Anchoring and Acquisitions*

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Abstract

For a comprehensive sample of mergers and acquisitions that involve both public and private targets, we find a reference price effect: acquirers earn higher (lower) announcement period returns when their pre-announcement stock prices are well below (near) their 52-week highs. Further, the reference price effect is stronger in deals involving greater uncertainty (more volatile acquirers, acquirers followed by fewer analysts, greater relative size, and non-cash payment) and greater individual investor ownership. Consistent with an anchoring bias, the reference price effect is reversed in the subsequent year. Our results survive a battery of control variables, robustness checks, and falsification tests.

Keywords: Mergers; Acquisitions; Reference point; Behavioral corporate finance
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1. Introduction

The stock market's reaction to announcements of mergers and acquisitions (M&A) has been extensively examined.[1] Most existing studies assume that investors rationally process the information available at the announcements and incorporate it into stock prices. In recent years, however, a growing body of literature challenges the notion that stock prices rationally reflect public information in a timely manner. In particular, several recent studies find evidence that a stock's proximity to a historic high price affects investor behavior. Heath, Huddart, and Lang (1999) find a strong tendency for company executives to exercise stock options when the underlying stock price moves past its 52-week high. George and Hwang (2004) find that a stock price's nearness to its 52-week high serves as a better predictor of future returns than traditional momentum strategies. Huddart, Lang, and Yetman (2009) document a significant increase in trading volume when a stocks' price crosses its 52-week high. Driessen, Lin, and Hemert (2012) examine implied volatilities derived from option prices and find that implied volatilities decrease for stocks approaching their 52-week high, but then increase after prices cross this threshold.[2]

Given this evidence suggesting that the 52-week high serves as a psychological price threshold for at least some investors, we are interested in whether proximity to its 52-week high influences the market response to an acquisition announcement for an acquiring firm's stock. Building on the work by Baker, Pan, and Wurgler (2012), who find strong evidence that offer

[1] The literature is vast and is comprehensively surveyed in Jensen and Ruback (1983), Jarrell, Brickley, and Netter (1989), Andrade, Mitchell, and Stafford (2001), and Betton, Eckbo, and Thorburn (2008).

[2] Many of the studies examining the influence of the 52-week high on investor behavior also consider the role of the 52-week low and often find that the historic low plays a statistically significant role. However, the 52-week high seems to have a stronger influence. In addition, most acquisitions are made by firms with stock prices closer to their 52-week high than their low. In our sample, for example, 65 percent of acquirers have stock prices nearer to their 52-week high than their 52-week low. Therefore, we focus on the role of the 52-week high in the bulk of our analysis. Nevertheless, we also consider the role of the 52-week low in our robustness checks.

premiums paid to publicly traded targets are significantly affected by the 52-week high prices of the targets, we investigate whether 52-week high prices play a role in the evaluation of *acquirers* at the announcements of mergers and acquisitions.

In a comprehensive sample of 12,687 acquisitions that involve both public and private targets, we find that acquirers with pre-announcement stock prices well below their 52-week highs earn significantly higher announcement period abnormal returns than those with prices at or near their 52-week highs. We call this result the reference price effect. Like other studies that examine how the 52-week high affects investor behavior, we focus on the anchoring phenomenon, which is considered one of "the most reliable and robust" results of experimental psychology (Kahneman, 2011).

According to the anchoring phenomenon, individuals commonly rely on salient, even if seemingly irrelevant, anchors in forming beliefs or norms (Tversky and Kahneman, 1974). If the 52-week high is a meaningful price threshold for investors, as suggested by the empirical evidence, it may be acting as an anchor and influence investors' perceptions regarding the plausible range of potential new firm values in light of an acquisition announcement. Specifically, if a stock's price is near its 52-week high, investors anchored on the 52-week high may be reluctant to bid the stock's price up even if it is warranted by the acquisition announcement and more inclined to sell down the stock's price if the acquisition announcement is received poorly. By contrast, if the pre-announcement stock price is well below the 52-week high, investors may be more willing to bid up the stock price in response to good news and less inclined to sell down the stock price in response to bad news.

In addition, anchors have greater influence on numeric estimates when there is greater uncertainty (Jacowitz and Kahneman, 1995) and/or subjects have less knowledge (Mussweiler and

Strack, 2000). Therefore, the reference price effect should be more important in acquisitions that involve greater uncertainty, an opaque information environment, or less sophisticated investors. Consistent with this implication, we find a stronger reference price effect among acquisitions made by acquirers with higher stock return volatility, acquirers that are followed by fewer analysts, acquisitions that are relatively large, and acquisitions financed with non-cash instruments. Finally, we also find that the reference price effect is stronger in acquirers with higher individual investor ownership levels.

A possible alternative explanation for our findings is that the reference price effect is explained by the impact of firm size on acquirer announcement period abnormal returns. Acquirers with prices near their 52-week highs tend to have experienced recent price appreciation and consequently have a larger market capitalization. To the extent that larger firms earn lower returns in acquisitions (Moeller, Schlingemann, and Stulz, 2004), the reference price effect could be due to the size effect. Another possibility is overvaluation. When an acquirer's stock price is near its 52-week high, investors might perceive the stock as overvalued. In the context of acquisitions, overvalued acquirers earn lower returns (e.g., Shleifer and Vishny, 2003; Rhodes-Kropf and Viswanathan, 2004). Thus, the reference price effect can potentially be explained by overvaluation. However, the reference price effect remains strong even after controlling for a host of firm and deal characteristics, including firm size and proxies for stock overvaluation, suggesting that the reference price effect is not explained by firm size or valuation levels, or other firm or deal characteristics.

We further find that the reference price effect is stronger among acquisitions of unlisted targets (private firms or subsidiaries) than acquisitions of publicly traded targets. To the extent that acquisitions of unlisted targets are less liquid, more difficult to value or involve greater uncertainty,

this finding also fits well with the anchoring hypothesis. In addition, a strong reference price effect among acquisitions of unlisted targets suggests that the reference price effect is independent of the offer price anchoring phenomenon documented in Baker, Pan, and Wurgler (2012), who examine only acquisitions of publicly traded targets. The reference price effect survives a battery of robustness checks. It is robust to alternative models of estimating abnormal returns and alternative relative price measures. The reference price effect is strong in the 1980s, 1990s, and the new millennium.

Although we find strong evidence of a reference price effect in the stock market's reaction to acquisition announcements, it is possible that this effect simply acts as a proxy for some other fundamental but unidentified factor associated with acquisition decisions. For example, fueled by high stock prices relative to their 52-week highs, managers might develop hubris or become overconfident (Roll, 1986; Malmendier and Tate, 2008) and make poor acquisition decisions. Higher stock prices might also give managers greater leverage over monitoring mechanisms, such as the board of directors and the market for corporate control, and protect them when they engage in activities that benefit themselves at the expense of shareholder value (e.g., Amihud and Lev, 1981; Jensen, 1986; Morck, Shleifer, and Vishny, 1990; Fu, Lin, and Officer, 2012; Duchin and Schmidt, 2013). As another possibility, when a company's stock price is near its 52-week high, investors might have anticipated that the firm is to make acquisitions and the anticipation might have been incorporated into the price already. Given that acquirers on average earn positive returns, at least in our sample, such an anticipation may lead to lower returns for anticipated acquisitions. These indirect effects are plausible and may be reflected in the market's reaction to the merger announcement.

If this is the case, however, we would expect the market's reaction to these merger announcements to be permanent. By contrast, the unique prediction of the anchoring hypothesis is that the announcement-period return pattern is being driven by a behavioral bias and is, therefore, reversed in the longer horizon when the bias is eventually corrected. To further distinguish the anchoring hypothesis from alternative explanations, we examine the long-horizon abnormal returns to merger announcements and find that, although the reference price effect persists for at least 20 days following the announcement date, it is reversed over the subsequent one-year period. Specifically, the long-horizon abnormal returns for acquirers with stock prices well below their 52-week highs are significantly lower than those for acquirers with stock prices near their 52-week highs. This is inconsistent with the reference price effect acting as a proxy for some unidentified fundamental factor associated with merger decisions. Rather, our results are consistent with the anchoring hypothesis.

The paper contributes to two important areas in the finance literature. First, we contribute to the M&A literature by documenting a new, non-fundamental factor in the market reactions to announcements of mergers and acquisitions. Recently, Danbolt et al. (2015) find a positive relation between a measure of investor sentiment and acquirer announcement period abnormal returns. Otherwise, most existing studies in the M&A literature interpret market reactions at the announcements as reflecting expected changes in firm fundamentals. Part of the relatively recent literature in this vein focuses on management performance (Lang, Stulz, and Walkling, 1989), asset relatedness (Matsusaka, 1993), corporate governance (Masulis, Wang, and Xie, 2007), free cash flows (Lang, Stulz, and Walkling, 1991; Harford, 1999), valuation (Dong, Hirshleifer, Richardson, and Teoh, 2006), firm size (Moeller, Schlingemann, and Stulz, 2004), CEO networking centrality (El-Khatib, Fogel, and Jandik, 2015), managerial overconfidence

(Malmendier and Tate, 2008), target asset uncertainty (Officer, Poulsen, and Stegemoller, 2009), dormant period (Cai, Song, and Walkling, 2011), management entrenchment (Harford, Humphrey-Jenner, and Powell, 2012), and cultural similarity (Bereskin, Byun, Officer, and Oh, 2016). Studies of the long-term performance of mergers emphasize the role of over-extrapolation (Rau and Vermaelen, 1998), market-wide valuation (Bouwman, Fuller, and Nain, 2009), firm-level valuation (Fu, Lin, and Officer, 2012), and the lack of monitoring during merger waves (Duchin and Schmidt, 2013), among others. We add to the literature by documenting the impact of investors' non-fundamental behavioral bias, specifically the anchoring bias, on market reactions to the announcements of mergers and acquisitions. As a unique feature of this study, we show not only the bias in the short term, but also its correction in the longer term.

Second, our paper adds further evidence on the role of anchoring as a psychological bias in behavioral finance. One of the central themes in behavioral finance is to understand what psychological phenomena help shape investors' demand for securities (Barberis, Shleifer, and Vishny, 1998; Shleifer, 2000; Baker, 2009; Baker and Wurgler, 2012). For the special case of firms making acquisitions, this paper reports direct evidence that anchoring bias helps shape investor demand for stocks. That is, for acquiring firms with stock prices well below their 52-week high, investors seem more (less) inclined to bid up (sell down) prices in response to an acquisition announcement. Because the 52-week high is fundamentally irrelevant, this anchoring bias in the market reactions is eventually corrected in the longer term. In addition, we find that the anchoring bias has a stronger impact among acquisitions of greater uncertainty and less sophisticated investor ownership, consistent with the notion that investor bias is more likely to exist where the difficulty of making accurate estimates of firm value is greatest and the forces of arbitrage are relatively limited.

We develop the anchoring hypothesis in section 2 and describe the sample and data in section 3. The base results are presented in section 4. Further analyses to test the anchoring hypothesis and competing explanations are discussed in sections 5 and 6. We check the robustness of the analysis in section 7 and conclude in section 8.

