The Underpricing of Private Targets*

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Abstract

We examine acquisitions of private firms with valuation histories and find a positive relation between acquirer announcement returns and target valuation revisions. Similar to other studies, acquirer announcement returns are positive, on average. However, positive acquirer announcement returns are mainly driven by targets that are acquired for more than their prior valuation. This relation is consistent with pricing effects associated with target valuation uncertainty and behavioral biases in negotiation outcomes.

JEL Classification: G24, G34

Keywords: Private acquisitions; Withdrawn IPOs; Underpricing; Valuation uncertainty

August 13, 2008

* We thank an anonymous referee, Andres Almazan, Chris Barry, Scott Bauguess, Dan Bradley, Alex Butler, Chitru Fernando, Brad Jordan, Sandy Klasa, Steve Mann, Ron Masulis, Vassil Mihov, Jeffry Netter, Micah Officer, Ajai Singh, and seminar participants at the 2006 Frank Batten Young Scholars Conference at the College of William & Mary, the 2006 Lone Star Finance Symposium at Southern Methodist University, the 2007 FMA European Conference, Baylor University, California State University - Fullerton, Texas Christian University, Texas Tech University, and the U. S. Securities and Exchange Commission for helpful comments. Thomas Moeller wishes to thank the Luther King Capital Management Center for Financial Studies at the Neeley School of Business at TCU for its financial support for this research.

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1. Introduction

The evidence of positive announcement returns to acquirers of private targets is pervasive and robust, yet explanations are sparse. In this paper, we examine the relation between valuation changes of private firms and the announcement returns of their public acquirers. Using a sample of acquisitions of private firms that withdraw an IPO, we calculate the change in firm value from the planned IPO to the acquisition and find a positive relation between this valuation revision and acquirer announcement returns. On average, acquirers have a statistically and economically significant announcement return of 7.6% when the valuation revision is positive, but only a statistically insignificant 0.7% when the revision is negative. Thus, in our withdrawn IPO sample, positive returns are mainly driven by acquisitions in which there has been an increase in the value of the target. We find a similar positive relation between valuation revisions and acquirer announcement returns in a sample of private targets with valuations from venture capitalists.

Two examples illustrate what we observe. In its June 28, 2002, IPO registration statement, NOMOS Corp. had an estimated value of $87.4 million. NOMOS subsequently withdrew its IPO registration citing unfavorable market conditions. On October 27, 2003, North American Scientific announced its purchase of NOMOS for $51.6 million, a valuation revision of -41%. (See Appendix A for the calculation of NOMOS' IPO valuation and acquisition price.) In the three days around the acquisition, North American Scientific's cumulative abnormal announcement return (*Acquirer CAR*) was -5.2%. In another transaction, Titan Corp. announced on March 27, 2000, the acquisition of AverStar Inc. for $205 million, 36% more than its July 30, 1999, IPO valuation of $151 million. The *Acquirer CAR* for Titan was 7.6%.

Several papers document positive returns to acquirers of private targets. Fuller, Netter, and Stegemoller (2002) find positive abnormal announcement returns in a sample of repeat acquirers of private targets, as do Moeller, Schlingemann, and Stulz (2004) in a large, relatively unrestricted sample, and Faccio, McConnell, and Stolin (2006) in non-U.S. acquirers. Other papers find a relation between the method of payment and acquirer returns. Chang (1998) shows that acquirers benefit when the owners of closely held private targets become blockholders of the acquirer in stock acquisitions. Officer, Poulsen,

and Stegemoller (2008) find that the acquirer's use of stock as a method of payment mitigates the negative effects of information asymmetry on acquirers and results in positive announcement returns. Our finding of a positive relation between changes in the target's value and acquirer announcement returns provides new insights into the pricing of private acquisitions and the associated gains to public acquirers. We consider two potential explanations for our finding: 1) behavioral biases in negotiation outcomes commonly known as prospect theory and 2) pricing effects associated with target valuation uncertainty.

We base our first explanation for the positive relation between target valuation revisions and acquirer announcement returns on the relation's similarity to the partial adjustment effect found in IPO underpricing (Hanley, 1993). As in Loughran and Ritter's (2002) application of prospect theory (Kahneman and Tversky, 1979) to IPOs, we contend that owners of the target evaluate the acquirer's offer in relation to the target's prior valuation. When the acquirer's offer is high relative to this prior value, the target is less likely to bargain aggressively to increase the acquisition price, thereby increasing the benefits accruing to the acquirer. Conversely, when the acquirer's offer is relatively low, the target will be more aggressive in takeover negotiations, yielding lower benefits to the acquirer. This behaviorally induced difference in the target's negotiation aggressiveness should result in high (low) acquirer announcement returns when the target's valuation revision is positive (negative).[1]

The target valuation uncertainty hypothesis assumes that managers of both the acquirer and target are risk averse, are less diversified than market participants, prefer skewness, and believe that the prior valuation is an important indicator of the target's market value.[2] During negotiations over the acquisition price, managers of both firms estimate the expected value of the target (i.e., the value that market

[1] Other explanations of the IPO partial adjustment effect are less applicable. For example, Benveniste and Spindt (1989), assuming the presence of many potential investors, predict a partial adjustment effect from a need to compensate IPO investors for the provision of favorable private information. Since the typical private acquisition has only one bidder, a similar rationale is unlikely to explain acquirer returns.

[2] These assumptions come from the existing literature. Jones and Rhodes-Kropf (2004) assume that venture capitalists can manage only a small number of investments and therefore hold significant idiosyncratic risk. Amihud and Lev (1981), among others, assume that managers are risk averse. Conine and Tamarkin (1981) assume investors prefer positive skewness. Mitton and Vorkink (2007) find that underdiversified investors hold positively skewed portfolios. For our main sample, the target was valued in conjunction with its planned IPO. Lowry and Schwert (2004) note, "the vast majority of public information is in fact fully incorporated [in the initial price range and final offer price]" and "the IPO pricing process is *almost* efficient."

participants are expected to attribute to the target as part of the acquirer) and its distribution. The prior valuation of the target should affect the distribution in two ways. First, valuation uncertainty should be higher the larger the absolute difference between the prior valuation and the expected value of the target. Since managers are risk-averse and the target's valuation uncertainty is transferred to the acquirer, larger absolute valuation revisions should result in higher target underpricing and greater gains to the acquirer. Second, the distribution of target values should be positively (negatively) skewed when the prior valuation is above (below) the target's expected value. As the purchaser, the acquirer prefers positively skewed distributions, while the target, as seller, prefers negatively skewed distributions. This implies lower target underpricing and smaller gains to the acquirer when the target's prior valuation is greater than its expected value and higher target underpricing and greater gains to the acquirer when the target's prior valuation is less than its expected value.[3]

For example, suppose the target's prior valuation is $150 and both acquirer and target managers estimate the expected value of the target to be $200. The $50 difference in values implies substantial valuation uncertainty, requiring a discount in the acquisition price to a level below the expected value, e.g., $180. Since the prior valuation is lower than the expected value, the distribution of values should be negatively skewed – the prior valuation of $150 implies that target values much below $200 are more likely than values much above $200. Thus, the target must offer a further discount in the acquisition price, e.g., $170, to compensate the acquirer for the downside risk associated with the negative skew. We should empirically observe a $20 increase in value ($150 to $170), $30 of target underpricing ($200 minus $170), and a positive acquirer announcement return. If the prior valuation is $250, instead of $150, there is still a $50 difference in the two values, but now there is a positive skew in the distribution of target values. The higher probability of a value much above $200 increases the target's risk of accepting too low a price. The acquirer prefers the positive skew and is willing to pay a higher price for the target than in the

[3] Since acquirer managers are less diversified than market participants are, idiosyncratic risk and skewness affect the acquisition price more than the target's expected value. We define target underpricing as the difference between the target's expected value and the acquisition price. Greater target underpricing should result in higher acquirer announcement returns, other things equal.

first example, e.g., $190. Hence, we should observe a $60 decrease in value, $10 of underpricing, and a smaller acquirer announcement return. Thus, the target valuation uncertainty hypothesis predicts a positive relation between the target's valuation revision and acquirer gains. This positive relation should be stronger for positive, rather than negative, valuation revisions. For positive valuation revisions, a higher valuation revision implies more valuation uncertainty and causes the distribution to become more negatively skewed. Both factors should increase target underpricing and gains to the acquirer. However, for negative revisions, the effects are opposite: a larger negative revision requires more underpricing to compensate for increased valuation uncertainty, but less underpricing due to increased positive skewness.

We provide two tests of the prospect theory and target valuation uncertainty hypotheses. First, we investigate the impact of firm-specific and market-wide valuation changes. The relation between market returns and acquirer announcement returns is positive under prospect theory. Since acquirers and targets can hedge the portion of target valuation uncertainty and skewness associated with market returns, there should be no relation between market returns and acquirer announcement returns under the target valuation uncertainty hypothesis. We find a consistently significant positive relation between firm-specific target valuation revisions and acquirer returns and only weak evidence of a positive relation between target valuation revisions resulting from market-wide price changes and acquirer returns. Thus, this evidence favors the target valuation uncertainty hypothesis.

Second, venture capitalists (VCs), as experts in pricing private firms, may place less weight on prior valuations and more weight on their own current valuation. Thus, VC ownership of the target should reduce the impact of prior valuations on target valuation uncertainty and skewness. Similarly, Loughran and Ritter (2002) contend that VCs might be less affected by the behavior biases of prospect theory. Therefore, both the target valuation uncertainty and prospect theory explanations predict that the relation between valuation revisions and acquirer announcement returns should be less positive when the target is VC-backed. Consistent with this prediction, we find that the effect of target valuation revisions on acquirer announcement returns is significantly smaller when VCs own a portion of the target.

