D intensity and alliances. All three models are significant at the 0.001 level. Log-likelihood ratio tests demonstrate that Models II and III have significantly more explanatory power than Model I (both $p < 0.001$), and Model III has significantly more explanatory power than Model II ($p < 0.001$). Model III correctly predicts whether the target is public or private for 85.3% of the transactions. This hit rate improves upon alternatives such as random assign-

TABLE II
Descriptive statistics and correlation matrix^a

Variable	Mean	S.D.	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Public target	0.42	0.49	–						
(2) Firm age	39.06	28.65	–0.09†	–					
(3) Inter-industry transaction	0.44	0.50	0.25*	–0.07	–				
(4) R&D intensity	4.45	2.41	0.27***	–0.18***	0.13***	–			
(5) Strategic alliances	0.19	0.72	0.28***	–0.09*	0.06†	0.11***	–		
(6) Equity stake	0.89	0.29	–0.58***	–0.06	0.06	–0.09*	–0.17***	–	
(7) Industry incumbents	22.95	16.98	–0.02	–0.04	–0.09**	–0.02	0.01	0.03	–
(8) Industry uncertainty	0.03	0.02	0.08*	–0.05	0.03	0.03	0.00	0.08*	0.06†

^a $N = 923$. † $p < 0.10$; * $p < 0.05$; ** $p < 0.01$, *** $p < 0.001$.

TABLE III
Logistic regression estimates^a

Variables	Model I	Model II	Model III
Constant	8.05*** (1.21)	5.04*** (1.15)	4.62*** (1.08)
Equity stake	-10.54*** (1.27)	-7.17*** (1.18)	-6.69*** (1.09)
Industry incumbents	0.00 (0.01)	0.01 (0.01)	0.00 (0.01)
Industry uncertainty	17.09*** (4.14)	12.78** (4.45)	11.99** (4.49)
Bidder industry fixed effects	Incl.	Incl.	Incl.
Firm age	–	-0.15** (0.01)	-0.15** (0.01)
Inter-industry transaction	– (0.20)	1.19*** (0.20)	1.22***
R&D intensity	– (0.11)	0.34** (0.11)	0.38***
Strategic alliances	– (0.30)	0.99*** (0.74)	2.53***
R&D intensity • Strategic alliances	–	–	1.85** (0.60)
χ^2	368.08***	448.97***	463.09***
Log Likelihood, $L(\beta_k)$	-443.98	-403.53	-396.47
$-2[L(\beta_i) - L(\beta_k)]$	–	80.90***	95.02***
$-2[L(\beta_{II}) - L(\beta_{III})]$	–	–	14.12***

^a $N = 923$. Positive coefficients indicate that increases in the variable tend to increase the likelihood that the target is public rather than private. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

ment (i.e., 50%) or the value that would obtain if all transactions were assigned to the dominant category of private targets (i.e., 58%).

The first hypothesis suggested that among younger targets, firms will be more willing to acquire publicly held small firms rather than their private counterparts to lessen the risk of adverse selection. Consistent with this hypothesis, acquisitions of private targets are more likely to involve older organizations, whereas younger firms that are acquired tend to have already gone public ($p < 0.01$ in both Model II and III). Given the large range in firm ages in the sample, we further examined the effects of the distribution in firm age in two ways. First, we excluded nine outliers, and firm age continued to be significantly negative ($p < 0.01$). Second, we also reran the multivariate model after re-coding firm age as a dummy variable based on the median age, yet the inter-

pretations are the same as those reported in the table. Thus, we concluded that the data supported the first hypothesis.

The second hypothesis predicted that bidders will be more willing to acquire private targets in the bidder's core business, but in noncore domains involving higher levels of information asymmetry, there is value in using the stock market to help screen targets prior to acquiring a firm. Consistent with this hypothesis, inter-industry M&A transactions are more likely to involve public targets than intra-industry deals ($p < 0.001$ in Models II and III).

The third hypothesis suggested that private targets with substantial intangible resources are apt to experience greater valuation challenges than equivalent public targets. Consistent with this prediction, both Model II and Model III suggest that there is a tendency for firms to purchase

publicly held targets in industries that are R&D intensive ($p < 0.01$ in Model II and $p < 0.001$ in Model III). The negative interaction effect between R&D intensity and strategic alliances in Model III provides support for the fourth hypothesis that alliances provide a means of signaling the value of intangible resources ($p < 0.01$).