2. The anchoring hypothesis

A growing stream of finance literature finds evidence of stocks' past peak prices, especially the 52-week high, being important in explaining investor behavior. The general premise is that the 52-week high seems to act as an important reference point in making decisions. This argument is supported in numerous decision scenarios, including employee stock option exercising decisions (Heath, Huddart, and Lang, 1999), return momentum (George and Hwang, 2004), post-earnings announcement drift (George, Hwang, and Li, 2014), investment and financing anomalies (George, Hwang, and Li, 2015), trading volume (Huddart, Lang, and Yetman, 2009), and merger offer premiums (Baker, Pan, and Wurgler, 2012). Likewise, Li and Yu (2012) find evidence of investor anchoring on the Dow 52-week high.

The adoption of the 52-week high price as a reference point has deep roots in the psychology literature, particularly the anchoring mechanism of Tversky and Kahneman (1974), who show that, when making decisions under high uncertainty, subjects are influenced by easily available, even if economically irrelevant, reference points in their estimates of an unknown quantity. In real estate markets, for example, listing prices influence perceived values for both amateurs and real estate professionals (Northcraft and Neale, 1987). In legal disputes, damage awards are influenced by what is asked for in court (Hastie, Schkade, and Payne, 1999).

The literature on human decision making identifies a variety of psychological mechanisms that can cause the anchoring phenomenon. Tversky and Kahneman (1974) initially identified an

anchoring-and-adjustment process whereby individuals will rely on salient reference points as starting points in numerical estimations and adjust away from the reference point until the estimate falls within the range of plausible target estimates (Strack and Mussweiler, 1997). Consequently, estimates tend to be insufficient and eventual estimates are biased toward the initial reference point. Subsequent work identifies other mechanisms, such as selective accessibility (Strack and Mussweiler, 1997), confirmatory hypothesis testing (Chapman and Johnson, 1994), and numeric priming (Oppenheimer, Leboeuf, and Brewer, 2008).

Regardless of the specific psychological mechanism involved, we consider the possibility that investors tend to anchor on the 52-week high in the evaluation of firms making acquisitions and that the 52-week high serves to influence investors' perceptions of plausible merged-firm values. Absent any behavioral biases, we would expect the process of estimating the acquiring firm's new stock price to start with the firm's pre-acquisition price and then adjust away from that price to reflect the perceived synergistic gains associated with the merger, the premium paid to the selling company, the method of payment, and other value relevant information associated with the acquisition. Just as in the process of making a merger bid to a publicly traded firm (Baker, Pan, and Wurgler, 2012) or assessing the impact of earnings announcements (George, Hwang, and Li, 2014), however, investors face great uncertainty and indeterminacy when valuing firms that are making acquisitions. Thus, reference prices may play an important role in explaining the stock market's response to an acquisition announcement. Specifically, if an acquirer's 52-week high price influences some investors' perceptions of plausible firm values, their price adjustment processes may be influenced by the distance between an acquirer's current stock price and its 52-week high. For those acquirers with stock prices that are well below their 52-week highs, investors' estimates of merged-firm value may be biased upward by leaning toward the plausible firm value

reflected in its 52-week high. For acquirers with stock prices at or near their 52-week highs, on the other hand, investors' estimates of the merged-firm value may be limited, or biased downward by the fact that there is no recently observed higher plausible firm value serving as a reference point. Consequently, merger announcements by firms with stock prices well below their 52-week high may result in a more positive stock price reaction, or less negative stock price reaction, relative to acquirers with stock prices near their 52-week highs.

Ultimately, these arguments imply that acquirer announcement period abnormal returns will be higher for acquirers with pre-announcement prices well below their 52-week highs than for acquirers with pre-announcement prices near their 52-week highs. Because the anchoring hypothesis is based on investors facing uncertainty about the value of a merged firm, it also suggests that the phenomenon of anchoring on reference prices will be more pronounced among acquisitions involving greater uncertainty or information opaqueness. Further, a substantial literature finds evidence that individual investors are prone to behavioral biases (e.g., Odean, 1998; Barber and Odean, 2008) and that institutional investors are more sophisticated (e.g., Nofsinger and Sias, 1999; Bartov, Radhakrishnan, and Krinsky, 2000). Therefore, we expect a stronger reference price effect in acquiring firms with more (less) individual (institutional) investor ownership.

3. Sample and Data

Our sample of acquisitions are drawn from the Securities Data Corporation (SDC). The deals are announced during the 1981-2012 period; the acquirers are publicly traded U.S. firms and have stock price data from CRSP and accounting data from Compustat; we exclude deals with transaction values lower than $1 million (as reported in SDC) or deals with relative sizes lower than 5% or higher than 200% of the acquiring firms' equity; deals are also excluded if the acquirer

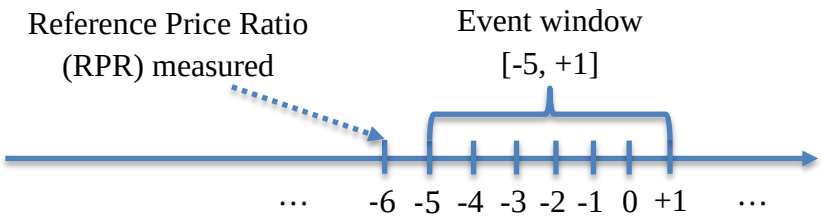
owns more than 50% of the target prior to the announcement. We further require that the data necessary to conduct the main analyses are available.

The final sample includes a total of 12,687 transactions. Table 1 presents basic information about the sample. The average transaction value is $482.23 million; out of these 72% involve unlisted targets (private firms or subsidiaries of other companies); 20% of the transactions are paid purely with stock, 22% by cash, and 58% with mixed instruments (cash, stock, debt, convertibles, earn-outs, etc.). The average acquirer has a reference price ratio of 0.82. As defined below, this indicates that, on average, the acquirers' pre-announcement stock price is 82% of its 52-week high.

Table 1 also lists the year-by-year averages for these variables. Most of these numbers vary over time, and there is a noticeable increase in the number of transactions and tendency to make acquisitions with stock in the late 1990s. This pattern is consistent with the merger wave over this time period. There is, however, no apparent time trend in the average reference price ratio.

[Insert Table 1 here]

The primary focus of our analysis is the impact of the reference price ratio (RPR, hereafter) on the stock market reaction to the merger announcement for acquiring firms. We model the RPR after the reference price ratio in George and Hwang (2004). Specifically, the reference price ratio (RPR) on day t is the ratio of the closing price P_t to the highest closing price over the previous 252 trading days (including day t), with prices adjusted by stock splits and dividends. RPR is by definition between 0 and 1. A company with a stock price near its 52-week high will have an RPR value close to 1. In our main analysis, we choose the RPR ratio calculated as of the sixth day prior to the deal announcement, t-6. The chart below illustrates the timing of measuring the RPR and the event window, where day 0 is the announcement date.



As shown in the robustness section, our main results are robust to alternative time points at which the RPR is measured. Our sample has an average RPR of 0.815, a median of 0.873, a range of 0.019 to 1, and an interquartile range of 0.732 to 0.952.

The main dependent variable in our analysis is the cumulative abnormal return (CAR, hereafter) over the seven-day event window [-5, +1], where day 0 is the announcement date. The abnormal return is estimated from a market model based on data over the [-370, -253] days relative to the announcement date. This approach follows Harford (1999). Our main results are robust to alternative measures of abnormal returns.

Our sample has an average CAR of 1.125%, with a median of 0.317%, ranging from -22.447% to 34.141%, and an interquartile range of -3.534% to 4.774%. The average numbers are similar to those reported in the literature with similar samples of both listed and unlisted targets (e.g., Moeller, Schlingemann, and Stulz, 2004). All other variables are defined in Appendix A.

4. Base results

4.1. Cumulative abnormal returns and reference price ratio

As an initial step in examining whether the reference price ratio and cumulative abnormal returns are related, we first sort our sample into two equal groups (by year) based on reference price ratios. The Low RPR (High RPR) group includes acquisitions with acquirers' RPR ratios below (above) the sample median. Table 2 shows basic summary statistics of the two groups. Panel A of Table 2 shows that the Low RPR group has an average RPR ratio of 0.689 and the High RPR group has an average RPR of 0.941, implying a difference of 0.253.

Panel B shows that the Low RPR group has an average CAR of 1.660%, with a median of 0.685%; the High RPR group has an average CAR of 0.591%, with a median of 0.084%. The difference is -1.069%, which is significant at the 1% level with a t-statistic of -6.79. The Wilcoxon test on the distributions of the two groups yields a test statistic of -5.05, which is significant at the 1% level. Combining the two differences between the Low RPR and High RPR groups from Panels A and B suggests that acquirer CARs increase by 4.225% (1.069%/.253) if the RPR decreases from 1 to 0. Put differently, acquirers with pre-announcement prices at half of their 52-week highs earn about 2% higher abnormal returns than those with pre-announcement prices near their 52-week highs. For convenience, we dub this negative relation between the reference price ratio and acquirer abnormal returns as the *reference price effect*.[3]

[Insert Table 2 here]

Fig.1 illustrates the reference price effect by graphing the cumulative average abnormal returns of the two RPR groups (Low RPR and High RPR) from five days before to 20 days after the announcement date. The end of day t-6 is the starting date. In addition to the salient gap between the two lines over the event window of [-5, +1], the figure shows that the reference price effect persists for at least 20 days after the announcement.[4]

[Insert Fig. 1 here]

4.2. Multiple regressions of cumulative abnormal returns

As both RPR and CAR are likely correlated with other firm and deal characteristics previously documented in the literature, it is important that we control for them before drawing

[3] We obtain similar results based on reference price ratios of the 39-, 26-, and 13-week highs. This finding is consistent with Baker, Pan, and Wurgler (2012), who find that target offer prices cluster on multiple past peak prices. For simplicity our main analysis focuses on the 52-week high as the reference price.

[4] Over the longer event window of [-5, +20], the average CAR is 1.260% for the Low RPR group and 0.218% for the High RPR group, implying a difference of -1.042% (t=-3.30), which is significant at the 1% level.

any concrete conclusions regarding the relation between reference price ratios and acquirer abnormal returns. In this section we discuss the correlation coefficient matrix, followed by multivariate regressions.

Table 3 contains the correlation coefficient matrix for a list of variables, including the CAR, RPR, and select control variables. The lower-left half is for Pearson correlation coefficients and the upper-right half is for Spearman coefficients. As they paint a similar picture of the correlations, we discuss the Pearson correlations only. CAR is negatively correlated with RPR, firm size, and stock payment but positively correlated with relative size, unlisted targets, and past return. RPR is negatively correlated with relative size and unlisted targets, and positively correlated with acquirer size and past return. Acquirer size is negatively correlated with relative size and unlisted targets. Pure stock payment is negatively correlated with unlisted targets but positively correlated with relative size.

It is worth discussing the relation between RPR and past return, which is the return of the acquirer over the past 12 months ending the month prior to the announcement. By construction, they are positively correlated, with a Pearson correlation coefficient of 0.301. According to Berry and Feldman (1990), this correlation does not pose any multicollinearity problems with RPR. Because past return is commonly used in the M&A literature as a proxy for management quality or acquirer stock valuation (e.g., Harford, Humphrey-Jenner, and Powell, 2012; Golubov, Yawson, and Zhang, 2015) we include it in our analyses. Our results hold regardless of its presence.

[Insert Table 3 here]

Table 4 presents two regressions. In the first regression, we regress CAR on RPR after controlling for Fama and French (1997) industry and year fixed effects. The coefficient on RPR is

-5.405% (t=-7.66), indicating a strong reference price effect. That is, CARs are higher (lower) when the t-6 price of the acquiring firm's stock is well below (close to) its 52-week high.