In summary, this paper contributes to our understanding of the valuation effects of private firm

acquisitions. Similar to other studies, we find positive announcement returns to public acquirers of private targets. Yet in our sample, these positive returns are mainly driven by private targets that experience positive valuation revisions. We explore two explanations for this positive relation between target valuation changes and *Acquirer CAR* — behavioral biases and target valuation uncertainty. Our evidence favors the target valuation uncertainty explanation. Furthermore, target valuation revisions dominate a broader measure of riskiness in explaining positive acquirer announcement returns. While we examine only a small portion of private acquisitions, our results may apply more broadly as most private firms have some valuation history, even if it is not observable to researchers. Finally, our finding suggests that a relation similar to the IPO partial adjustment effect is present in mergers and acquisitions.

The next section presents the data and descriptive statistics. Our main empirical results are in Section 3. Section 4 presents robustness tests, Section 5 verifies our main empirical results with a larger sample of targets with prior valuations by private equity and VC firms, and Section 6 concludes.

2. Data description

This section describes our sample, provides a description of the acquisition process for a subset of our firms, and explains the calculation of our variables.

2.1. Sample selection

We collect 1,119 withdrawn U.S. IPOs from 1996 to 2005 from the Thomson SDC New Issues database. The beginning of our sample coincides with the availability of electronic filings on the Securities and Exchange Commission's (SEC) EDGAR database. We match the CIDGEN, a firm-specific number assigned by SDC, and the SDC CUSIP of the firms in the withdrawn IPO sample to the universe of acquisitions in the Thomson SDC Mergers & Acquisitions (SDC M&A) database from 1996 to 2005. We also visually inspect for matching names between the sample of withdrawn IPOs and the acquisitions database. This process produces 710 matching transactions out of the 1,119 withdrawn IPOs. We likely miss some acquisitions of withdrawn IPO firms with our matching procedure, namely instances when the

target changes its name and identifying numbers between the IPO withdrawal and the acquisition.

From the 710 matches, we remove 399 transactions for the following reasons: the target is publicly traded at the time of the acquisition (146 firms); the target is acquired as part of a joint venture (4 firms); the acquirer purchases less than 50% of the target or does not own 100% of the target after the acquisition (249 firms). These screens leave 311 transactions, of which 100 involve a non-public acquirer.

Of the remaining 211 acquisitions, we require the target's original or amended IPO registration statement to have the filing price range (i.e. an estimate of the IPO's offer price), the anticipated number of primary and secondary shares in the offering, the number of shares outstanding after the planned IPO, and financial statements listing the target's total assets and stockholders' equity. These requirements eliminate 91 firms. We also collect the name of the book underwriter and VC ownership from the IPO registration statements. We eliminate 52 observations due to: confounding events of seven acquirers (e.g., simultaneous acquisition announcements), one target being in bankruptcy, one transaction being misclassified (i.e., in substance, the target purchased the acquirer), seven transactions having missing information (e.g., price paid for the target by the acquirer), one target being a Real Estate Investment Trust and one a subsidiary of another firm, one substantial restructuring of the target in the period between the IPO withdrawal and acquisition, five acquisitions occurring before the IPO registration date, and 28 acquirers not having data on the Center for Research in Security Prices (CRSP) datasets. The resulting sample contains 68 private firms that file with the SEC for an IPO, withdraw their registration, and are subsequently acquired by a publicly traded firm.[4]

There are four possible outcomes for firms that withdraw an IPO. They can (1) be acquired by a publicly traded firm, (2) re-file and complete an IPO, (3) be acquired by a private firm, or (4) stay private. Our data show that publicly traded firms acquire about 19% (211/1,119) of withdrawn IPOs while the

[4] Fifteen of the acquirers in our sample file form S-4 with the SEC. Form S-4 is frequently required when the acquirer issues stock in connection with the acquisition. In general, the S-4s do not emphasize the target's withdrawn IPO, although ten mention the failed IPO explicitly. In four cases the bidder and target are already negotiating while the target is still in registration for its IPO, six targets conduct informal auctions, and two deals have multiple bidders. The target's board justifies the merger with, among other reasons, the failed IPO coupled with the difficulty of raising funds in two cases, only the failed IPO in two cases, and only the difficulty of raising funds in one case. The board suggests that the merger is a "better deal" than the IPO in four cases.

firm is still private. The frequency of re-filing and completing an IPO is lower. Dunbar (1998) and Dunbar and Foerster (2008) find that less than 10% re-file and complete an IPO. We find the median time from the last IPO filing (i.e. the last filing with the SEC for the planned IPO containing valuation information) to acquisition is 243 days with a maximum of about six years. Dunbar and Foerster (2008) find the median time from withdrawal to re-IPO is 663 days, with a maximum of about ten years. Thus, the percentages of withdrawn IPOs that are acquired by publicly traded firms or that re-IPO are likely higher than shown above since the final outcomes of some firms are still undetermined.

2.2. Calculation of the IPO valuation and target's valuation revision

Our main variable, *Valuation Revision*, compares the estimated value of the target at the time of its planned IPO to the acquisition price. We estimate the target's *IPO Valuation* as the target's implied value of equity plus book value of liabilities as of the last IPO registration statement before the withdrawal. The implied value of equity is the product of the number of shares of common stock outstanding before the IPO and the average of the high and low filing prices. We use the pre-IPO shares outstanding, which is calculated as the number of shares to be outstanding after the IPO minus the number of primary shares to be issued in the IPO, so that the IPO value and acquisition price are comparable. (Since the acquisition does not raise capital, we do not include the expected proceeds of the IPO in the calculation of *IPO Valuation*.) We calculate the book value of liabilities as the firm's total assets minus stockholders' equity. *Valuation Revision* equals *Acquisition Price* divided by *IPO Valuation* minus one. We calculate *Acquisition Price* from information in LexisNexis and SEC filings. It is the sum of cash, acquirer stock (valued two trading days before the announcement using CRSP), and assumed liabilities. In most of our analysis, we log *Valuation Revision* to reduce the influence of outliers.

2.3. Descriptive statistics

Because our sample is unique, we provide descriptive statistics in Table 1 and compare them to the private acquisition literature. *Acquirer CAR* is the cumulative return in excess of the CRSP equal-

weighted index[5] for the three days centered on the acquisition announcement, which is the earlier of the announcement date found on LexisNexis or that reported by SDC.[6] The mean *Acquirer CAR* is 2.8%, which is similar to the CARs of 2.1%, 1.5%, and 3.8% reported in Fuller, Netter, and Stegemoller (2002), Moeller, Schlingemann, and Stulz (2004), and Officer, Poulsen, and Stegemoller (2008), respectively.

The mean *Acquisition Price* for the target is $219 million, which is similar to the mean target value of $244 million reported in Officer, Poulsen, and Stegemoller (2008), but larger than the $105 million reported in Officer (2007). The mean *IPO Valuation* is $333 million. *Valuation Revision* has a mean of -2.6% and median of -33.0%, implying that the typical target's acquisition price is less than its estimated value at the time of the proposed IPO.

The average acquirer market value of equity two trading days before the takeover announcement, *Acquirer Size*, is $10.2 billion, which is larger than the acquirer equity value of $3.2 billion in Officer, Poulsen, and Stegemoller (2008). The average *Relative Size*, the ratio of *Acquisition Price* minus assumed liabilities to *Acquirer Size*, is 27.6%. The median value of *Fraction Stock*, the fraction of the transaction paid with stock from the SDC M&A database, is 69.8%. Compared to Officer (2007) and Officer, Poulsen, and Stegemoller (2008), our transactions are relatively large and use stock more frequently.

VC Ownership is the sum of venture capital and private equity firms' fractional target ownership as of the last IPO filing. We combine venture capital and private equity ownership because they serve similar roles in the private firm and because it is difficult in the ownership data to distinguish between the two types of firms. Hereafter, we denote both as VC firms. We assume that *VC Ownership* is zero if there are more than five years between the last IPO filing and the acquisition date. In these situations, we assume that the VCs have liquidated their equity position prior to the acquisition.[7] On average, VCs own 26.4% of the target. Further, 65% of our firms have at least some VC participation. This percentage is higher

[5] Using the CRSP value-weighted index return, CRSP Nasdaq equal-weighted index return, or CRSP Nasdaq value-weighted index return instead of the CRSP equal-weighted index return does not affect our main results.

[6] The LexisNexis and SDC announcement dates are identical, except for three observations where the LexisNexis date is one day earlier than the SDC date. The three-day window we use to calculate acquirer CAR captures both dates.

[7] Venture partnerships have finite lifetimes of usually 10 years (Gompers and Lerner, 1999). In Section 4.2, we redefine *VC Ownership* to assume that the venture capital ownership is still present beyond five years.

than the 41% reported by Poulsen and Stegemoller (2008) in their sample of private takeovers. However, it is similar to the 56% VC-backing in IPOs in 1999 reported by Gompers and Lerner (2001), who show a rapidly increasing trend in VC-backed IPOs. In summary, although we highlight some differences, our unique sample appears to be largely representative of private firm acquisitions.