The results for the control variables also deserve some comment. The negative coefficient estimate on the equity stake variable indicates that full acquisitions are more likely for private firms, and partial acquisitions tend to occur with greater incidence for publicly held targets ($p < 0.001$ in all models). This finding is consistent with the need for acquirers to purchase larger stakes in private firms to obtain control due to the greater concentration of ownership in such firms (Demsetz and Lehn, 1985). Likewise, the level of industry uncertainty appears to bear upon the means by which small firms are acquired even after accounting for information asymmetry effects ($p < 0.001$ in Model I, and $p < 0.01$ in Models II and III). By contrast, the number of firms in the target industry (i.e., Industry Incumbents) appears to be insignificant in all three models.

6. Discussion

This study has examined acquisitions of small manufacturing firms and has explored the differences between private and public targets. Although prior research has indicated that small firms exhibit a high propensity of being acquired, such firms have not received adequate attention in the M&A literature to date. By studying such firms further, future studies may be able to enhance our understanding of sell-side considerations in mergers and acquisitions. In fact, M&A researchers have long lamented the fact that target firm processes or issues have not received their due in the acquisition literature. Our analysis has focused on small manufacturing targets, and future work might also compare small manufacturing targets with firms in other sectors. Moreover, since our analysis is limited to firms that have been acquired, extensions that could collect primary data on private firms to track them over time and examine the likelihood of acquisition would be valuable.

Although different types of small targets tend

to experience a similar set of problems such as signaling difficulties (e.g., McConnell and Pettit, 1984; Becchetti and Trovato 2002), we have developed the argument that such difficulties vary across public and private targets. The evidence that bidders tend to be sensitive to adverse selection problems in selecting publicly held or private targets suggests that future M&A studies should carefully consider the implications of pooling public and private targets in analyses or generalizing findings from samples of public targets to the universe of M&A transactions. Where possible, future studies should examine whether the effects examined differ across public and private targets. Replications of prior M&A studies could also explicitly examine the extent to which received findings in the literature in fact generalize to acquisitions of small businesses and private targets.

For small firms, the results shed light on the benefits of being publicly traded and some of the criteria used by bidders in pursuing acquisition candidates. Even though valuation difficulties may still loom larger for small businesses relative to other organizations, the results suggest that such problems may be less severe for small businesses that have gone public. Being public may either reduce information asymmetries in M&A transactions directly or attenuate the effects of such difficulties for targets. By going public, the firm reveals information in a more credible fashion just as the equity market serves as a screening device, aggregates heterogeneous information which assists bidders calibrate their bids, and offers a liquid resale market for shares. Going public also allows the firm to signal value through a variety of means, including the relationship it has with an investment banker who, owing to its repeat business, has an incentive to develop reputational capital by avoiding misrepresentations. Our findings are therefore at odds with the traditional view of IPOs as being a natural end-state for small firms aimed at addressing purely financial objectives. In fact, going public has potential implications for the transfer of control rights rather than just ownership rights and is therefore a decision that affects the future evolution of firms. The results and interpretations are broadly consistent with recent evidence that capital markets and the market for corporate control are not independent

as often assumed (e.g., Pagano et al., 1998; Field and Mulherin, 1999).

The findings presented here indicate that collaborative agreements are another means of addressing valuation difficulties in M&A markets for small firms. Such relationships among firms can reduce information asymmetries directly and also mitigate the effects of information asymmetry for other potential acquirers by signaling value. Future studies might examine other potential means of enhancing the efficiency of M&A transactions, including asocial and social remedies such as alternative deal structures (Datar et al., 2001), other intermediaries such as venture capitalists (Amit et al., 1998), or other members of bidders' and targets' networks (e.g., Haunschild, 1993; Rangan, 2000). Such research could examine the relative efficiency of alternative solutions such as these to adverse selection problems. It is plausible that some alternatives like alliances may be comparably inexpensive, but their relatively low cost may also mean that the signaling value attached to them is weaker than other remedies like going public.

Finally, the present analysis relies on a discrete choice model and the conventional reduced form set-up that it implies. Thus, the paper is ultimately silent on the actual performance of acquisitions of public and private small targets. Future research could examine the performance implications of acquisitions of private and public small targets for both bidders and targets when adverse selection problems are present or absent. For example, in order to assess the roles played by information asymmetry as well as the remedies discussed here, this research could explore whether the dispersion of abnormal returns for firms acquiring public targets is lower than for equivalent private targets and whether the going public decision in fact reduces the risks to bidders under conditions of information asymmetry. Research along these lines might enhance our understanding of acquisitions of small firms, sell-side considerations in M&A deals, and the differences underlying public and privately held targets.

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