In the second model, we regress CAR on RPR and several variables designed to control for various deal and firm characteristics. We include the most frequently controlled variables among the more recent studies in the M&A literature for which we have data (e.g., Fuller, Netter, and Stegemoller, 2002; Moeller, Schlingemann, and Stulz, 2004; Moeller, Schlingemann, and Stulz, 2005; Masulis, Wang, and Xie, 2007; Officer, Poulsen, and Stegemoller, 2009; Golubov, Petmezas, and Travlos, 2012; Harford, Humphery-Jenner, and Powell, 2012; El-Khatib, Fogel, and Jandik, 2015; Golubov, Yawson, and Zhang, 2015). To alleviate the impact of outliers we winsorize all continuous variables at the 1st and 99th percentiles.

The second regression in Table 4 reports an RPR coefficient of -5.581% with a t-stat of -7.14, showing a strong reference price effect even after controlling for the comprehensive list of firm and deal characteristics. The coefficients on the control variables are largely consistent with the literature (Chang, 1998; Fuller, Netter, and Stegemoller, 2002; Faccio, McConnell, and Stolin, 2006; Officer, Poulsen, and Stegemoller, 2009; Golubov, Yawson, and Zhang, 2015). Notably, unlisted acquisitions earn higher returns; with both unlisted and listed deals included in the sample, the coefficient on stock as a method of payment is negative, but using stock tends to earn higher acquirer returns in unlisted transactions as indicated by the positive and significant coefficient on the interaction term that equals one for stock transactions involving unlisted deals (e.g., Fuller, Netter, and Stegemoller, 2002; Slovin, Sushka, and Polonchek, 2005). Relative size has a positive and significant coefficient. Leverage has a positive but insignificant coefficient. The M/B ratio has a significant negative coefficient, consistent with the valuation hypothesis that acquirers with higher valuations earn lower returns at the M&A announcements. Consistent with Moeller,

Schlingemann, and Stulz (2004), larger acquirers earn lower acquisition returns. If an acquisition is announced following a long dormant period (a year), the returns tend to be higher, consistent with Cai, Song, and Walkling (2011). The coefficient on tender offers is positive, but not significant, while acquisitions involving toeholds earn lower returns. Past return has a positive coefficient, consistent with the view that acquirers with higher management quality earn greater acquisition returns.

To sum up, the second model in Table 4 establishes a strong reference price effect in a multivariate regression setting. This regression specification is taken as the baseline model and applied as the workhorse in most of the subsequent analyses.

[Insert Table 4 here]

5. Testing the anchoring hypothesis

The anchoring hypothesis predicts that the reference price effect is stronger among deals involving greater uncertainty, more opaque information environments, and less sophisticated investor ownership. To test these predictions, we examine the extent that the reference price effect is influenced by various proxies for information uncertainty and individual investor ownership levels.

5.1. Anchoring and information uncertainty

We consider four proxies for information uncertainty: the volatility of acquirer firm stock returns, the number of analysts following the acquirers, the relative size of the acquisition, and an indicator variable for non-cash methods of payment. The reasoning for the proxies is straightforward. Stocks in general, including stocks of acquirer firms, are more difficult to value if their prices are more volatile. To the extent stock analysts produce valuation-relevant information, stocks with fewer analysts following have a more opaque information environment

and are more difficult to value. Similarly, if the transaction value relative to the total equity of the acquirer is larger, the acquisition will have a greater impact on the stock value, posing greater uncertainty to the valuation process. Last, but not least, non-cash payment for the deal is possibly used to address the greater uncertainty of the acquired assets (Hansen, 1987; Officer, Poulsen, and Stegemoller, 2009).

As testable implications, the anchoring hypothesis predicts a stronger reference price effect for acquirers with more volatile stocks, for acquirers followed by fewer analysts, for deals of greater relative size, and for deals that involve non-cash payment. We test these implications in multiple regressions by adding interaction terms. Table 5 presents the regression results.

In model 1 of Table 5, we add both Sigma, and RPR*Sigma to the baseline model. Sigma is the acquirer firm's weekly stock return volatility, measured over the past 52 weeks (Zhang, 2006). For ease of interpretation we subtract the sample mean from the variable Sigma. The anchoring hypothesis implies a negative coefficient for RPR*Sigma. Model 1 of Table 5 reports a coefficient of RPR*Sigma at -0.447 (t=-2.65), which confirms the prediction. The coefficient on RPR is -4.915% (t=-5.47), indicating a significant reference price effect for firms with Sigma values at the sample mean. Sigma itself has a positive and significant coefficient (Golubov, Yawson, and Zhang, 2015). The coefficients on the control variables are similar to those in the baseline model.

In model 2 of Table 5, we add an interaction term RPR* Few analysts, where Few analysts is a binary variable equal to one if the number of analysts following the acquirer firm over the six months prior to the announcement month is below the sample median. The anchoring hypothesis predicts a negative coefficient on this interaction term. That is, acquirers followed by fewer analysts have a stronger (more negative) reference price effect. This prediction is confirmed in the

data. In model 2 of Table 5 the coefficient on RPR is -3.936% (t=-3.85), indicating a strong reference price effect for acquirers with an above-median number of analysts following. That is, even for those with relatively better information environments, there is a strong reference price effect. For acquirers with a below-median number of analysts, the reference price effect is even stronger as the coefficient on RPR*Few analysts is -2.805 (t=-2.21), significant at the 5% level. We also report a positive coefficient for the binary variable Few analysts.

We add the interaction term between RPR and relative size to model 3. The anchoring hypothesis predicts a negative coefficient on this interaction term. The coefficient reported in model 3 of Table 5 on the interaction term is -5.724 (t=-3.10), further supporting the anchoring hypothesis. Similar to model 1, the variable relative size is demeaned. Thus, the coefficient on RPR itself, -5.333 (t=-6.90) represents the reference price effect for acquisitions with relative size at the sample mean. Model 4 of Table 5 includes an interaction term RPR * Non cash and the usual control variables. The anchoring hypothesis implies a negative coefficient on this term. Reported in Model 4 of Table 5, the coefficient on RPR* Non cash is -3.730 (t=-2.66), confirming the prediction.

[Insert Table 5 here]

5.2. Anchoring and investor sophistication

To this point, our analysis indicates a significant reference price effect, particularly for acquisitions involving greater information uncertainty, as predicted by the anchoring hypothesis. To further explore the implications of the anchoring hypothesis, we examine whether less sophisticated investors are more susceptible to the influence of the 52-week high as an anchor. Generally, empirical evidence suggests that individual investors are prone to behavioral biases (e.g., Odean, 1998; Barber and Odean, 2008) and that institutional investors tend to be more

sophisticated (e.g., Nofsinger and Sias, 1999; Bartov, Radhakrishnan, and Krinsky, 2000). Therefore, we first examine whether the reference price effect exists in subsamples formed on individual investor ownership levels. Next, we examine whether the reference price effect varies with individual investor ownership. Following other studies, we treat non-institutional investor ownership as our proxy for individual investor ownership (e.g., Nofsinger and Sias, 1999; Gompers and Metrick, 2001; Sias and Whidbee, 2010).

Institutional ownership data is from Thomson Reuter 13f. Total institutional ownership of the acquirer is measured at the most recent quarter end prior to the announcement month. It is the total number of shares owned by institutions divided by the number of shares outstanding at the end of the reporting quarter. The variable "Indiv. Own" is one minus the institutional ownership measure. If a company has a missing institutional ownership it is assigned as zero, and "Indiv. Own" is equal to one. Admittedly, this measure of investor sophistication is potentially problematic and is not necessarily indicative of investors who trade in an acquirer's stock in the days surrounding announcement dates. However, we suggest that the investing environment surrounding stocks with relatively high (low) individual (institutional) ownership will be more exposed to potential behavioral biases.

The results of the regressions incorporating individual ownership levels are shown in Table 6. The first two models follow the baseline model but are estimated on subsamples of acquirers with low individual investor ownership (Low IO) and high individual investor ownership (High IO), where the subsamples are formed on yearly sample medians. The RPR coefficients are -3.160% (t=-2.90) for acquirers with low individual investor ownership and -7.098% (t=-6.32) for the subsample of acquirers with high individual investor ownership. These negative and significant RPR coefficients suggest that the reference price effect exists regardless of individual investor

ownership levels. To examine whether the reference price effect varies with individual investor ownership levels we include an interaction term RPR *Indiv.Own in the baseline specification (All) along with the Indiv.Own variable itself. The coefficient on the interaction term is -0.078 (t=-3.53) indicating that the reference price effect is stronger when Individual investors own a greater percentage of acquiring firms' stock.

Overall, the evidence presented in Tables 5 and 6 is consistent with the anchoring hypothesis. Our results indicate that the reference price effect is stronger for acquisitions involving greater uncertainty or opaque information environments, and when less sophisticated investors hold a greater share of acquiring firms' stock.

6. Alternative explanations

This section examines whether the influences of size and valuation levels may explain the reference price effect. We also discuss the relation between the reference price effect and the target firm offer price anchoring effect found by Baker, Pan, and Wurgler (2012). Finally, we examine long-horizon returns to determine whether the reference price effect reflects a long-term change in firm value or a short-term phenomenon that is ultimately corrected in the long run.

6.1. The role of size

It is possible that the reference price effect can be explained by the impact of firm size on acquirer announcement period abnormal returns. That is, acquirers whose prices are near their 52-week high tend to have experienced recent price appreciation and consequently have a larger market capitalization. To the extent that larger firms earn lower returns in acquisitions (Moeller, Schlingemann, and Stulz, 2004), the reference price effect could be due to the size effect. If the reference price effect is simply due to acquirer size, we expect the reference price effect to disappear after controlling for the size effect. We have already presented first-pass evidence

showing that this is not the case. In our baseline analysis we control for firm size in the regression and find that a strong reference price effect coexists with the size effect. In this section we conduct further analysis of the potential impact of firm size on our results. First, we examine whether the reference price effect exists in subsamples formed on firm size. Second, we examine whether the reference price effect varies with firm size.

The regression results are presented in Table 7. The first two models are similarly specified as the baseline model but are estimated on the subsamples of smaller and larger acquirers, respectively. The two subsamples are formed yearly on the sample medians. The RPR coefficients are -6.591% (t=-6.18) for the subsample of smaller acquirers and -4.094% (t=-3.67) for larger acquirers. These negative and significant RPR coefficients suggest that the reference price effect exists regardless of acquirer size. To examine how the reference price effect varies with firm size we include an interaction term RPR *Size based on the baseline specification. The results are shown in the last column of Table 7. The coefficient on the interaction term is 1.576% (t=4.58), indicating that the reference price effect is stronger among smaller acquirers.

Interestingly, although the coefficient on stock, as the method of payment, and the interaction term of Unlist*Stock are significant in the regression involving all acquirers, neither coefficient is significant in the regression involving larger acquirers. Put another way, the coefficients on stock and the Unlist*Stock interaction term are only significant in the regression involving smaller acquirers. Nevertheless, the coefficient on RPR is negative and significant regardless of acquirers' size classifications.

The evidence in Table 7 makes it clear that the reference price effect exists regardless of acquirer firm size and that the reference price effect is stronger among smaller acquirers. This latter result is consistent with the anchoring hypothesis. To the extent that the information

environment for smaller acquirers is more opaque and thus these firms are more difficult to value, investors are more likely to rely on the 52-week high as a reference point while estimating values for these firms.