CM-Rank is Loughran and Ritter's (2004) updated Carter and Manaster (1990) ranking of the lead underwriter for the planned IPO. The median *CM-Rank* is eight, with nine being the maximum. Thus, prestigious investment banks lead the withdrawn IPOs in our sample. *IPO Filing Price* is the average of the high and low filing prices as of the last IPO filing. *IPO Filing Proceeds* is the product of *IPO Filing Price* and the anticipated number of shares to be issued in the IPO. Means for *IPO Filing Price* and *IPO Filing Proceeds* are $12.1 and $98 million, respectively.

Dunbar and Foerster (2008) examine a sample of 1,473 firms from 1985 to 2000 that file for an IPO and then withdraw their IPO registration. Of their sample, 138 firms re-file and complete an IPO. Dunbar and Foerster (2008) find that having high prestige underwriters and VC backing are important factors in predicting the probability the firm will successfully return to the IPO market. For example, they show that the firms that re-file and complete an IPO have a mean Carter and Manaster (1990) lead underwriter rank of 7.4 and 25% are VC-backed. For the firms that do not re-file and complete an IPO, the mean Carter and Manaster (1990) rank is 6.5 and only 13.5% of these firms are VC-backed. Compared to the Dunbar and Foerster (2008) sample of firms that re-IPO, our sample firms have similarly prestigious underwriters, but are more frequently VC-backed. Since our sample period begins during a period of increased VC-backing for IPOs (Gompers and Lerner, 2001), it is not surprising that our sample has a higher fraction of VC-backed firms. Overall, this finding suggests that prestigious underwriters and VC backing are important factors in withdrawn IPO firms being successful acquisition candidates.

Table 2, Panel A, presents the distribution of last IPO filings and acquisition announcements by year. Slightly more than half of our firms file their last IPO registration statement in 1999 or 2000, the peak of the Nasdaq bubble. Conversely, there is only one observation in 2003 and none in 2005. Since there is a high number of IPO withdrawals in 1999 and 2000, we investigate the effects of this clustering in Section

4.1. Acquisition announcements are more evenly distributed across our sample period.

In Table 2, Panel B, we report the number of observations in the top six target industries. Unless otherwise noted, we define "industry" using the Fama and French 49-industry classification. Approximately half of the targets and one third of the acquirers come from the Computer Software and Business Services industries. This distribution of targets is similar to that in Fuller, Netter, and Stegemoller (2002) and Officer, Poulsen, and Stegemoller (2008). Overall, our targets and acquirers are from 18 and 22 different industries, respectively. The acquirer and target are in the same industry in 31 of the 68 acquisitions. We control for industry characteristics, such as industry liquidity index and industry return. We also use industry dummy variables in unreported regressions, but they do not affect our results.

3. Results

In this section, we test whether valuation changes of the target affect acquirer announcement returns.

3.1. Univariate analysis

In Table 3, we split our sample into terciles based on *Valuation Revision*. Acquisitions with larger target valuation revisions have significantly higher *Acquirer CARs*. The mean (median) *Acquirer CAR* in the highest tercile is 7.0% (3.2%) compared to -1.6% (-2.5%) in the lowest tercile, and the differences are significant at the 0.05 level. Of our 68 observations, 21 have positive valuation revisions. The mean (median) *Acquirer CAR* for targets with positive revisions is 7.6% (3.2%), and both numbers are statistically different from zero at the 0.05 level. In contrast, the mean (median) *Acquirer CAR* for the 47 targets with negative revisions is only 0.7% (0.0%), both not different from zero. The differences in means and medians between these two groups are significant at the 0.05 and 0.1 levels, respectively. We also calculate the correlation of *Valuation Revision* and *Acquirer CAR*. Confirming the other univariate tests, the correlation coefficient equals 0.32 and is significant at the 0.01 level. Thus, acquisitions of targets with positive valuation revisions are associated with higher acquirer announcement returns.

3.2. Determinants of Valuation Revision

We examine the determinants of *Valuation Revision* to understand better the cause for its positive relation with *Acquirer CAR*. A target's value can change between its IPO filing date and acquisition announcement date for at least two reasons. First, the fundamental value of the target can change due to adjustments in expected cash flows or discount rates. Second, the value change can reflect the inherent uncertainty of valuing private firms. Prospect theory predicts a positive relation between valuation revisions and target underpricing without regard to the reason for the change in target value. The target valuation uncertainty hypothesis relies on the second reason to explain this positive relation. To assess the relative importance of these two reasons for target value changes, we regress *Log Valuation Revision*, i.e., the natural log of (1 + *Valuation Revision*), on proxies for changes in fundamental value and the target's valuation uncertainty.

The target's fundamental value should change with market movements and IPO withdrawal should cause distressed targets to suffer a decline in value between the last IPO filing and the acquisition. Thus, we proxy for the change in the target's fundamental value with *Industry Return since last IPO Filing* (the compounded value-weighted return of the target's industry from the last IPO filing to two trading days before the acquisition announcement) and two firm-specific target distress variables: *Debt to Assets Target* (the target's liabilities divided by total assets) and *Distressed Target* (a dummy variable equal to one when the target's earnings before interest, taxes, and depreciation are less than its interest expense). Data for these two variables are from 35 S-4 or 8-K acquirer filings linked to the acquisition. For the 33 observations without these filings, we use the information from the target's last IPO filing. If the change in the value of the target reflects changes in the target's fundamental value, there should be a positive relation between *Industry Return since last IPO Filing* and *Log Valuation Revision* and a negative relation between the target distress variables and *Log Valuation Revision*.

Under the target valuation uncertainty hypothesis, targets with a high absolute *Log Valuation Revision* should have high valuation uncertainty. To test, we calculate two additional, broader proxies for

target valuation uncertainty: the standard deviations of the price-to-earnings and price-to-assets multiples of a matched group of public firms, *σ(Price-to-Assets Multiple Target)* and *σ(Price-to-Earnings Multiple Target)*. The matched public firms must be in the same industry and have a contemporaneous (based on the calendar year of the acquisition announcement) equity market value between 50% and 200% of the equity value of the target. The public firm's equity value is the numerator, and book value of total assets is the denominator in the price-to-assets multiple and net income is the denominator in the price-to-earnings multiple. We exclude negative price-to-earnings multiples. If there is a positive relation between the absolute *Log Valuation Revision* and the target's valuation uncertainty, there should also be a positive relation between the absolute *Log Valuation Revision* and the target's standard deviation of multiples.

Log Valuation Revision is the dependent variable in Table 4. Consistent with *Log Valuation Revision* reflecting changes in the target's fundamental value, *Industry Return since last IPO Filing* is positive with *p*-values of 0.10 in each model, and both distress variables are negative and significant at the 0.01 level. Both *σ(Price-to-Assets Multiple Target)*, column (1), and *σ(Price-to-Earnings Multiple Target)*, column (2), are significantly positive at the 0.01 level. In untabulated analyses, we re-estimate the regression in column (1) separately for positive and negative valuation revisions and for above and below median revisions. (For this and our remaining analysis, we use *σ(Price-to-Assets Multiple Target)* as a measure of valuation uncertainty because it allows the use of all 68 observations, is better behaved than price-to-earnings, and does not require deleting comparable firms with negative earnings.) The coefficient for *σ(Price-to-Assets Multiple Target)* is always positive and is statistically significant in three of the four subsamples (the *p*-value is 0.12 in the subsample of only positive revisions).

The positive relation between *Log Valuation Revision* and *σ(Price-to-Assets Multiple Target)* with positive and above median valuation revisions is consistent with *Log Valuation Revision* reflecting target valuation uncertainty, but the positive relation for negative and below median valuation revisions is inconsistent with this view. This result may be an artifact of sample selection biases. The withdrawn IPOs with the most negative valuation revisions are likely never acquired, possibly excluding those

observations in which *Log Valuation Revision* and target valuation uncertainty are most likely to be negatively related. Alternatively, *Log Valuation Revision* may measure other aspects of valuation uncertainty not captured by σ*(Price-to-Assets Multiple Target).*

3.3. Regression analysis

We next consider the relation between *Log Valuation Revision* and *Acquirer CAR* in a multivariate setting including common control variables from the acquisitions literature. We include *Relative Size* as a control variable because Faccio, McConnell, and Stolin (2006) and Asquith, Bruner, and Mullins (1983) find a positive relation between acquirer announcement returns and relative size in private and public acquisitions, respectively. Moeller, Schlingemann, and Stulz (2004) find that larger acquirers earn approximately 2% lower announcement returns than do smaller acquirers. They interpret this finding as evidence of hubris (Roll, 1986). Thus, we include *Log Acquirer Size*, the natural log of *Acquirer Size.*

Fuller, Netter, and Stegemoller (2002) and Faccio, McConnell, and Stolin (2006) find higher acquirer returns when the acquirer uses stock to purchase the private target. Further, Officer, Poulsen, and Stegemoller (2008) show that using stock as a method of payment mitigates asymmetric information about the target and leads to more positive acquirer returns. However, Moeller, Schlingemann, and Stulz (2004) find no difference between stock and cash deals. To test the effects of payment with stock in our sample, we include *Stock* as a dummy variable equal to one if *Fraction Stock* is higher than 95%.