[Insert Table 7 here]

6.2. The role of valuation levels

The reference price effect could also be explained by valuation levels. If prices are high relative to their 52-week highs, they may also be high relative to their fundamental, or intrinsic, firm values. Under this premise, acquirers with **a** high (low) RPR may also be overvalued (undervalued). Given the evidence that overvalued acquirers earn lower announcement period returns (e.g., Shleifer and Vishny, 2003; Rhodes-Kropf and Viswanathan, 2004), the reference price effect may be driven by valuation levels rather than investors anchoring on the 52-week high.

We test this possibility by forming subsamples on proxies for valuation levels. The M&A literature provides many alternative proxy measures (e.g., Rhodes-Kropf, Robinson, and Viswanathan, 2005; Ang and Cheng, 2006; Dong, Hirshleifer, Richardson, and Teoh, 2006; Ma, Whidbee, and Zhang, 2011; Fu, Lin, and Officer, 2012; Akbulut, 2013). One choice is the market-to-book ratio, or M/B, which is already in our baseline regression specification. Unreported analysis shows that a strong reference price effect exists in subsamples formed on M/B.[5]

We further distinguish the reference price effect from the influence of valuation levels by investigating alternative proxies for valuation. Considering data availability, we follow the regression approach developed by Rhodes-Kropf, Robinson, and Viswanathan (RKRV, 2005) to

[5] This intuitive proxy for overvaluation is noisy. It (or its highly correlated variants such as Tobin's Q) can also be a proxy for managerial quality, which has an opposite implication for acquirer abnormal returns (Lang, Stulz, and Walkling, 1989). Unreported analysis reveals that the M/B ratio and RPR are negatively, not positively, correlated, although the correlation is not statistically significant. We thus focus on other valuation proxies.

construct the valuation proxies. The RKRV approach generates three measures of overvaluation, RKRV1, RKRV2, and RKRV3 (see Appendix A for their definitions).

We first confirm that the RKRV variables are positively correlated with RPR, with correlation coefficients ranging from 0.109 to 0.165, suggesting that acquirers with higher RPR are indeed possibly overvalued. In addition, when we use each of the RKRV measures to replace M/B in the baseline regression model, the coefficients on the RKRV variables are all negative and significant, indicating that they are valid valuation proxies.

To test the reference price effect with valuation controlled for, we first form two equal (by year) subsamples on each of the three RKRV proxies. A total of six subsamples are formed. For each of the subsamples we estimate the baseline regression (after replacing M/B with the corresponding RKRV variable). Table 8 lists the regression results. As is clear, the coefficients on RPR in all six regressions are negative and statistically significant, ranging from -7.284% (t=-6.43) for the low RKRV1 subsample to -2.382% (t=-2.13) for the high RKRV3 subsample. There are also some curious patterns in the coefficients between the high and low valuation subsamples. The valuation proxies have significant negative coefficients in all three subsamples of lower valuation. In the high valuation subsamples, however, the coefficients on the valuation proxies are not significant and the coefficients on RPR are relatively weaker.[6]

Table 8 thus suggests that valuation does not explain the reference price effect. Rather, the reference price effect is independent of, and coexists with the impact of valuation levels on the market response to acquisition announcements.[7]

[6] Further analysis (unreported) reveals that in the high RKRV subsamples, the correlations between RPR and RKRV are actually negative, not positive. This lack of positive correlation between RPR and valuation proxies indicates that the regressions on these high RKRV subsamples do not necessarily help distinguish the reference price effect from valuation. Nevertheless, the strong evidence of the reference price effect in the low RKRV subsamples suggests that the reference price effect is independent of valuation.

[7] As a cleaner test to further distinguish the reference price effect from the impact of valuation levels, we run the baseline regression on the subsample of deals that involves only cash payment. We find that the coefficient on RPR

[Insert Table 8 here]

6.3. The relation with Baker, Pan, and Wurgler (2012)

Baker, Pan, and Wurgler (2012) find that target firm 52-week high prices serve as reference points in acquisitions of publicly traded targets. Our paper focuses on the acquirer side, examining whether investors of acquiring firm stocks use 52-week high prices as reference points while evaluating the impact of merger announcements on acquirer stocks. In this section we explore how the two studies are related.

Because the Baker, Pan, and Wurgler (2012) study was limited to listed stocks, we first investigate the reference price effect in subsamples of listed and unlisted transactions. The regression results are presented in Table 9. The coefficients on RPR are -5.951% (t=-6.67) for unlisted and -3.884% (t=-2.65) for listed deals. Thus, the reference price effect exists in both subsamples, regardless of the target's listing status. When we include an interaction term RPR*Unlisted in the regression model for the whole sample, we find the interaction term carries a marginally significant negative coefficient of -2.439% (t=-1.67). The latter result is consistent with the anchoring hypothesis, given that investors know less about unlisted than listed targets.[8] That is, when evaluating acquisitions of unlisted assets, investors face greater uncertainty and are more likely to anchor on the acquirers' 52-week high as a reference point.

For the subset of listed deals for which the target firm stocks are covered in CRSP, we conduct further, albeit exploratory, analysis by considering whether the target firm's RPR, also measured at the sixth day prior to the announcement date, may be influencing our analysis. In the

is -3.076% (t=-2.19), indicating that the reference price exists even among deals where valuation levels matter little. The relatively smaller magnitude of the coefficient on RPR in this subsample is consistent with the anchoring hypothesis that the reference price effect is less pronounced among deals of less uncertainty.

[8] Consistent with the view of greater uncertainty, unlisted targets face a liquidity discount and tend to be paid lower (see Officer, 2007).

last model of Table 9 we include both acquirer and target RPR ratios in the regression. The acquirer RPR has a coefficient of -3.448% (t=-1.87) and the target RPR has a coefficient of 2.346% (t=1.95).[9]

While a comprehensive investigation of this issue is outside of the scope of our paper, we offer two possible explanations of the positive coefficient on target RPR. First, targets with stock prices near their 52-week high might reflect investors' high assessment of the quality of the target assets. Alternatively, in the framework of Baker, Pan, and Wurgler (2012), for targets with their pre-announcement price already near their 52-week highs, acquirers will tend to pay a relatively lower premium to meet (or even beat) target investors' reference price, which is the 52-week high. Everything else equal, paying a lower premium adds value to the acquirer.

[Insert Table 9 here]

6.4. Long run returns

Evidence presented earlier in the paper indicates that the reference price effect persists for at least 20 days after the announcement date (see Fig. 1), suggesting that the market reaction to these merger announcements is potentially permanent in nature. According to the anchoring hypothesis, however, the announcement-period return pattern is being driven by a behavioral bias and should, therefore, eventually be corrected. In this section we examine longer-horizon abnormal

[9] We want to caution readers when interpreting this result. First, we expect a weaker, if any, reference price effect in this CRSP subsample. For targets traded on major securities exchanges, due to listing requirements the information about these targets is more readily available and the impact of the acquisition on acquirer stock value is more closely examined by analysts, the media, and investors. Thus, investors are less likely to anchor on past stock price, including using the 52-week high as a reference point in their valuation of the acquirers. Second, to our surprise, the correlation between RPR of the acquirers and RPR of the targets is 0.59. Third, unreported analysis shows that when we estimate the baseline regression without the target RPR, the coefficient on acquirer RPR is -2.182% with a t-stat of -1.29, which is no longer statistically significant; likewise, when we estimate the baseline regression with the target RPR but excluding the acquirer RPR, the coefficient on target RPR is 1.377% with a t-stat of 1.24. While it is outside the scope of our paper for a thorough investigation of the reference price ratios of both acquirers and targets, the collective evidence here appears qualitatively consistent with our main finding that the reference price effect is stronger among acquisitions that involve greater uncertainty or opaque information.

returns for evidence of either permanency in the announcement-period price change or a reversal of the reference price effect. We follow two approaches commonly adopted in the literature: buy-and-hold abnormal returns (BHAR), and calendar time portfolio returns (CTPR).

As in Table 2, we form two equal subsamples (by year) on pre-announcement acquirer RPR ratios and examine their average BHAR and CTPR. Table 10 presents the results. Panel A shows that the acquirers in our sample earn -2.75% over the one-year period following the announcement month and -6.02% over the two-year period.[10] The magnitude of the BHARs is in line with other recent studies (e.g., Bouwman, Fuller, and Nain, 2009; Duchin and Schmidt, 2013).

More striking are the different BHARs of the Low RPR and High RPR groups. As defined in Table 2, Low RPR (High RPR) represents lower (higher) RPR acquirers. Throughout the analyses so far we have shown that the Low RPR group earns higher abnormal returns than does the High RPR group over the announcement period (up to 20 days after announcement). The one-year BHAR is -4.36% for Low RPR and -1.14% for high RPR, resulting in a difference of 3.22%; the two-year BHAR is -8.22% for Low RPR and -3.83% for High RPR, resulting in a difference of 4.40%. These return differences clearly exhibit a reversal of the short-term return pattern. Recall that Low RPR acquirers earned significantly higher short-horizon announcement period abnormal returns, but the long-horizon results shown in Table 10 indicate that the Low RPR acquirers earn significantly lower long-horizon abnormal returns than the High RPR acquirers.

[10] The t-stats presented here assume independence across the acquisitions deals. In reality, however, these deals are clustered and thus BHARs might be cross-correlated. To address the issue of sample clustering and cross-correlation, the literature (e.g., Lyon, Barber, and Tsai, 1999; Mitchell and Stafford, 2000) suggests the use of bootstrapping to derive the empirical distribution. This approach is adopted in Bouwman, Fuller, and Nain (2009). We follow their approach and find that the t-stats for the whole sample BHAR are -4.34 (however, the empirical distribution indicates statistical significance at the 5% level) for the one-year BHAR and -6.04 (significant at the 1% level) for the two-year BHAR. Regardless of how the statistical significance is measured, the pattern of reversal in BHAR is clear. Our accompanying CTPR analysis provides further, perhaps even cleaner, evidence of reversal.

Panel B of Table 10 shows the Fama and French (2015) five-factor alphas of the calendar time portfolios for the whole sample of acquirers and for the Low RPR and High RPR subsamples. As the numbers in Panel B are monthly alphas and those in Panel A are buy-and-hold abnormal returns, the magnitude of the numbers in Panel B is smaller. For the whole sample, there is no statistically significant monthly alpha. There is, however, significant differences between the Low and High RPR groups. Over the one-year period, the alphas are -0.30% (t=-2.06) for the Low RPR group and 0.04% (t=0.41) for High RPR, implying a difference of 0.33% (t=2.44); over the two-year period, the alphas are -0.25% (t=-2.03) for the Low RPR group and -0.05% (t=-0.56) for the High RPR group, leading to a difference of 0.20% (t=2.05). The differential alphas between the High and Low groups indicate a strong reversal of the short-term pattern.

Table 10 establishes a strong long-term reversal over the one- to two-year period following announcement. Combined with the earlier analyses in the paper, the pattern of long-term reversal provides further evidence that the reference price effect is, at least partly, due to investors using acquirer firms' 52-week high as an anchor price when evaluating the value implications of merger announcements. Further, the significant negative long-term returns of the low RPR acquirers suggest that there is an overreaction in the market response to announcements of acquisitions made by low RPR firms. By contrasts, the high RPR acquirers earn mild returns at the announcements, followed by little, if any, abnormal returns over the longer horizon.

In light of these long-horizon results, it is tempting to infer that the announcement period abnormal returns for high RPR firms are more rational than those for low RPR firms. However, drawing such a conclusion would require a much more thorough analysis of the large number of factors at work in these acquisitions. Such an effort is beyond the scope of this paper. Rather, our focus is on whether 52-week high prices act as anchors in investor reactions to acquisition

announcements after controlling for the main factors known to drive M&A announcement period abnormal returns, particularly those factors that may be systematically related to the 52-week high. Overall, our results provide evidence that the 52-week high does seem to influence investor behavior in the short term, but consistent with that influence being based on a behavioral bias, the influence seems to be reversed in the long-run.[11]

[Insert Table 10 here]

7. Robustness checks

We examine the robustness of the reference price effect by using alternative measures of CAR, alternative measures of RPR, and by subsamples of time periods. These analyses are briefly discussed in this section. All unreported results discussed here are available upon request.

7.1. Alternative methods of estimating CAR

In our main analysis we use the market model approach to estimate abnormal returns over the event window of [-5, +1]. To check robustness, we estimate four models following, respectively, Fuller, Netter, and Stegemoller (2002) and Faccio, McConnell, and Stolin (2006) for model 1, Officer, Poulsen, and Stegemoller (2009) for model 2, Moeller, Schlingemann, and Stulz (2004) for model 3, and Masulis, Wang, and Xie (2007) for model 4. They vary in event windows and/or expected return models.

We then use each of these alternative CARs to estimate the baseline regression. The results are reported in Panel A of Table 11. As is clear, in all regressions, the RPR coefficients are negative

[11] Our results are consistent with the anchoring phenomenon, but other behavioral biases may also be influencing investor behavior. For example, Kahneman and Tversky's (1979) prospect theory has been used to explain the disposition effect, investors' tendency to hold onto losing stocks too long and sell winners too soon (Shefrin and Statman, 1985). If RPR levels are related to a stock's disposition within investors' portfolios, the disposition effect may also be affecting investors' propensities to sell acquirer firms' stock.

and significant at the 1% level. Thus, the reference price effect we document here is robust to alternative methods of estimating abnormal returns.

One might argue that the reference price effect exists even without announcements of mergers and acquisitions. That is to say, stocks in general might exhibit such a return pattern associated with the reference price ratios. To test this possibility, we re-estimate the acquirers' cumulative abnormal returns using a benchmark formed on reference price ratios. Specifically, for each acquirer in an acquisition deal, we find a set of control firms whose reference price ratio at day t-6 are similar (same percentile) to that of the acquirer and who do not make acquisitions. We then use their average returns over the event window [-5, +1] of the acquirer as the benchmark. The abnormal returns to the acquirer constructed in this approach have already filtered out the "general" return pattern associated with reference price ratios. Using this RPR-controlled cumulative abnormal return as the dependent variable in our baseline regression yields similarly strong results. Thus, the reference price effect we find is not a general return pattern. Instead, it is associated with the announcements of mergers and acquisitions.

[Insert Table 11 here]

7.2. Alternative measures of RPR

In the main analysis we choose the RPR ratio as of the sixth day prior to the acquisition announcement. To show that our results are not sensitive to this choice, we estimate four alternative measures of RPR: RPR on the 11^{th} and 21^{st} days prior to the announcement, RPR at the month end prior to the announcement month, and RPR quintiles (0 to 4). We then estimate the baseline regression model by replacing the RPR by each of the four alternative RPR measures. Results are presented in Panel B of Table 11. All RPR coefficients are negative and significant, suggesting that the reference price effect is robust to various possible reference prices.

Throughout the paper we only consider the 52-week high. To the extent that the 52-week low is also salient, it might play a role. To test this possibility, we first add a variable P/L, which is the ratio of stock price at day t-6 to L, the 52-week low, in the baseline regression. We find that the coefficient of P/L is not significant and the RPR coefficient is -5.475% (t=-7.01), similar to that in the baseline regression. Further, we construct an alternative reference price ratio by taking into account both the 52-week high and low. Specifically, it is (P-L)/(H-L), where P is the stock price on day t-6, and H and L are the 52-week high and low prices, respectively (see the normalized value definition as in Lee and Yerramilli, 2016). We find that this new measure has a correlation coefficient of 0.836 with our reference price ratio. When we use this alternative variable in place of the RPR in the baseline regression, the coefficient on this variable is -1.851% with a t-stat of -5.41. When both RPR and (P-L)/(H-L) are included in the regression, the coefficient on RPR is -8.118% (t=-6.29) and that on (P-L)/(H-L) is 1.835% (t=3.23). Thus, including the 52-week low in our analysis leads us to the same conclusion.

As another possibility, investors might react differently to announcements of mergers and acquisitions because the overall market is near or far below its 52-week high. To examine this possibility, we construct the reference price ratio for the S&P 500 index, or RPR of SP. Indeed, we find that firm-level RPR is positively correlated with RPR of SP, with a correlation coefficient of 0.2853. When we replace the firm-level RPR with the RPR of SP in our baseline regression, however, its coefficient is a positive 1.778% (t=0.97), which is not statistically significant. When both firm- and market-level RPRs are in the regression, the coefficient of the firm-level RPR is -5.918% (t=-7.43) and that of the market-level RPR is 5.095% (t=2.73). Likewise, taking into account the 52-week low of the S&P 500 level in the market-level RPR yields virtually identical

results. Thus, the reference price effect we document in this paper is not due to the contemporaneous overall market index relative to its 52-week high or low.

We also conduct falsification tests similar to the analysis in Baker, Pan, and Wurgler (2012). Specifically, we construct the reference price ratios relative to the 75^{th}, 90^{th}, 95^{th}, and 99^{th} percentiles, respectively, of the prices over the past 52-weeks (252 trading days) relative to the sixth day before the announcement date. For convenience we call them RPR75, RPR90, RPR95, and RPR99. By design, they are highly correlated with the original RPR; the correlation is higher for the reference price closer to the 52-week high (0.6928, 0.9019, 0.9563, 0.9927). When these alternative measures of reference price ratios piecewise enter the baseline regression without the original RPR, they all have significant negative coefficients. The magnitude and statistical significance of the coefficients increase monotonically from RPR75 to RPR99. When these alternative RPRs piecewise enter the regression with the presence of the original RPR, however, for RPR75, RPR90 and RPR95 none of these alternative RPR ratios carries a significant negative coefficient. In fact, their coefficients are all positive with varying, but generally weak statistical significance. By contrasts, the coefficient of the original RPR remains negative and statistically significant. Due to the extremely high correlation (0.9927) between RPR99 and the original RPR, the regression with them both present has serious multicollinearity problems. Neither coefficient is significant. In sum, these falsification tests highlight the importance of the 52-week high price, not some highly correlated but less salient numbers that affects investors' valuation process.

Further, RPRs based on 39-, 26-, and 13-week highs yield results similar to those in the baseline regression. The results indicate that, in addition to the commonly studied 52-week highs, some investors could also anchor on peak price levels over the past 39-, 26-, or 13 weeks.

Regardless of the exact peak prices used, the results support the same economic implication: anchoring. These unreported results are available upon request.

7.3. The reference price effect over time

Of concern here is whether the reference price effect holds over time. If, for example, investors learn about this bias and correct it over time, we expect the reference price effect to decay over time. To test this possibility, we construct three subsamples by year of announcements: 1981-1989, 1990-1999, and 2000-2012 and estimate the baseline regression models for each of the subsamples. The regression results are listed in Panel C of Table 11. The RPR coefficients are -4.842% (t=-2.74) for the 1980s subsample, -8.765% (t=-6.39) for the 1990s subsample, and -3.486% (t=-3.15) for the most recent time period. Thus the reference price effect persists over time. The more pronounced reference price effect over the 1990s, which includes a large merger wave, is also consistent with Duchin and Schmidt (2013) in that acquisitions during merger waves are of greater uncertainty and thus investors are more likely to anchor on 52-week high price in their valuation of acquiring firms.

Further (unreported) analyses are conducted to determine whether and how investor inattention interacts with the reference price effect. Louis and Sun (2010) document that acquisitions announced on Fridays receive less investor attention. In subsamples of deals on Fridays and deals on other days we find that the reference price effect exists in both subsamples with similar coefficients in the baseline regression.

8. Conclusion

We find a reference price effect in mergers and acquisitions: acquirers earn higher announcement returns when their pre-announcement stock prices are well below their 52-week highs. Consistent with investors anchoring on the 52-week high, the reference price effect is

stronger among deals of greater uncertainty (more volatile acquirers, acquirers followed by fewer analysts, greater relative size, and non-cash payment) and when individual investors hold more equity. The reference price effect is not explained by size or valuation levels and is independent of the offer price anchoring documented in Baker, Pan, and Wurgler (2012). Nor is the effect explained by other firm or deal characteristics identified in the literature as explaining the market response to merger announcements. Further, the reference price effect persists for at least 20 days but is reversed in the subsequent year, suggesting that the reference price effect is eventually corrected as the actual value of the combined firm is realized. Our results add to a growing body of literature that documents a tendency for investors to look to reference prices as indicators of value, or potential value, under circumstances where actual values are difficult to determine.

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Appendix A
Variable definitions

BHAR is calculated using the reference portfolio approach. Each month, we sort all NYSE common stocks into size quintiles based on their month end market capitalization. These quintiles are further sorted into quintiles using book-to-market ratios, which are further sorted into quintiles based on return of past 12 months. We then place AMEX and NASDAQ firms into one of these 125 portfolios based on their month end size, book-to-market ratios, and past 12-month returns. After excluding firms that made significant acquisitions in the past two-year period, we calculate the monthly return for each of the 125 reference portfolios by averaging the monthly returns across all stocks in each portfolio. These portfolio returns are then used as benchmarks to calculate buy-and-hold abnormal returns for our sample firms.

CAR is the cumulative abnormal returns to the acquirer, measured over the event window [–5, +1], adjusted by the market model expected return estimated over the [-370, -253] window.

Cash is equal to one if the total considerations are paid in cash.

Complete is equal to one if the deal status is recorded as complete.

Cross border is equal to one if the acquirer and target come from different countries.

Dormant > 1 Yr is a dummy variable equal to 1 if the current transaction is at least one year apart from the previous transaction made by peers in the same CRSP 4–digit SIC industry. The definition follows Cai, Song, and Walkling (2011)

Few analysts is binary equal to 1 if the number of analysts following the acquirer (over the past six months prior to the acquisition announcement month) is below sample median (by year).

Hostile is equal to one if the SDC classifies the deal as hostile or unsolicited.

Indiv.Own is one minus the institutional ownership measure, which is the total number of shares owned by institutional investors divided by the number of shares outstanding at the end of the most recent reporting quarter. A missing value for institutional ownership is assigned as zero and the Indiv.Own is assigned as one.

Leverage is defined as total assets minus book value of equity, normalized by total assets, all measured at the yearend before announcement.

M/B is defined as market value of equity divided by book value of equity, all measured at the fiscal year end before the announcement.

Non cash is equal to one if at least part of the payment is not in cash.

Past return is the raw return over the 12-month period prior to the announcement month.

Rel. size is defined as the ratio of the transaction value excluding assumed liability, divided by market capitalization of the acquirer, measured at the beginning of the year.

RKRV1: The sum of firm and sector components of log(M/B) decomposition following model 1 of Rhodes-Kropf, Robinson, and Viswanathan (2005, pp.574-8).

RKRV2: The sum of firm and sector components of log(M/B) decomposition following model 2 of Rhodes-Kropf, Robinson, and Viswanathan (2005, pp.574-8).