Lang, Stulz, and Walkling (1989) show that acquirers with high Tobin's *Q* gain more than acquirers with low Tobin's *Q*. Thus, we include *Acquirer Q* which is the acquirer's total assets minus book value of equity plus market value of equity, all divided by total assets. Total assets and book value of equity are from Compustat as of the year preceding the acquisition, and acquirer market value of equity is as of two trading days before the takeover announcement. We also control for the acquisition activity of the target's industry with *Liquidity Index Target Industry*. Similar to Schlingemann, Stulz, and Walkling (2002), this variable is the value of all acquisitions in the SDC M&A database (removing repurchases, self-tender offers, and deals with the same acquirer and target name) divided by the total book value of assets for

firms in the same two-digit SIC during the same year. Ratios larger than one are set equal to one.[8]

Acquirer CAR is the dependent variable in Table 5. The coefficient of *Log Valuation Revision* in column (1) equals 0.036 and is significant at the 0.01 level.[9] Of the control variables, only *Log Acquirer Size* is significant at the 0.1 level and the coefficient is negative. *Stock* is never significantly positive in any of our regressions.[10] Because of our relatively small sample size, we do not want to overemphasize this result. Further, the information within the target's IPO registration statement, especially valuations by investment banks, would likely reduce the type of asymmetric information that Officer, Poulsen, and Stegemoller (2008) rely on to explain the positive influence of stock payments in their analysis.

Our main regression in column (2) adds controls for VC-related effects. *VC* is a dummy variable equal to one if *VC Ownership* is greater than zero. Gompers and Xuan (2006) find that announcement returns to acquirers of VC-backed private targets are less positive than those of non-VC-backed private targets. They interpret this result as VC-backed private targets having a greater price negotiating ability than those that are not VC-backed. VC backing could also reduce target underpricing due to monitoring and certification effects (see Barry, Muscarella, Peavy, and Vetsuypens (1990) and Megginson and Weiss (1991) for similar arguments in an IPO setting). *VC* should have a negative sign.

With respect to prospect theory, Loughran and Ritter (2002) contend, "…venture capitalists, with their years of experience at taking firms public, might be less susceptible to psychological factors affecting their aggressiveness in bargaining." However, they find no evidence of this contention in a sample of IPOs and there is some evidence that institutional investors are also subject to behavioral biases (e.g., Crane and Hartzell, 2007). Alternatively, VCs' pricing expertise can reduce the influence of the prior valuation on target valuation uncertainty and skewness and therefore reduce the positive relation

[8] We construct a discount measure similar to Officer (2007) using a portfolio of industry, size, and time matched public firms. We also construct a blockholder formation variable (Chang, 1998) similar to Officer, Poulsen, and Stegemoller (2008). We include the discount and blockholder variables in unreported regressions. Both variables are insignificant and do not significantly influence our other variables.

[9] We determine significance levels using heteroskedasticity consistent standard errors with a small sample adjustment based on White (1980) and MacKinnon and White (1985).

[10] In unreported regressions we interact *Stock* with *Log Valuation Revision*, change the definition of *Stock* to equal one if the method of payment is at least 50% stock, and if it is 100% stock. In no specification do our results match the positive relation between stock and returns to acquirers of private targets found in most of the literature.

between valuation revision and acquirer return. We add *Log Valuation Revision x VC* and predict a negative coefficient.

In column (2) of Table 5, the coefficient for *VC* is -0.064 with a *p*-value of 0.03. VC participation appears to reduce target underpricing, consistent with greater negotiating power, monitoring, and certification effects. The significantly negative coefficient for *Log Valuation Revision x VC* indicates that the relation between valuation revision and acquirer returns is weaker in the subsample of VC-backed targets. This result supports the hypothesis that VC-backed targets are less susceptible to the psychological effects of prospect theory. Alternatively, the impact of prior valuations on valuation uncertainty and skewness can be lower with VC-backed targets. *Log Valuation Revision* remains positive and is significant at the 0.01 level after the inclusion of *VC* and *Log Valuation Revision x VC.*

Eighteen of our targets that received VC funding before their last IPO filing also received VC funding after their last IPO filing, thus providing a more recent valuation and potentially reducing the relevance of the target's earlier IPO valuation. Therefore, one reason for the negative sign for *Log Valuation Revision x VC* could be the inclusion of these 18 observations. In an untabulated regression, we exclude the 18 observations and re-estimate our main regression with the remaining 50 observations. *VC* and *Log Valuation Revision x VC* remain negative, but are now insignificant with *p*-values of 0.21 and 0.22, respectively. *Log Valuation Revision* remains positive with a coefficient of 0.069 and is significant at the 0.01 level. We also examine the 18 observations with additional VC funding and estimate the regression in column (1). The coefficient for *Log Valuation Revision* is positive and significant at the 0.05 level, but has a point estimate of only 0.012. The lower point estimate suggests that subsequent equity valuations reduce the relevance of the prior IPO valuation and provide an alternative explanation for the negative relation between *Log Valuation Revision x VC* and *Acquirer CAR*.

In column (3), we investigate the impact of firm-specific versus market-related changes in target value. Similar to the argument in Loughran and Ritter (2002) for IPOs, the relation between market returns and *Acquirer CAR* should be positive under prospect theory. Since acquirers can hedge the portion of target valuation uncertainty and skewness associated with market returns, there should be no relation

between market returns and *Acquirer CAR* under the target valuation uncertainty hypothesis.

We decompose *Log Valuation Revision* into the parts due to firm-specific value changes and market returns. Specifically, we calculate the firm-specific value change as the natural log of (*Acquisition Price* divided by *Industry Adjusted IPO Valuation*). *Industry Adjusted IPO Valuation* is the product of *IPO Valuation* and (1 + *Industry Return since Last IPO Filing*). We then re-estimate our main regression using *Industry Adjusted Log Valuation Revision* as the continuous variable and in interaction with *VC*, and include *Industry Return since Last IPO Filing* as a proxy for the market return. *Industry Adjusted Log Valuation Revision* is positive and significant at the 0.01 level, and *Industry Return since Last IPO Filing* is positive and significant at the 0.1 level. Similar to our main regression, *VC* and *Log Industry Adjusted IPO Valuation x VC* are significantly negative at the 0.05 and 0.01 levels, respectively. Hence, the effects of target valuation revisions and VC presence are insensitive to market returns. We also adjust valuation revision using the CRSP value-weighted Nasdaq return and a multiples-based return.[11] Overall, the results are similar to those presented in column (3), but the Nasdaq and multiples return variables are weaker than *Industry Return since Last IPO Filing* with *p*-values of 0.13 and 0.98, respectively. In addition, *Industry Return since last IPO Filing* is insignificant in the regression specifications presented in columns (5) to (8). Thus, the significance of market returns in determining *Acquirer CAR* is sensitive to the return measurement and regression specification, casting some doubt on the importance of prospect theory as an explanation for the effect of target valuation revisions on *Acquirer CAR*.

Like interim VC valuations, dated IPO valuations and the prestige of the IPO underwriter could influence the relative importance of the IPO valuation. If low-ranked underwriters provide lower quality and less informative IPO valuations, then a valuation from a low-ranked underwriter should have less influence on the managers' estimates of the target's value distribution than a valuation from a high-ranked underwriter. According to the target valuation uncertainty hypothesis, the relation between *Log Valuation Revision* and *Acquirer CAR* when the target has a low-ranked underwriter should be weaker than for

[11] The multiples-based return is the percentage change of the mean valuation multiple of industry, size, and year matched portfolios of publicly traded firms from the time of the last IPO filing to the acquisition.

targets with high-ranked underwriters. Likewise, a long period between the last IPO filing and acquisition makes the IPO valuation less reliable. Similarly, under the prospect theory hypothesis, less relevant IPO valuations should be weaker "anchors."

In column (4), we add *Low Rank Underwriter*, a dummy variable equal to one if the IPO underwriter's *CM-Rank* is less than eight (the sample median), and *Long Time*, a dummy variable equal to one if more than 365 days pass between the last IPO filing and the acquisition announcement. We also include the interactions of these two variables with *Log Valuation Revision*. Consistent with our predictions, the point estimates of the interactions of *Log Valuation Revision* with *Low Rank Underwriter* and *Long Time* are negative. Yet, except for *Long Time*, the new variables are insignificant. Estimates for the remaining variables are similar to column (2). Because *Low Rank Underwriter*, *Long Time*, and their interactions with *Log Valuation Revision* have little effect on the estimates of our main variables of interest, we conduct most of our remaining tests without them.[12]

In column (5) of Table 5, we test the relation between *Acquirer CAR* and our measures for valuation uncertainty, distress, and market movements from Table 4. The coefficient on *σ(Price-to-Assets Multiple Target)* is positive and significant at the 0.05 level, consistent with risk-averse managers discounting the target's price when valuation uncertainty is high. The target's *Industry Return since last IPO Filing* and the distress variables are insignificant. We add the acquisition-related control variables in column (6). No variable in this model is significant, but the coefficient of *σ(Price-to-Assets Multiple Target)* is positive, with a *p*-value of 0.103. We add *Log Valuation Revision* and *Log Valuation Revision x VC* in column (7). As in our main regression, these two variables are significantly positive and negative, respectively. *Debt to Assets Target* becomes significant at the 0.1 level. Adding *Log Valuation Revision* and *Log Valuation Revision x VC* reduces the coefficient of *σ(Price-to-Assets Multiple Target)* from 0.059 to 0.004 and the

[12] We also examine the effect of switching investment banks on *Log Valuation Revision* to see if improving (lowering) the quality of the investment bank after the withdrawal increases (decreases) the valuation revision. We find that 33 firms switch investment banks between the withdrawal and the acquisition and that there is a positive relation between the change in investment bank reputation and *Log Valuation Revision*. We are unable to distinguish whether choosing a better investment bank increases the target valuation or whether better target performance attracts better investment banks.

variable is insignificant (*p*-value of 0.90). The reduced significance for *σ(Price-to-Assets Multiple Target)* could be due to multicollinearity. Nonetheless, *Log Valuation Revision* dominates our broader measure of riskiness in explaining acquirer announcement returns. Its explanatory power suggests that *Log Valuation Revision* captures important effects not previously considered in the acquisitions literature.

Finally, we include all of the variables from previous model specifications in column (8). Despite the large number of explanatory variables relative to the number of observations, *Log Valuation Revision* and *Log Valuation Revision x VC* are still significant at the 0.01 and 0.05 levels, respectively.

Log Valuation Revision is positive and significant in all regressions in Table 5, with a point estimate of 0.067 in our main regression in column (2). The interaction of *Log Valuation Revision* and *VC* has a point estimate of -0.049. These coefficients imply that in a comparison of two otherwise identical transactions with VC-backing, one with a 20% increase in target valuation and one with a 75% decrease (roughly the .75 and .25 percentiles of *Valuation Revision*), *Acquirer CAR* is about 2.8 percentage points higher for the transaction with the 20% increase in valuation. The 2.8% represents an increase in value of $27 million for the median acquirer. With the median *Acquisition Price* of $124 million, the $27 million represents target underpricing of about 18% (= 27 / (124 + 27)), which is similar in magnitude to IPO underpricing and the marketability discount of private firms (Officer, 2007). For firms without VC-backing the implied underpricing is larger at about 44%.

In summary, our multivariate regressions show a significant positive relation between target valuation revisions and acquirer returns. The analyses provide support for the target valuation uncertainty hypothesis and somewhat weaker evidence for the prospect theory explanation.

4. Robustness and alternative explanations

In this section, we address several concerns that could affect our results and explore alternative explanations for the relation between *Log Valuation Revision* and *Acquirer CARs*.

4.1. Nasdaq bubble, target size, and positive versus negative valuation revisions

One concern is that unusually large price movements associated with the Nasdaq bubble unduly influence our results. An IPO that is withdrawn during this period and acquired after the bubble years is likely to have an acquisition price much lower than its IPO valuation, resulting in a negative *Valuation Revision*. If there is also a less favorable reception for acquisitions after the bubble period, low acquirer announcement returns are likely. The combination of these two features could lead to a spurious positive relation between *Acquirer CAR* and *Log Valuation Revision*. We perform two tests to address this issue.

In column (1) of Table 6, we eliminate 17 observations in which the last IPO filing is in 1999 or 2000 and the acquisition announcement is after 2000 and re-estimate regression (2) from Table 5. For these 17 firms, the median value for *Valuation Revision* is -74.7% compared to -19.0% for the 51 other firms, which is significantly different at the 0.05 level. Our results remain qualitatively unchanged after exclusion of these 17 firms. In an untabulated regression, we add two dummy variables to our main regression to account for any influence of the Nasdaq bubble. The first dummy equals one if the acquisition announcement is between 1996 and 1998 and the second equals one if the announcement is in 1999 or 2000. Neither dummy is significant. The results for the remaining variables are similar to those presented for our main regression.

Jarrell and Poulsen (1989) show that acquisitions have little impact on the value of the acquirer if the acquirer is large and the target is relatively small. Therefore, *Acquirer CARs* can be noisier when *Relative Size* is small. In column (2) of Table 6, we exclude seven observations in which *Relative Size* is less than 1%. *Log Acquirer Size* becomes insignificant, but the results for the remaining variables are largely unchanged from those in Table 5, column (2). In untabulated regressions, we exclude transactions in which *Relative Size* is less than 5% and less than 10%. *Log Valuation Revision* remains positive and significant at the 0.01 level. Overall, our results are robust to the exclusion of relatively small targets.

The target valuation uncertainty hypothesis states that the relation between *Log Valuation Revision* and *Acquirer CAR* will be stronger for positive revisions than negative revisions. However, a "lemons

problem" (Akerlof, 1970) could strengthen the relation between *Log Valuation Revision* and *Acquirer CAR* for targets with large negative valuation revisions. Most of these targets experience a negative capital market event in the IPO withdrawal (Dunbar and Foerster, 2008). The owners of these firms could find it difficult to raise necessary capital or exit their investment. Investors may react negatively to acquisitions of these targets because they believe that acquirers overestimate their ability (Roll, 1986) to turn these targets around (Clark and Ofek, 1994). Therefore, in columns (3) and (4) of Table 6, we split the sample into positive and negative valuation revisions. *Log Valuation Revision* is positive and significant for both subsamples with a higher point estimate for the subsample of positive valuation revisions. However, there is no statistical difference in the coefficients for *Log Valuation Revision* in the two subsamples – possibly due to the small sample size. Overall, these regressions provide some weak evidence in support of the target valuation uncertainty hypothesis.

4.2. Additional robustness tests

Due to a small sample size, outliers could unduly influence our results. We address this concern by first performing an analysis of residuals for our main regression, column (2) of Table 5, and identifying the five most influential outliers. We then sequentially delete the most, three most, and five most influential outliers, and re-estimate our main regression on the smaller samples. In all three cases, *Log Valuation Revision* remains positive and significant at the 0.01 level. *VC* and *Log Valuation Revision x VC* remain significantly negative in all three cases. The results for the remaining variables are largely unchanged. We also eliminate 26 transactions in which the absolute dollar gain to the acquirer is greater than the amount paid for the target. Our results remain qualitatively the same, except for *VC* and *Log Valuation Revision x VC,* which become insignificant with *p*-values of 0.69 and 0.22, respectively. We also re-estimate our main regression using *Valuation Revision*, i.e., we do not take logs, and change the interaction variable to *Valuation Revision x VC*. *Valuation Revision* is positive and significant at the 0.01 level, *VC* is negative with a *p*-value of 0.18, and *Valuation Revision x VC* is negative and significant at the 0.05 level. Therefore, neither the particular specification of valuation revision, nor outliers appear to drive

our main results.

VC is determined by examining ownership data contained in the target's last IPO filing. Ideally, *VC* would be determined at the time of the acquisition, but ownership data for private targets is rarely available at that time. In the IPO filings, we find that 44 firms have VC ownership. SDC's VentureXpert shows that 18 of these 44 firms receive additional VC funding after the IPO withdrawal. There are 24 sample firms that have no VC funding as of, or after, the last IPO filing date. Since we are unable to discern otherwise, we assume that VC ownership as of the last IPO filing is maintained until the acquisition date, except when the time between the last IPO filing and the acquisition date is more than five years. In that case, we assume the VC has liquidated its equity position by the acquisition date. We re-estimate our main regression assuming that VC ownership is present beyond the five years. The results are similar to those reported in column (2) of Table 5.

4.3. Sample selection bias

Withdrawn IPOs can have two possible successful conclusions: the firm can re-enter the IPO market successfully or a public firm can acquire it. Both accomplish the primary goals of most IPOs: the shares of the firm become liquid and the firm gets access to capital. Because we focus on one of these successful conclusions to withdrawn IPO filings, we have a sample bias in the sense that it does not include private firms that withdraw their IPOs and stay private. Does this bias affect our results?

It could be that only the more successful withdrawn IPO firms are acquired. If markets perceive the acquisition of a successful target as better news for the acquirer than the acquisition of a struggling target, then our finding of a positive relation between target valuation revisions and acquirer returns might be a spurious result of our sample selection criteria. To address this issue, we first note that firms in our sample mostly decline in value between their attempted IPO and acquisition. Therefore, although we cannot compare these firms to the set of withdrawn IPOs that remain private, it does not appear that our firms are unusually successful. In addition, well performing firms should be able to re-enter the IPO market. However, even if our sample firms are unusually successful, it is not obvious (apart from the

explanations provided in our paper) why a bidder that acquires a well-performing target will experience a higher announcement return than a bidder that acquires a poorly performing target. If the acquisition price is fair, both well and poorly performing targets add or subtract the same value to the acquirer.

An additional bias could result from observing only those targets that have a disclosed deal value. As noted in Rodrigues and Stegemoller (2007), acquirers are not legally required to disclose target financial data, or even the deal value, for targets below a certain relative size threshold unless the transaction can otherwise be classified as material or is not made in the course of normal business. Thus, of the deals that do not require disclosure, acquirers may report only the most beneficial transactions. We address this bias by eliminating transactions with *Relative Size* less than 1%, 5%, or 10%, as described in Section 4.1, and *Log Valuation Revision* remains positive and significant at the 0.01 level.

In summary, our finding of a positive relation between target valuation revisions and acquirer returns in a sample of private acquisitions is robust to various specifications of our main model and does not appear to be driven by obvious sample selection biases. In addition, acquirer announcement returns are related to target valuation changes due to firm-specific and (more weakly) market movements. While we cannot definitively distinguish what causes our results —valuation uncertainty or behavioral biases—they are consistent with both explanations.