RKRV3: The sum of firm and sector components of log(M/B) decomposition following model 3 of Rhodes-Kropf, Robinson, and Viswanathan (2005, pp.574-8).

RPR is the RPR ratio of the acquirer as of the 6^{th} day prior to the announcement date.

RPR Prior month is the RPR ratio of the acquirer as of the month end prior to the announcement month.

RPR Target is the RPR ratio of the target firm (if covered in CRSP) as of the sixth day prior to the announcement date.

RPR t-11 is the RPR ratio of the acquirer as of the 11th day prior to the announcement date.

RPR t-21 is the RPR ratio of the acquirer as of the 21st day prior to the announcement date.

RPR quintiles is the quintile assignment (0 to 4) on the acquirer RPR ratios (by year).

Same industry (or *Same Ind.*) is a dummy variable equal to one if the acquirer and acquired assets share two–digit Standard Industry Code (SIC).

Sigma is the weekly return standard deviation of the acquirer over the past 52 weeks prior to the acquisition announcement month.

Size is the natural logarithm of total assets measured at the yearend before the acquisition announcement. Raw total assets are in constant million dollars (year 2009).

Stock is equal to one if the total considerations are paid in stock.

Tender offer is equal to one if the deal is classified as a tender offer.

Toehold is equal to one if the acquirer owns 5% or more of the target before the announcement.

Unlisted is equal to one if SDC classifies the target public status as subsidiary or private firm.

Table 1
Sample distribution

The sample includes a total of 12,687 acquisitions made by U.S. acquirers over the 1981-2012 period. Transaction value ($million) is as reported in the SDC, %Unlisted is the percentage of transactions involving unlisted targets (private firms or subsidiaries); Stock (Cash) is the percentage of deals financed purely with stock (cash); Mixed is the percentage of deals financed with neither pure cash nor pure stock; RPR is the average RPR ratio of the acquirers. RPR ratio is the ratio of the closing price of the sixth day prior to the announcement date to the 52-week high.

Year	# Obs.	Transaction Value ($mil)	Unlisted	Stock	Mixed	Cash	RPR
All	12687	482.23	0.72	0.20	0.58	0.22	0.82
1981	130	396.79	0.68	0.01	0.98	0.02	0.85
1982	163	162.71	0.76	0.01	0.99	0.00	0.82
1983	211	115.60	0.78	0.00	0.99	0.01	0.91
1984	226	259.35	0.69	0.01	0.95	0.04	0.82
1985	203	336.27	0.49	0.21	0.43	0.36	0.90
1986	238	238.41	0.61	0.24	0.51	0.25	0.87
1987	190	227.02	0.55	0.28	0.50	0.22	0.82
1988	219	205.76	0.64	0.14	0.64	0.21	0.75
1989	240	265.18	0.67	0.25	0.52	0.23	0.89
1990	211	216.76	0.75	0.23	0.55	0.22	0.76
1991	245	133.69	0.69	0.30	0.53	0.18	0.82
1992	267	146.79	0.69	0.34	0.50	0.16	0.85
1993	381	265.32	0.76	0.29	0.49	0.22	0.85
1994	498	184.06	0.72	0.32	0.47	0.20	0.82
1995	634	261.11	0.71	0.35	0.47	0.19	0.85
1996	649	402.78	0.71	0.31	0.55	0.14	0.86
1997	892	334.20	0.72	0.28	0.56	0.16	0.85
1998	954	763.09	0.74	0.31	0.53	0.16	0.79
1999	690	679.43	0.71	0.31	0.51	0.18	0.73
2000	529	926.07	0.68	0.31	0.50	0.19	0.74
2001	438	765.95	0.67	0.22	0.57	0.21	0.72
2002	417	324.73	0.76	0.13	0.64	0.23	0.75
2003	428	274.63	0.72	0.15	0.59	0.26	0.84
2004	520	397.97	0.77	0.10	0.65	0.25	0.86
2005	497	669.99	0.79	0.09	0.60	0.31	0.85
2006	527	685.26	0.76	0.08	0.60	0.32	0.84
2007	466	638.68	0.74	0.08	0.59	0.33	0.83
2008	304	644.87	0.75	0.09	0.62	0.29	0.69
2009	250	1058.72	0.72	0.16	0.56	0.27	0.71
2010	320	574.99	0.79	0.07	0.57	0.36	0.84
2011	357	850.87	0.83	0.07	0.58	0.35	0.83
2012	394	564.35	0.81	0.06	0.60	0.34	0.84

Table 2
Cumulative abnormal returns (CAR) by RPR groups

The sample includes a total of 12,687 acquisitions made by U.S. acquirers over the 1981-2012 period. Panel A shows the mean, median, and number of observations of the average RPR value for the whole sample (first column) and two subsamples formed (by year) on the acquirer's RPR ratio. The Low RPR group represents acquisitions with the acquirer's RPR below the sample median and the High RPR group is above the sample median. Panel B reports the mean and median values of the acquirer cumulative abnormal returns (CAR) for the whole sample and the two subsamples. Column "Test statistics" presents the t-statistics (for mean) and Wilcoxon sign-test statistics (for median) testing equality between the two subsamples. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Acquirer RPR levels of the sample of acquisitions

	All	Low RPR	High RPR
Mean	0.815	0.689	0.941
(Median)	(0.873)	(0.733)	(0.952)
[N]	[12,687]	[6,335]	[6,352]

Panel B: Acquirer cumulative abnormal returns

	All CARs	Low RPR (L)	High RPR (H)	Test statistics (t/Z)
Mean	1.125***	1.660***	0.591***	(t=-6.79)***
Median	(0.317)***	(0.685)***	(0.084)	(Z=-5.05)***

Table 3
Correlation coefficient matrix
The sample includes a total of 12,687 acquisitions made by U.S. acquirers over the 1981-2012 period. This table lists the Spearman (upper-right half) and Pearson (lower-left half) correlation coefficients between the variables listed in the first column and on the first row. The variables are defined in Appendix A.

	CAR	RPR	Size	Stock	Rel. size	Unlisted	M/B	Past ret.	Same Ind.	Complete	Cross border
CAR		-0.050	-0.122	-0.071	0.027	0.159	-0.019	0.020	-0.013	0.028	0.011
RPR	-0.127		0.322	0.017	-0.055	-0.076	-0.035	0.579	-0.003	0.049	-0.046
Size	-0.156	0.355		0.013	-0.153	-0.315	-0.159	0.052	0.067	0.020	-0.027
Stock	-0.027	-0.018	0.007		0.093	-0.316	0.115	0.061	0.115	-0.047	-0.057
Rel. size	0.074	-0.066	-0.148	0.108		-0.212	-0.138	-0.021	0.044	-0.094	-0.037
Unlisted	0.134	-0.072	-0.317	-0.316	-0.192		-0.011	-0.003	-0.144	0.117	0.033
M/B	-0.005	-0.011	-0.037	0.007	-0.005	0.005		0.158	0.056	0.027	0.081
Past ret.	0.017	0.301	-0.081	0.079	0.012	0.025	0.037		0.011	0.040	-0.016
Same Ind.	-0.019	-0.006	0.071	0.115	0.031	-0.144	-0.010	0.011		0.008	-0.007
Complete	0.007	0.059	0.026	-0.047	-0.121	0.117	0.002	0.023	0.008		-0.021
Cross border	-0.003	-0.047	-0.027	-0.057	-0.029	0.033	-0.001	0.026	-0.007	-0.021	

Table 4
Multivariate regressions

The sample includes a total of 12,687 acquisitions made by U.S. acquirers over the 1981-2012 period. This table presents the coefficients and t-stats for two OLS regressions. T-stats are based on robust standard errors clustered by firm. The dependent variable is the acquirer CAR as measured over the seven-day event window [-5, +1]. All regressions include Fama and French (1997) industry and year fixed effects. All variables are defined in Appendix A. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Variables	Model 1	Model 2
RPR	-5.405	-5.581
	(-7.66)***	(-7.14)***
Unlisted		2.083
		(8.10)***
Stock		-1.129
		(-3.40)***
Unlist*Stock		1.766
		(3.63)***
Cash		0.072
		(0.37)
Rel. size		1.822
		(6.10)***
Leverage		0.590
		(1.11)
M/B		-0.122
		(-2.83)***
Size		-0.300
		(-4.95)***
Dormant > 1 Yr		0.580
		(2.07)**
Same industry		0.091
		(0.48)
Complete		0.471
		(1.68)*
Tender offer		0.924
		(1.43)
Hostile		-0.383
		(-0.74)
Toehold		-1.048
		(-2.00)**
Cross border		-0.256
		(-0.84)
Past return		0.874
		(4.10)***
Intercept	5.303	5.069
	(6.89)***	(5.26)***
N	12,687	12,687
Adj. R2	0.026	0.056

Table 5
Reference price effect and information uncertainty

The sample includes a total of 12,687 acquisitions made by U.S. acquirers over the 1981-2012 period. This table presents the coefficients and t-stats for four OLS regressions. T-stats are based on robust standard errors clustered by firm. The dependent variable is the acquirer CAR as measured over the seven-day event window [-5, +1]. In model 1, Sigma is demeaned and in model 3 relative size is demeaned. All regressions include Fama and French (1997) industry and year fixed effects. All variables are defined in Appendix A. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Variables	Model 1	Model 2	Model 3	Model 4
RPR	-4.915	-3.936	-5.333	-2.522
	(-5.47)***	(-3.85)***	(-6.90)***	(-1.99)**
RPR * Sigma	-0.447			
	(-2.65)***			
RPR * Few analysts		-2.805		
		(-2.21)**		
RPR * Rel. Size			-5.724	
			(-3.10)***	
RPR * Non cash				-3.730
				(-2.66)***
Sigma	0.271			
	(2.10)**			
Few analysts		2.301		
		(2.10)**		
Unlisted	2.089	2.086	2.063	2.532
	(8.15)***	(8.12)***	(8.04)***	(11.19)***
Stock	-1.152	-1.154	-1.119	
	(-3.47)***	(-3.49)***	(-3.38)***	
Unlist*Stock	1.755	1.758	1.671	0.728
	(3.62)***	(3.62)***	(3.43)***	(1.84)*
Cash	0.058	0.077	0.059	-2.888
	(0.30)	(0.40)	(0.31)	(-2.36)**
Rel. size	1.848	1.804	6.376	1.779
	(6.20)***	(6.05)***	(4.03)***	(5.98)***
Leverage	0.495	0.514	0.489	0.610
	(0.93)	(0.95)	(0.93)	(1.15)
M/B	-0.118	-0.122	-0.119	-0.128
	(-2.74)***	(-2.79)***	(-2.78)***	(-3.00)***
Size	-0.340	-0.291	-0.293	-0.300
	(-5.49)***	(-4.05)***	(-4.84)***	(-4.96)***
Dormant > 1 Yr	0.606	0.580	0.568	0.589
	(2.17)**	(2.08)**	(2.03)**	(2.11)**
Same industry	0.099	0.101	0.117	0.099
	(0.52)	(0.53)	(0.61)	(0.52)
Complete	0.468	0.474	0.514	0.484
	(1.68)*	(1.69)*	(1.84)*	(1.73)*
Tender offer	0.935	0.924	0.881	1.225
	(1.46)	(1.43)	(1.36)	(1.99)**
Hostile	-0.395	-0.395	-0.302	-0.221
	(-0.77)	(-0.76)	(-0.58)	(-0.43)
Toehold	-1.006	-1.038	-1.084	-1.043
	(-1.92)*	(-1.98)**	(-2.04)**	(-2.00)**