5. Evidence from venture capital valuations

Given the specificity of our main sample and the resulting limitations in generalizing our results, we expand our analysis to other acquisitions of private firms with available prior valuations. The SDC VentureXpert database provides some post-round valuations of private firms receiving venture capital or private equity financing (hereafter "VC valuations"). We extract from the Mergers & Acquisitions portion of the VentureXpert database all transactions from 1996 to 2005 of targets that are private at the time of the acquisition announcement and whose acquirer is publicly traded on the NYSE, Nasdaq, or American Stock Exchange. This step provides 1,109 acquisitions. We use the last VC valuation in our analysis and require a valuation of at least $25 million (the smallest target in our main sample has an IPO valuation of

$26 million), a corresponding transaction in the SDC M&A database with the acquirer purchasing 100% of the target, and the deal not being in our main sample of withdrawn IPOs. Of the remaining 300 firms, we exclude 53 transactions due to the following confounding events: simultaneous announcements of 1) other acquisitions or divestitures (37 deals), 2) a double-digit percentage change in earnings, a double-digit percentage loss of employees or sales, or a triple-digit percentage increase in sales (13 deals), or 3) secondary equity offerings or repurchases (3 deals). We exclude 33 transactions in which the acquirer's stock price as of two trading days before the acquisition announcement is less than five dollars due to the noise inherent in low-price firms (e.g., distress, risk, high volatility).[13] Finally, we exclude deals that have data limitations: three deals have no acquisition announcement on LexisNexis; there is no acquisition price in the SDC M&A database or in LexisNexis for ten deals; we cannot compute *Acquirer Q* for three transactions; and four transactions have no information regarding the method of payment (either in LexisNexis or SDC). Our final sample consists of 194 firms.

We expect a decreased ability to find significant results in this sample for three reasons. First, the results from our main sample of withdrawn IPOs suggest that *Log Valuation Revision* for VC-backed acquisitions (the entirety of this new sample) is less influential on *Acquirer CAR* than for non-VC-backed acquisitions. Second, we are skeptical of the VC valuations because they are self-reported and there are incentives for VCs to report biased values. We find some evidence for biases: 61% of firms have positive valuation revisions in this sample compared to 31% in our main sample. Third, the values provided by the VC firms do not contain the same amount or quality of information as the IPO valuations in our main sample, which have undergone a significantly more rigorous information gathering process than those in this sample. The lower quality and level of information contained in the VC valuation is important for both the valuation uncertainty hypothesis (managers are not likely to place much weight on the prior valuation) and prospect theory (target managers may be "less anchored" on this value).

In column (1) of Table 7, we re-estimate regression (1) from Table 5 using this alternative sample.

[13] Inclusion of these acquirers reduces the significance of the results. Seven acquirers have share prices below five dollars in our main sample. Excluding these acquirers from our main sample does not significantly affect our results.

We do not include *VC* and *Log Valuation Revision x VC* as in our main regression since all targets have VC funding. In column (2), we account for the Nasdaq bubble by eliminating 65 firms in which the VC valuation is in 1999 or 2000 and the acquisition announcement is after 2000. In column (3), we adjust for industry returns from the VC valuation date to the acquisition date, similar to the procedure used in column (3) of Table 5. As in regression (1) of Table 5, *Log Valuation Revision* is positive and significant at the 0.05 level in all three regression specifications.

Remarkably, we obtain an almost identical point estimate for *Log Valuation Revision* as compared to our main regression. In column (2) of Table 5, the point estimate of *Log Valuation Revision* is 0.067. Subtracting 0.049, the coefficient of *Log Valuation Revision x VC*, suggests a coefficient of 0.018 on *Log Valuation Revision*. In Table 7, the coefficient of *Log Valuation Revision*, depending on regression specification, ranges from 0.012 to 0.018. *Relative Size* is significantly negative using the VC valuation sample while it is insignificant using our main sample. This difference could be due to more relatively small firms in the VC valuation sample; the mean relative size is 8.6% for the VC valuation sample compared to 27.6% in our main sample. Our claim that the VC valuation sample suffers from lower data quality is supported by the adjusted R^2s. Using the VC valuation sample, the adjusted R^2s range between 0.03 and 0.04, while it is 0.14 in regression (1) of Table 5.

In sum, this evidence provides further support for the influence of prior valuations on the pricing of private targets and acquirer announcement returns. It raises the question of whether this effect influences private acquisitions more generally and other transactions, for example, acquisitions of public targets.

6. Conclusions

We provide new insights into acquirer announcement returns. We show that private targets experiencing positive valuation changes between their last SEC filing before their withdrawn IPO and subsequent acquisition are more underpriced and that acquirers benefit. Our findings are similar to the partial adjustment effect in IPOs and our paper is the first to show this partial adjustment effect in private acquisitions. Additional analysis on a sample of targets with valuations by private equity and VC firms

confirms our results.

Pricing effects associated with target valuation uncertainty appear to be important in explaining announcement returns for acquirers of private firms. We find somewhat weaker support for a behavioral explanation for our results based on prospect theory. Although not observable to researchers, most private targets likely have received valuations prior to their acquisitions. Thus, it is possible that similar pricing effects are present in most private acquisitions and in many other negotiation outcomes. Theoretical models linking target underpricing, acquirer announcement returns, target valuation revisions, and target valuation uncertainty would be useful in further interpreting our empirical results.

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Appendix A: Calculation of the IPO valuation and acquisition price for NOMOS Corporation

On April 29, 2002, NOMOS filed form S-1 with the SEC for its anticipated IPO. Filing prices and shares were first included on its first amendment to form S-1 filed on June 5, 2002. NOMOS filed a second amendment to form S-1 on June 19, 2002. Then on June 28, 2002, NOMOS filed a post-effective amendment to form S-1, which contains the last valuation information prior to withdrawal. Finally, NOMOS filed form RW on July 18, 2002, withdrawing the registration for its IPO, citing adverse market conditions. On October 27, 2003, North American Scientific Inc. announced that it was purchasing NOMOS Corp. for 5.3 million shares of stock and $12 million in cash. North American Scientific Inc.'s closing stock price was $7.47 two trading days before the announcement, resulting in an acquisition price of $51.6 million.

We use the following information from the June 28, 2002, post-effective amendment to form S-1 to calculate *IPO Valuation*:

High filing price	$12
Low filing price	$10
Primary shares	2,500,000
Secondary shares	0
Shares outstanding after offering	9,620,987
Total assets as of March 31, 2002	$16,092,000
Preferred stock as of March 31, 2002	$6,279,000
Stockholders' equity as of March 31, 2002	$723,000

IPO Valuation = Implied value of equity + book value of liabilities
Implied value of equity = (($12+$10) / 2) (9,620,987 – 2,500,000) = $78,330,857
Book value of liabilities[14] = $16,092,000 - $6,279,000 - $723,000 = $9,090,000
IPO valuation = $78,330,857 + $9,090,000 = $87,420,857

[14] In general, we calculate book value of liabilities as book value of assets minus book value of stockholders' equity. Thus, book value of liabilities includes preferred stock if preferred stock is not included in the total given for stockholder equity (as in the case of NOMOS). However, NOMOS planned to convert its preferred stock into common stock in conjunction with its IPO and the 9,620,987 shares outstanding after the offering include these converted shares. Therefore, we subtract the preferred stock to determine book value of liabilities. We make similar calculations for the 19 other targets that planned to convert preferred stock to common stock. The remaining targets do not have preferred stock, do not plan to convert it to common stock, or include the preferred stock in stockholders' equity.

Appendix B: List of acquisitions of withdrawn IPOs

Acquirer name	Target name	Last SEC filing date	Acquisition announced
Cardiac Science Inc	SurVivaLink Corp	08/01/1996	02/14/2001
Imation Corp	Cemax-Icon Inc	08/14/1996	05/14/1997
Agouron Pharmaceuticals Inc	Alanex Corp	10/15/1996	04/29/1997
Cardinal Health Inc	MediQual Systems Inc	10/15/1996	05/27/1997
Lightbridge Inc	Coral Systems Inc	12/19/1996	09/09/1997
Millennium Pharmaceuticals Inc	ChemGenics Pharmaceuticals Inc	01/14/1997	01/20/1997
KeyCorp	Champion Mortgage Holdings	02/10/1997	06/16/1997
Pharmacopeia Inc	Molecular Simulations Inc	02/10/1997	02/04/1998
Aspect Telecommunications	Voicetek Corp	02/14/1997	04/01/1998
Roto-Rooter Inc	Vitas Healthcare Corp	09/23/1997	12/19/2003
Registry Inc	Hunter Group Inc	10/02/1997	11/14/1997
RCN Corp	Erols Internet Inc	12/05/1997	01/21/1998
Cendant Corp	Credentials Services Intl Inc	12/17/1997	04/13/1998
JDS Uniphase Corp	Epitaxx	05/13/1998	10/04/1999
PepsiCo Inc	Tropicana Products Inc	07/17/1998	07/20/1998
Verio Inc	Hiway Technologies Inc	07/20/1998	07/29/1998
Hain Food Group Inc	Natural Nutrition Group Inc	08/03/1998	04/05/1999
Giant Group Ltd	Periscope Sportswear Inc	08/10/1998	12/04/1998
Texas Regional Bancshares	Riverway Holdings Inc	08/11/1998	09/17/2001
Orchid BioSciences Inc	LifeCodes Corp	09/03/1998	10/01/2001
Mercer Insurance Group	Fin Pacific Ins Group Inc	11/13/1998	05/02/2005
Becton Dickinson & Co	Clontech Laboratories Inc	03/02/1999	04/27/1999
eBay Inc	Butterfield & Butterfield Corp	04/02/1999	04/26/1999
AppliedTheory Corp	CRL Network Services Inc	06/17/1999	12/06/1999
Goldman Sachs Group Inc	Hull Group Inc	07/06/1999	07/09/1999
Briggs & Stratton Corp	Generac Portable Products Inc	07/19/1999	03/01/2001
Hoovers Inc	Powerize.com Inc	07/28/1999	07/12/2000
Titan Corp	AverStar Inc	07/30/1999	03/27/2000
Sonic Automotive Inc	FirstAmerica Automotive Inc	08/09/1999	08/25/1999
eMusic.com Inc	Tunes.com Inc	08/17/1999	11/30/1999
Macromedia Inc	Andromedia Inc	09/24/1999	10/07/1999
Genesco Inc	Hat World Inc	09/28/1999	02/05/2004
TDK Corp	Headway Technologies Inc	10/08/1999	03/08/2000
Globix Corp	ComStar.net Inc	11/22/1999	08/23/2000
Dollar Tree Stores Inc	Dollar Express Inc	02/22/2000	04/05/2000
Quokka Sports Inc	Total Sports Inc	02/23/2000	07/21/2000
Wind River Systems Inc	Embedded Support Tools Corp	02/24/2000	02/28/2000
Covad Communications Group Inc	Bluestar Communications Group	03/20/2000	06/16/2000
Celgene Corp	Signal Pharmaceuticals Inc	03/22/2000	06/30/2000
Overture Services Inc	AltaVista Co	04/10/2000	02/18/2003
Lions Gate Entertainment Corp	Artisan Entertainment Inc	04/18/2000	10/24/2003
SONICBlue Inc	ReplayTV Inc	05/01/2000	02/01/2001
MatrixOne Inc	Synchronicity Inc	05/09/2000	06/07/2004
Ariba Inc	SupplierMarket.com	05/11/2000	06/26/2000

Appendix B – continued

Acquirer name	Target name	Last SEC filing date	Acquisition announced
Sun Microsystems Inc	LSC Inc	05/31/2000	02/02/2001
AirGate PCS Inc	IPCS Inc	07/19/2000	08/29/2001
PC Connection Inc	MoreDirect.com Inc	07/21/2000	03/26/2002
interWAVE Communications	Wireless Inc	08/17/2000	03/19/2001
Open Text Corp	Corechange Inc	08/18/2000	02/26/2003
Broadbase Software Inc	ServiceSoft Inc	08/25/2000	09/18/2000
ScreamingMedia Inc	Stockpoint Inc	09/05/2000	07/23/2001
Peregrine Systems Inc	Extricity Inc	09/25/2000	03/12/2001
Lion Bioscience AG	NetGenics Inc	09/27/2000	01/14/2002
JD Edwards & Co	Youcentric Inc	10/10/2000	08/15/2001
eFunds Corp	Clearcommerce Corp	10/10/2000	01/12/2005
Microsoft Corp	PlaceWare Inc	11/13/2000	01/21/2003
Click Commerce Inc	Webridge Inc	01/30/2001	03/18/2004
Itron Inc	Silicon Energy Corp	07/18/2001	01/21/2003
Marathon Oil Corp	Khanty Mansiysk Oil Corp	08/29/2001	04/22/2003
Tom Brown Inc	Matador Petroleum Corp	09/10/2001	05/07/2003
Schering-Plough Corp	Neogenesis Pharmaceuticals Inc	02/06/2002	01/20/2005
United Defense Industries Inc	United States Marine Repair	04/25/2002	05/28/2002
Paychex Inc	Advantage Payroll Svcs Inc	06/07/2002	09/18/2002
North American Scientific Inc	NOMOS Corp	06/28/2002	10/27/2003
Chicos FAS Inc	White House Inc	06/24/2003	07/31/2003
Allied Capital Corp	Financial Pacific Co	05/14/2004	06/30/2004
Friedman Billings Ramsey Group	First NLC Fin Serv Inc	06/07/2004	01/11/2005
Encore Medical Corp	Empi Inc	08/04/2004	08/09/2004

Table 1
Descriptive statistics
This table contains descriptive statistics for our sample of 68 firms that file an IPO registration statement, withdraw, and are subsequently acquired by a public firm from 1996 to 2005. *Acquirer CAR* is the three-day cumulative abnormal return for the acquirer around the acquisition announcement in which expected returns are measured with the CRSP equal-weighted index. *Acquisition Price* is the announced acquisition price for the target, including cash, acquirer stock, and assumed liabilities, as collected from LexisNexis and SEC filings. The value of acquirer stock is calculated two trading days before the acquisition announcement. *IPO Valuation* uses data gathered from the last SEC filing for the planned IPO and is equal to the target's implied value of equity plus the book value of liabilities on the target's balance sheet. The implied value of equity is the product of the common stock outstanding before the planned IPO and *IPO Filing Price*, which is the average of the planned IPO's high and low filing prices. *Valuation Revision* is equal to *Acquisition Price* divided by *IPO Valuation* minus one. *Acquirer Size* is the acquirer market value of equity two trading days before the acquisition announcement. *Relative Size* is *Acquisition Price* minus assumed liabilities divided by *Acquirer Size*. *Fraction Stock* is the fraction of consideration paid in stock as collected from SDC. *VC Ownership* is the fractional ownership of venture capitalists in the target as gathered from the last SEC filing for the planned IPO. *VC Ownership* is assumed to be zero if the last SEC filing for the planned IPO occurred more than five years before the acquisition announcement. *CM-Rank* is the Carter and Manaster (1990) rank of the lead IPO underwriter, as updated by Loughran and Ritter (2004). *IPO Filing Proceeds* is *IPO Filing Price* times the anticipated number of shares to be issued with the IPO as gathered from the last SEC filing for the planned IPO.

	(1) Mean	(2) Median	(3) Minimum	(4) Maximum	(5) Standard deviation
Acquirer CAR	0.028	0.010	-0.286	0.402	0.116
Acquisition Price ($million)	219	124	3	3,300	419
IPO Valuation ($million)	333	192	26	4,075	604
Valuation Revision	-0.026	-0.330	-0.983	4.933	1.163
Acquirer Size ($million)	10,217	942	9	296,161	38,259
Relative Size	0.276	0.087	0.001	2.074	0.474
Fraction Stock	0.533	0.698	0.000	1.000	0.461
VC Ownership	0.264	0.248	0.000	0.909	0.264
CM-Rank	7.8	8.0	3.0	9.0	1.4
IPO Filing Price ($)	12.1	12.0	6.0	22.0	3.3
IPO Filing Proceeds ($million)	98	49	6	2,739	328

Table 2
Observations by year and industry
This table presents the number of observations by year and top six target industries for our sample of 68 firms that file an IPO registration statement, withdraw, and are subsequently acquired by a public firm from 1996 to 2005. Panel A, column (1), shows the number of observations based on the date of the last SEC filing for the planned IPO; column (2) contains the number of observations based on the acquisition announcement date. Panel B, column (1), shows the number of target firms per industry for the top six industries; column (2) contains the number of acquirers. We classify the industry of our sample firms using the Fama and French 49-industry classification.

Panel A. Year

	(1) Last SEC filing for IPO	(2) Acquisition date
1996	5	0
1997	8	7
1998	8	7
1999	13	9
2000	22	11
2001	4	11
2002	4	4
2003	1	10
2004	3	5
2005	0	4
Observations	68	68

Panel B. Industry

Industry	(1) Target	(2) Acquirer
Computer Software	17	15
Business Services	16	7
Retail	4	5
Electronic Equipment	4	4
Banking	4	3
Medical Equipment	4	2

Table 3
Acquirer cumulative abnormal return and target valuation revision
This table presents means, medians, and number of observations for *Acquirer CAR*, separated by terciles of *Valuation Revision* for our sample of 68 firms that file an IPO registration statement, withdraw, and are subsequently acquired by a public firm from 1996 to 2005. Tercile breakpoints for *Valuation Revision* are, from lowest to highest, less than or equal to -65%, between -65% and -6%, and greater than or equal to -6%. The first *p*-value in column (4) is from a *t*-test of difference in means between columns (1) and (3); the second *p*-value is from a Wilcoxon test of difference in medians between columns (1) and (3). All variables are defined in previous tables.

	(1) Valuation Revision Bottom Tercile	(2) Valuation Revision Middle Tercile	(3) Valuation Revision Top Tercile	(4) *p*-value (1) vs. (3)
Mean	-1.6%	3.1%	7.0%**	.0232**
Median	-2.5%	3.3%	3.2%**	.0220**
Number of observations	23	22	23	

***, **, * denote significance at the 0.01, 0.05, and 0.10 level, respectively.

Table 4
Regression results for log valuation revision
This table presents regression results for our sample of 68 firms that file an IPO registration statement, withdraw, and are subsequently acquired by a public firm from 1996 to 2005. The dependent variable is *Log Valuation Revision*, which is the natural log of (1 + *Valuation Revision*). ***σ(****Price-to-Assets Multiple Target)* and ***σ(****Price-to-Earnings Multiple Target)* are the standard deviations of valuation multiples of size, industry, and year-matched public firms, measured as of the calendar year of the acquisition announcement date. The first multiple is the market value of equity scaled by total assets; the second is the market value of equity scaled by net income. *Debt to Assets Target* is the target's liabilities divided by its total assets. *Distressed Target* is a dummy variable equal to one if the target's earnings before interest, taxes, and depreciation are less than its interest expense in the same year. The previous two accounting variables are measured as of the calendar year of the acquisition announcement date, if available, or if unavailable, from the most recent IPO filing by the target prior to its withdrawal. *Industry Return since last IPO Filing* is the compounded value-weighted return of the target's industry from the last SEC filing for the planned IPO to two trading days before the acquisition announcement. We use the 49-industry returns from http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/**.**All other variables are defined in previous tables. *p*-values, based on heteroskedasticity adjusted standard errors, are in brackets.