Cross border	-0.222	-0.264	-0.239	-0.242
	(-0.73)	(-0.87)	(-0.79)	(-0.80)
Past return	1.034	0.881	0.887	0.865
	(4.25)***	(4.14)***	(4.16)***	(4.06)***
Intercept	2.946	3.714	3.448	5.090
	(2.94)***	(3.21)***	(3.63)***	(5.09)***
N	12,687	12,687	12,687	12,687
Adj. R2	0.058	0.057	0.058	0.056

Table 6

Reference price effect and individual investor ownership

The sample includes a total of 12,687 acquisitions made by U.S. acquirers over the 1981-2012 period. This table presents the coefficients and t-stats for three OLS regressions, of which the first (second) regression is based on the subsample of acquirers with lower (higher) individual investor ownership. We use the sample median (by year) to assign acquirers to the "Low IO" and "High IO" subsamples. T-stats are based on robust standard errors clustered by firm. The dependent variable is the acquirer CAR as measured over the seven-day event window [-5, +1]. In the last regression the variable "Indiv. Own" is demeaned. Indiv. Own is one minus the total institutional ownership, where the total institutional ownership of the acquirer is measured at the most recent quarter end prior to the announcement month. All other variables are defined in Appendix A. All regressions include Fama and French (1997) industry and year fixed effects. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Variables	Low IO	High IO	All
RPR	-3.160	-7.098	-4.949
	(-2.90)***	(-6.32)***	(-6.39)***
RPR * Indiv. Own			-0.078
			(-3.53)***
Indiv. Own			0.067
			(3.48)***
Unlisted	2.330	1.713	2.101
	(6.79)***	(4.54)***	(8.20)***
Stock	-1.436	-0.981	-1.143
	(-3.04)***	(-2.11)**	(-3.45)***
Unlist*Stock	1.867	1.905	1.725
	(2.67)***	(2.80)***	(3.56)***
Cash	0.161	-0.122	0.075
	(0.62)	(-0.42)	(0.39)
Rel. size	1.016	2.427	1.808
	(2.37)**	(5.53)***	(6.07)***
Leverage	0.950	0.026	0.431
	(1.32)	(0.03)	(0.79)
M/B	-0.102	-0.107	-0.121
	(-1.72)*	(-1.64)	(-2.80)***
Size	-0.199	-0.283	-0.262
	(-2.25)**	(-2.78)***	(-3.94)***
Dormant > 1 Yr	0.704	0.472	0.579
	(2.08)**	(0.98)	(2.08)**
Same industry	0.214	0.006	0.118
	(0.85)	(0.02)	(0.62)
Complete	0.656	0.342	0.519
	(1.89)*	(0.78)	(1.86)*
Tender offer	1.475	-0.251	0.933
	(1.77)*	(-0.35)	(1.44)
Hostile	-0.704	0.518	-0.326
	(-1.17)	(0.55)	(-0.63)
Toehold	-0.748	-1.322	-1.021
	(-1.13)	(-1.53)	(-1.96)*
Cross border	0.116	-0.887	-0.258

	(0.31)	(-1.67)*	(-0.85)
Past return	0.867	0.847	0.876
	(2.87)***	(2.83)***	(4.11)***
Intercept	2.181	6.524	3.172
	(1.63)	(4.49)***	(3.36)***
N	6,336	6,351	12,687
Adj. R2	0.050	0.064	0.058

Table 7
Reference price effect and acquirer size

The sample includes a total of 12,687 acquisitions made by U.S. acquirers over the 1981-2012 period. This table presents the coefficients and t-stats for three OLS regressions. T-stats are based on robust standard errors clustered by firm. The dependent variable is the acquirer CAR as measured over the seven-day event window [-5, +1]. The first two columns are based on subsamples formed on acquirer size and the last column is based on the full sample. In the last column, size is demeaned. All regressions include Fama and French (1997) industry and year fixed effects. All variables are defined in Appendix A. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Variables	Smaller acquirers	Larger acquirers	All acquirers
RPR	-6.591	-4.094	-3.899
	(-6.18)***	(-3.67)***	(-4.95)***
RPR * Size			1.576
			(4.58)***
Unlisted	1.764	2.083	2.122
	(3.47)***	(7.96)***	(8.29)***
Stock	-2.421	-0.535	-1.177
	(-3.25)***	(-1.60)	(-3.56)***
Unlist*Stock	3.506	0.311	1.725
	(3.76)***	(0.63)	(3.56)***
Cash	-0.282	0.345	0.097
	(-0.90)	(1.51)	(0.50)
Rel. size	2.863	0.286	1.784
	(6.25)***	(0.82)	(6.01)***
Leverage	0.602	0.869	0.482
	(0.82)	(1.09)	(0.91)
M/B	-0.124	-0.131	-0.130
	(-2.21)**	(-1.97)**	(-3.04)***
Size	-0.503	-0.165	-1.576
	(-3.27)***	(-1.96)**	(-5.24)***
Dormant > 1 Yr	0.956	0.289	0.610
	(2.12)**	(0.89)	(2.18)**
Same industry	0.162	0.142	0.108
	(0.53)	(0.65)	(0.57)
Complete	0.529	0.325	0.502
	(1.08)	(1.17)	(1.80)*
Tender offer	0.342	1.047	0.944
	(0.41)	(1.44)	(1.46)
Hostile	-1.205	-0.125	-0.366
	(-0.93)	(-0.24)	(-0.71)
Toehold	-0.376	-1.504	-0.974
	(-0.38)	(-2.63)***	(-1.86)*
Cross border	-0.514	0.017	-0.267
	(-1.08)	(0.05)	(-0.88)
Past return	0.595	1.601	0.910
	(2.27)**	(5.03)***	(4.27)***
Intercept	6.524	3.397	2.080
	(4.18)***	(2.31)**	(2.17)**
N	6,336	6,351	12,687
Adj. R2	0.044	0.061	0.060

Table 8
Reference price effect and valuation levels

The sample includes a total of 12,687 acquisitions made by U.S. acquirers over the 1981-2012 period. This table presents the coefficients and t-stats for six OLS regressions. T-stats are based on robust standard errors clustered by firm. The dependent variable is the acquirer CAR as measured over the seven-day event window [-5, +1]. Each regression is conducted on subsamples formed on RKRV valuation variables as designated on the column head. All regressions include Fama and French (1997) industry and year fixed effects. All variables are defined in Appendix A. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Variables	RKRV1		RKRV2		RKRV3	
	Low	High	Low	High	Low	High
RPR	-7.284	-2.868	-6.646	-2.852	-6.985	-2.382
	(-6.43)***	(-2.43)**	(-5.73)***	(-2.43)**	(-6.00)***	(-2.13)**
Unlisted	2.221	1.965	2.371	1.787	2.448	1.775
	(5.47)***	(5.58)***	(6.10)***	(4.77)***	(5.63)***	(5.39)***
Stock	-1.080	-1.442	-0.770	-1.890	-1.655	-1.111
	(-2.04)**	(-3.15)***	(-1.56)	(-3.86)***	(-2.57)**	(-2.68)***
Unlist*Stock	1.356	1.958	1.256	2.245	2.409	1.469
	(1.78)*	(2.93)***	(1.77)*	(3.19)***	(2.58)***	(2.55)**
Cash	0.384	-0.157	0.192	-0.161	0.097	0.015
	(1.27)	(-0.54)	(0.64)	(-0.54)	(0.32)	(0.05)
Rel. size	2.421	1.061	1.869	1.835	2.078	1.533
	(5.39)***	(2.23)**	(4.23)***	(3.83)***	(4.25)***	(3.53)***
Leverage	1.047	0.593	0.502	0.855	1.957	0.789
	(1.18)	(0.74)	(0.55)	(1.09)	(1.91)*	(0.87)
Valuation	-1.052	-0.197	-1.297	-0.086	-1.379	0.073
	(-2.56)**	(-0.64)	(-2.96)***	(-0.27)	(-2.70)***	(0.19)
Size	-0.389	-0.226	-0.394	-0.187	-0.385	-0.192
	(-3.81)***	(-2.61)***	(-4.10)***	(-2.10)**	(-3.79)***	(-2.37)**
Dormant > 1 Yr	0.716	0.559	0.697	0.422	0.724	0.348
	(1.69)*	(1.36)	(1.68)*	(1.01)	(1.83)*	(0.81)
Same industry	-0.068	0.178	-0.173	0.289	-0.016	0.123
	(-0.23)	(0.64)	(-0.58)	(1.01)	(-0.05)	(0.47)
Complete	0.194	0.618	0.024	0.815	0.012	0.869
	(0.45)	(1.41)	(0.06)	(1.85)*	(0.02)	(2.20)**
Tender offer	1.484	0.366	1.325	0.483	1.170	0.667
	(1.25)	(0.67)	(1.21)	(0.80)	(1.13)	(1.12)
Hostile	-0.211	-0.506	0.720	-1.330	-0.175	-0.800
	(-0.24)	(-0.77)	(0.79)	(-2.05)**	(-0.19)	(-1.20)
Toehold	-1.261	-1.434	-1.102	-1.257	-0.832	-1.626
	(-1.46)	(-1.74)*	(-1.31)	(-1.61)	(-1.06)	(-1.93)*
Cross border	-0.780	0.098	-0.755	0.077	-0.889	0.355
	(-1.58)	(0.24)	(-1.58)	(0.18)	(-2.01)**	(0.79)
Past return	0.803	0.581	0.490	0.778	0.680	0.768
	(2.39)**	(2.32)**	(1.35)	(3.15)***	(1.80)*	(3.22)***
Intercept	6.740	1.968	6.812	1.616	5.630	1.268
	(4.56)***	(1.25)	(4.72)***	(1.05)	(3.61)***	(0.87)
N	5,647	5,663	5,642	5,665	5,643	5,664
Adj. R2	0.073	0.045	0.081	0.045	0.067	0.050