	(1)	(2)
σ(Price-to-Assets Multiple Target)	1.296***	
	[.000]	
σ(Price-to-Earnings Multiple Target)		0.086***
		[.003]
Debt to Assets Target	-0.660***	-0.693***
	[.001]	[.000]
Distressed Target	-0.718***	-0.896***
	[.001]	[.002]
Industry Return since Last IPO Filing	0.695*	0.791
	[.100]	[.101]
Intercept	-1.217***	-1.086**
	[.002]	[.020]
F-statistic	17.51***	15.21***
Adjusted R^2	.4775	.3956
Number of observations	68	67

***, **, * denote significance at the 0.01, 0.05, and 0.10 level, respectively.

Table 5
Regression results for acquirer cumulative abnormal returns
This table presents regression results for our sample of 68 firms that file an IPO registration statement, withdraw, and are subsequently acquired by a public firm from 1996 to 2005. The dependent variable is *Acquirer CAR*. *Log Acquirer Size* is the natural log of *Acquirer Size*. *Stock* is a dummy variable equal to one if the fraction of consideration paid in stock is greater than 95%. *Acquirer Q* is the acquirer's total assets minus book value of equity plus market value of equity, all scaled by total assets. *Liquidity Index Target Industry* is the value of all corporate control transactions divided by the total book value of assets for firms in the same two-digit SIC code during the same year. *VC* is a dummy variable equal to one if the last SEC filing for the planned IPO indicates that the target is backed by venture capital. *VC* is equal to zero if the last SEC filing for the planned IPO occurred more than five years before the acquisition announcement. *Log Valuation Revision x VC* is the interaction of *Log Valuation Revision* and *VC*. *Low Rank Underwriter* is a dummy variable equal to one if the IPO underwriter's *CM-Rank* is less than eight. *Log Valuation Revision x Low Rank Underwriter* is the interaction of *Log Valuation Revision* and *Low Rank Underwriter*. *Long Time* is a dummy variable equal to one if the number of days between the last SEC filing for the planned IPO and the acquisition announcement date is more than 365 days. *Log Valuation Revision x Long Time* is the interaction of *Log Valuation Revision* and *Long Time*. In column (3), we replace *Log Valuation Revision,* in both the continuous variable and its interaction with *VC,* with *Industry Adjusted Log Valuation Revision*, the natural log of {*Acquisition Price* divided by [*IPO Valuation* x (1 + *Industry Return since last IPO Filing*)]}. All other variables are defined in previous tables. *p*-values, based on heteroskedasticity adjusted standard errors, are in brackets.

- continued on next page -

- Table 5 continued -

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Valuation Revision	0.036***	0.067***		0.079***			0.074***	0.090***
	[.005]	[.000]		[.010]			[.004]	[.009]
Industry Adjusted Log Valuation Revision			0.063***					
			[.001]					
Relative Size	0.022	0.017	0.020	0.027		0.041	0.020	0.025
	[.600]	[.631]	[.556]	[.432]		[.342]	[.524]	[.487]
Log Acquirer Size	-0.015*	-0.015*	-0.012	-0.014		-0.004	-0.010	-0.010
	[.088]	[.067]	[.158]	[.103]		[.611]	[.218]	[.233]
Stock	-0.026	-0.032	-0.036	-0.049		-0.005	-0.025	-0.042
	[.353]	[.257]	[.208]	[.115]		[.850]	[.380]	[.139]
Acquirer *Q*	0.000	0.000	0.000	0.000		0.000	0.000	-0.000
	[.378]	[.511]	[.428]	[.780]		[.130]	[.348]	[.648]
Liquidity Index Target Industry	0.079	0.134	0.143	0.078		0.017	0.078	-0.008
	[.618]	[.373]	[.333]	[.616]		[.928]	[.653]	[.967]
VC		-0.064**	-0.067**	-0.057*		-0.020	-0.054	-0.056
		[.030]	[.029]	[.077]		[.537]	[.127]	[.118]
Log Valuation Revision x VC		-0.049**		-0.053**			-0.059**	-0.056**
		[.013]		[.015]			[.018]	[.013]
Industry Adjusted Log Valuation Revision x VC			-0.059***					
			[.006]					
Low Rank Underwriter				0.032				0.016
				[.333]				[.639]
Log Valuation Revision x Low Rank Underwriter				-0.009				-0.005
				[.671]				[.837]
Long Time				-0.060**				-0.062**
				[.043]				[.045]
Log Valuation Revision x Long Time				-0.017				-0.024
				[.491]				[.320]
σ(Price-to-Assets Multiple Target)					0.076**	0.059	0.004	0.011
					[.022]	[.103]	[.901]	[.760]
Debt to Assets Target					0.041	0.035	0.057*	0.053*
					[.250]	[.379]	[.068]	[.056]
Distressed Target					-0.043	-0.033	0.001	0.011
					[.138]	[.292]	[.968]	[.756]
Industry Return since Last IPO Filing			0.077*		0.067	0.061	0.066	0.075
			[.077]		[.142]	[.209]	[.205]	[.125]
Intercept	0.147*	0.190**	0.161**	0.198**	-0.079	-0.034	0.086	0.114
	[.075]	[.019]	[.050]	[.028]	[.136]	[.703]	[.245]	[.186]
F-statistic	2.35**	4.53***	4.70***	4.41***	3.28**	2.46**	3.70***	4.36***
Adjusted R^2	.1360	.1976	.1970	.1969	.1485	.1176	.2320	.2200
Number of observations	68	68	68	68	68	68	68	68

***, **, * denote significance at the 0.01, 0.05, and 0.10 level, respectively.

Table 6
Robustness
This table presents regression results for our sample of 68 firms that file an IPO registration statement, withdraw, and are subsequently acquired by a public firm from 1996 to 2005. The dependent variable is *Acquirer CAR*. All other variables are defined in previous tables. Regression results in column (1) exclude 17 takeovers in which the last SEC filing for the planned IPO is filed in 1999 or 2000 and in which the takeover announcement occurred after 2000. The results in column (2) exclude seven takeovers in which *Relative Size* is less than 1%. In columns (3) and (4), we split the sample into positive and negative valuation revisions, respectively. *p*-values, based on heteroskedasticity adjusted standard errors, are in brackets.

	(1)	(2)	(3)	(4)
Log Valuation Revision	0.053***	0.080***	0.205*	0.061**
	[.002]	[.000]	[.058]	[.027]
Relative Size	0.061*	0.015	0.005	0.000
	[.084]	[.677]	[.962]	[.989]
Log Acquirer Size	-0.006	-0.015	-0.053*	-0.016
	[.513]	[.181]	[.051]	[.114]
Stock	-0.008	-0.037	0.037	-0.047
	[.814]	[.251]	[.582]	[.158]
Acquirer *Q*	0.000	0.000	0.000	0.003**
	[.733]	[.575]	[.720]	[.046]
Liquidity Index Target Industry	0.105	0.087	-0.061	-0.062
	[.497]	[.591]	[.878]	[.754]
VC	-0.072**	-0.071**	0.103	-0.057
	[.021]	[.020]	[.279]	[.200]
Log Valuation Revision x VC	-0.047**	-0.059***	-0.314*	-0.039
	[.042]	[.010]	[.069]	[.176]
Intercept	0.109	0.203**	0.354	0.203**
	[.203]	[.050]	[.144]	[.048]
F-statistic	2.12*	6.17***	4.03**	5.81***
Adjusted R^2	.1517	.2111	.2638	.0976
Number of observations	51	61	21	47

***, **, * denote significance at the 0.01, 0.05, and 0.10 level, respectively.

Table 7
Deals with venture capital valuations
This table presents regression results for a sample of 194 firms that receive a valuation from a venture capital or private equity firm and are subsequently acquired by a public firm from 1996 to 2005. The dependent variable is *Acquirer CAR. VC Valuation*, from the SDC VentureXpert database, is the latest post-round valuation of the private firms that receive venture capital or private equity financing. Regression results in column (2) exclude acquisitions in which the *VC Valuation* was in 1999 or 2000 and the acquisition announcement occurred after 2000. *Log Valuation Revision* is the natural log of (1 + *Valuation Revision*). *Valuation Revision* is equal to *Acquisition Price* divided by *VC Valuation* minus one. *Log Industry Adjusted Valuation Revision* is the natural log of {*Acquisition Price* divided by [*VC Valuation* x (1 + *Industry Return since VC Valuation*)]}. *Industry Return since VC Valuation* is the compounded value-weighted return of the target's industry from the date of the *VC Valuation* to two trading days before the acquisition announcement. All other variables are defined in previous tables. *p*-values, based on heteroskedasticity adjusted standard errors, are in brackets.

	(1)	(2)	(3)
Log Valuation Revision	0.012**	0.018**	
	[0.033]	[0.020]	
Log Industry Adjusted Valuation Revision			0.015***
			[0.007]
Relative Size	-0.234***	-0.284***	-0.246***
	[0.002]	[0.001]	[0.001]
Log Acquirer Size	-0.008*	-0.011**	-0.009**
	[0.087]	[0.037]	[0.029]
Stock	-0.001	-0.004	-0.001
	[0.937]	[0.877]	[0.951]
Acquirer *Q*	0.001	0.001	0.001
	[0.274]	[0.261]	[0.304]
Liquidity Index Target Industry	0.000	0.019	0.018
	[0.997]	[0.863]	[0.867]
Industry Return since VC Valuation			0.004
			[0.651]
Intercept	0.066*	0.092*	0.074**
	[0.098]	[0.061]	[0.043]
F-statistic	2.00*	1.83*	1.93*
Adjusted R^2	.0303	.0376	.0326
Number of observations	194	129	194

***, **, * denote significance at the 0.01, 0.05, and 0.10 level, respectively.