Table 9
Reference price effect and target listing status

The sample includes a total of 12,687 acquisitions made by U.S. acquirers over the 1981-2012 period. This table presents the coefficients and t-stats for four OLS regressions. T-stats are based on robust standard errors clustered by firm. The dependent variable is the acquirer CAR as measured over the seven-day event window [-5, +1]. The first three models are based on the whole sample, the sample of acquisitions of unlisted targets only, and the subsample of acquisitions of listed targets only, respectively, as denoted by the column head. The last model is based on the subsample of acquisitions of targets that are covered in CRSP. All regressions include Fama and French (1997) industry and year fixed effects. All variables are defined in Appendix A. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Variables	Unlisted	Listed	All targets	CRSP listed
RPR	-5.951	-3.884	-3.695	-3.448
	(-6.67)***	(-2.65)***	(-2.70)***	(-1.87)*
RPR * Unlisted			-2.439	
			(-1.67)*	
Target RPR				2.346
				(1.95)*
Unlisted			4.099	
			(3.18)***	
Stock	0.444	-0.454	-1.102	-0.268
	(1.07)	(-1.35)	(-3.33)***	(-0.68)
Unlist*Stock			1.737	
			(3.58)***	
Cash	-0.241	1.017	0.091	1.173
	(-1.06)	(2.75)***	(0.47)	(2.67)***
Rel. size	3.603	-0.987	1.810	-1.323
	(8.68)***	(-2.40)**	(6.06)***	(-2.85)***
Leverage	-0.201	1.974	0.592	0.799
	(-0.33)	(1.79)*	(1.12)	(0.65)
M/B	-0.073	-0.212	-0.121	-0.177
	(-1.48)	(-2.48)**	(-2.83)***	(-1.76)*
Size	-0.175	-0.435	-0.305	-0.368
	(-2.31)**	(-4.32)***	(-5.02)***	(-3.07)***
Dormant > 1 Yr	0.590	0.573	0.576	0.715
	(1.82)*	(1.11)	(2.06)**	(1.20)
Same industry	-0.148	0.750	0.086	0.844
	(-0.64)	(2.33)**	(0.45)	(2.27)**
Complete	0.464	0.306	0.459	-0.162
	(1.27)	(0.72)	(1.63)	(-0.32)
Tender offer	4.138	0.171	0.941	0.154
	(0.98)	(0.38)	(1.45)	(0.30)
Hostile	-1.730	0.063	-0.366	0.273
	(-0.78)	(0.11)	(-0.71)	(0.43)
Toehold	-0.837	-1.411	-1.037	-1.449
	(-0.73)	(-2.42)**	(-1.99)**	(-2.20)**
Cross border	-0.365	0.148	-0.270	-1.569
	(-1.05)	(0.24)	(-0.89)	(-1.18)
Past return	0.842	1.194	0.872	0.990
	(3.42)***	(2.87)***	(4.09)***	(1.99)**
Intercept	6.735	3.872	3.526	2.663
	(6.24)***	(2.02)**	(2.61)***	(1.19)

N	9,183	3,504	12,687	2,691
Adj. R2	0.047	0.040	0.057	0.035

Table 10

Longer term abnormal returns by RPR groups

Panel A shows the buy-and-hold abnormal returns of the whole sample and two subsamples formed on pre-announcement RPR ratios. The Low (High) RPR group includes acquisitions with acquirer RPR ratios below (above) the sample median. The holding periods of the BHARs are either one year or two years following the announcement month. The row "H – L" lists the differences in BHARs between the two subsamples. T-statistics are presented in parentheses. Panel B lists the Fama and French (2015) factor model alphas of calendar-time portfolio returns of the acquiring firms for the one- and two-year periods following the announcement month. The row "H – L" represents the difference between the two subsamples. T-statistics are presented in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Buy-and-hold abnormal returns (BHAR)

Groups	Holding period	
	One year	Two years
Whole sample	-2.75	-6.02
	(-4.71)***	(-6.79)***
Low RPR	-4.36	-8.22
	(-4.47)***	(-5.69)***
High RPR	-1.14	-3.83
	(-1.77)*	(-3.71)***
H - L	3.22	4.40
	(2.76)***	(2.48)**

Panel B: Calendar time portfolio Fama and French (2015) factor alphas

Groups	Holding period	
	One year	Two years
Whole sample	-0.04	-0.08
	(-0.45)	(-0.86)
Low RPR	-0.30	-0.25
	(-2.06)**	(-2.03)**
High RPR	0.04	-0.05
	(0.41)	(-0.56)
H - L	0.33	0.20
	(2.44)**	(2.05)**

Table 11
Robustness

The sample includes a total of 12,687 acquisitions made by U.S. acquirers over the 1981-2012 period. Panel A presents four regressions that differ by how the dependent variable CAR is defined. Respectively, CARs are defined following Fuller, Netter, and Stegemoller (2002) and Faccio, McConnell, and Stolin (2006) for model 1, Officer, Poulsen, and Stegemoller (2009) for model 2, Moeller, Schlingemann, and Stulz (2004) for model 3, and Masulis, Wang, and Xie (2007) for model 4. Panel B contains four regressions with the main independent variable reference price ratio replaced by its alternatives. Panel C lists three regressions, estimated respectively on the subsamples of acquisitions announced in the 1981-1989, 1990-1999, and 2000-2012 periods, respectively. For all the regressions the t-stats are based on robust standard errors clustered by firm. All regressions include Fama and French (1997) industry and year fixed effects. All variables are defined in Appendix A. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A: Alternative measures of CARs

Variables	Model 1	Model 2	Model 3	Model 4
RPR	-4.474	-3.480	-4.155	-5.951
	(-6.18)***	(-5.53)***	(-6.77)***	(-7.62)***
Unlisted	2.126	2.084	2.038	2.067
	(9.12)***	(10.21)***	(10.08)***	(8.29)***
Stock	-1.232	-1.336	-1.451	-1.067
	(-4.02)***	(-4.91)***	(-5.38)***	(-3.32)***
Unlist*Stock	1.820	1.711	1.749	1.806
	(4.05)***	(4.27)***	(4.42)***	(3.76)***
Cash	0.222	0.226	0.238	0.101
	(1.30)	(1.50)	(1.60)	(0.54)
Rel. size	1.137	1.204	1.190	1.679
	(4.01)***	(4.83)***	(4.81)***	(5.75)***
Leverage	1.267	0.754	0.634	0.621
	(2.60)***	(1.78)*	(1.52)	(1.21)
M/B	-0.044	-0.049	-0.045	-0.043
	(-1.15)	(-1.52)	(-1.43)	(-1.02)
Size	-0.377	-0.296	-0.240	-0.378
	(-6.75)***	(-5.98)***	(-4.95)***	(-6.32)***
Dormant > 1 Yr	0.706	0.367	0.448	0.421
	(2.69)***	(1.65)*	(2.03)**	(1.54)
Same industry	0.285	0.221	0.278	0.109
	(1.69)*	(1.50)	(1.90)*	(0.59)
Complete	0.490	0.430	0.401	0.452
	(1.91)*	(1.94)*	(1.83)*	(1.66)*
Tender offer	0.670	0.688	0.607	0.814
	(1.33)	(1.43)	(1.26)	(1.30)
Hostile	-0.294	-0.216	-0.122	-0.385
	(-0.62)	(-0.55)	(-0.32)	(-0.77)
Toehold	-0.600	-0.465	-0.522	-1.035
	(-1.19)	(-1.10)	(-1.22)	(-1.97)**
Cross border	-0.106	-0.058	-0.071	-0.276
	(-0.38)	(-0.24)	(-0.30)	(-0.92)
Past return	0.654	0.530	0.014	1.128
	(3.57)***	(3.38)***	(0.09)	(5.49)***
Intercept	4.540	3.578	3.817	6.145
	(5.12)***	(4.65)***	(5.04)***	(6.48)***

N	12,687	12,683	12,683	12,687
Adj. R2	0.060	0.068	0.071	0.065

Panel B: Alternative measures of reference price ratios

Variables	Model 1	Model 2	Model 3	Model 4
RPR t-11	-4.380			
	(-5.55)***			
RPR t-21		-3.535		
		(-4.55)***		
RPR Prior month			-3.621	
			(-4.86)***	
RPR quintiles				-0.332
				(-4.89)***
Unlisted	2.074	2.065	2.076	2.065
	(8.06)***	(8.00)***	(8.04)***	(8.00)***
Stock	-1.134	-1.132	-1.146	-1.074
	(-3.42)***	(-3.40)***	(-3.44)***	(-3.23)***
Unlist*Stock	1.786	1.798	1.822	1.810
	(3.66)***	(3.67)***	(3.72)***	(3.69)***
Cash	0.058	0.040	0.046	0.021
	(0.30)	(0.21)	(0.24)	(0.11)
Rel. size	1.828	1.812	1.806	1.846
	(6.11)***	(6.05)***	(6.04)***	(6.15)***
Leverage	0.581	0.592	0.588	0.646
	(1.09)	(1.11)	(1.10)	(1.21)
M/B	-0.116	-0.111	-0.106	-0.108
	(-2.69)***	(-2.58)***	(-2.46)**	(-2.51)**
Size	-0.332	-0.356	-0.356	-0.396
	(-5.51)***	(-5.89)***	(-5.92)***	(-6.51)***
Dormant > 1 Yr	0.574	0.567	0.539	0.544
	(2.05)**	(2.03)**	(1.93)*	(1.94)*
Same industry	0.093	0.091	0.087	0.084
	(0.48)	(0.47)	(0.45)	(0.44)
Complete	0.454	0.432	0.431	0.399
	(1.62)	(1.53)	(1.53)	(1.41)
Tender offer	0.913	0.920	0.924	0.888
	(1.41)	(1.41)	(1.41)	(1.37)
Hostile	-0.369	-0.364	-0.359	-0.384
	(-0.71)	(-0.70)	(-0.69)	(-0.74)
Toehold	-1.044	-1.031	-1.026	-1.036
	(-1.99)**	(-1.97)**	(-1.97)**	(-1.98)**
Cross border	-0.245	-0.235	-0.242	-0.232
	(-0.81)	(-0.77)	(-0.79)	(-0.76)
Past return	0.741	0.643	0.658	0.473
	(3.44)***	(2.97)***	(3.07)***	(2.29)**
Intercept	4.294	3.749	3.813	1.777
	(4.44)***	(3.92)***	(4.05)***	(2.28)**
N	12,687	12,687	12,687	12,687
Adj. R2	0.053	0.052	0.052	0.051

Panel C: Reference price effect over time

Variables	1981-1989	1990-1999	2000-2012
RPR	-4.842	-8.765	-3.486
	(-2.74)***	(-6.39)***	(-3.15)***
Unlisted	0.470	3.094	2.186
	(1.25)	(5.29)***	(6.06)***
Stock	-1.390	-0.653	-1.086
	(-2.34)**	(-1.05)	(-1.96)**
Unlist*Stock	2.373	1.149	1.390
	(2.43)**	(1.52)	(1.31)
Cash	-0.157	-0.238	0.137
	(-0.36)	(-0.69)	(0.55)
Rel. size	0.342	2.974	1.103
	(0.71)	(6.08)***	(2.14)**
Leverage	0.816	-1.371	2.112
	(0.72)	(-1.54)	(2.63)***
M/B	-0.307	-0.113	-0.134
	(-1.55)	(-1.56)	(-2.35)**
Size	-0.439	-0.174	-0.324
	(-3.73)***	(-1.71)*	(-3.36)***
Dormant > 1 Yr	0.677	0.574	0.453
	(1.31)	(1.14)	(1.07)
Same industry	0.700	0.051	0.079
	(2.26)**	(0.15)	(0.28)
Complete	0.389	0.306	0.481
	(1.03)	(0.61)	(1.02)
Tender offer	0.200	3.426	-0.130
	(0.38)	(2.18)**	(-0.18)
Hostile	-0.450	-1.827	2.030
	(-0.65)	(-2.08)**	(1.93)*
Toehold	-1.219	-1.525	-0.075
	(-1.59)	(-1.58)	(-0.07)
Cross border	-1.315	-1.294	0.233
	(-1.77)*	(-2.31)**	(0.61)
Past return	1.745	0.739	0.864
	(2.92)***	(2.06)**	(2.94)***
Intercept	5.226	5.934	2.657
	(2.45)**	(3.83)***	(1.93)*
N	1,819	5,421	5,447
Adj. R2	0.066	0.083	0.038

Figure 1
Acquirer cumulative abnormal returns and reference price ratios
The sample includes 12,687 acquisitions in 1981-2012. Acquirers are yearly sorted into two equal groups by their reference price ratios as of the sixth day prior to the announcement date. Low RPR (High RPR) represents the group with lower (higher) reference price ratios. The abnormal returns are based on a market model estimated from days [-370, -253] relative to the announcement date.