# The Sensitivity of Merger Premium and Deal Response to Retail and Institutional Investors' Historical Purchase Prices

by

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January 2023

## Abstract

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We have benefited from the comments of Yakov Amihud, Ian Cooper, Roni Michaely, Amir Rubin, Zvi Wiener, Avi Wohl, Yishay Yafeh, and participants at the 2nd Summer Jerusalem Finance and Accounting Conference, the 3rd Israeli Behavioral Finance Conference, the New Zealand Finance Meeting (2021), the Australasian Finance and Banking Conference (2021), the Financial Markets and Corporate Governance Conference (2022), the 31st European Financial Management Association (EFMA) conference (2022), and seminars at Bar Ilan University, Hebrew University, and Tel Aviv University. Financial support by the Raymond Ackerman Family Chair in Israeli Corporate Governance is gratefully acknowledged.

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## Abstract

This paper examines whether the prices target shareholders originally paid for their shares affect merger deals. Specifically, when the pre-offer market price is below the historical purchase price, target shareholders may be reluctant to realize their nominal loss. In a sample of all U.S. public firm merger offers in 1990–2019, we find that nominal target shareholder losses are associated with higher premiums and negative acquirer announcement returns. Both institutional and retail investors losses are compensated, and consistent with realization utility, the effect is stronger in cash-only deals. Our results suggest that behavioral reference prices are revealed during pre-bid negotiations.



*Keywords:* mergers and acquisitions; reference prices; anchoring; retail investors: Prospect Theory.

*JEL classification:* G34, G41

## 1. Introduction

Much of the mergers and acquisitions (M&A) literature assumes that a merger offer is evaluated based on the price offered relative to the target's market price on the eve of the offer. However, an acquisition bid is also an offer to target shareholders to sell their shares and essentially realize their nominal loss or gain relative to their original purchase price. If averse to realizing nominal losses, target shareholders' purchase price may impact acceptance rates and offer premiums. However, little is known about such a purchase-price effect, which is distinct from other behavioral factors, such as anchoring to the 52-week high. We develop a measure of the stock purchase price of all target shareholders based on rolling-back daily turnovers. We then decompose the estimated average purchase price to that of retail and institutional investors, as these two investor sectors may have different average purchase prices as well as a different effect on merger deals. Overall, we find that the purchase prices of both retail and institutional investors have a significant effect on the premium offered, and an economically significant effect on bidder announcement return and market value. Our results suggest that purchase price helps explain several puzzling features in M&A, most notably the transfer of wealth from acquirers to targets.

To estimate a representative stock purchase price of all current target shareholders, we build on the Proportional Trading Model commonly used by courts in securities' fraud litigation (Furbush and Smith, 1994). Intuitively, on past days with higher turnover, more shareholders bought shares, and hence the day's price should be assigned a higher weight in our purchase price measure. However, higher turnover on a past day also means that more shareholders sold shares, and thus no longer hold them when the merger offer comes in. Our measure of target shareholders' average purchase price (TAPP, henceforth) considers both of these factors. It also aims to capture all shareholders on the eve of an acquisition bid—including the most veteran ones—and thus goes all the way to the IPO of each target firm. Last, to distinguish between retail and institutional investors, we use a purchase price measure of institutional investors developed by Frazzini (2006), and later applied in the M&A domain by Ye (2014). Institutional investors' average purchase price (IIAPP, henceforth) relies on changes in quarterly institutional holdings. After we estimate both the purchase price of all investors (TAPP) and the purchase price of institutional investors (IIAPP), we impute the purchase price of retail investors. We then examine how the different purchase price

measures help explain the offered premium, the market response to the announcement, and the eventual deal completion likelihood.

We examine all mergers of U.S. public firms between 1990 and 2019 available on the SDC M&A database (by Thomson Reuters). Our final sample includes 4,910 merger offers, with most of them friendly—i.e., the offers are negotiated, agreed upon, and recommended by target and bidder managements and board of directors—leaving enough room for behavioral reference points to affect deal terms. We find that when the TAPP exceeds the target's pre-offer stock price—i.e., target shareholders are in loss on average—the bidder adjusts the offer price upwards (to partially compensate target shareholders for their loss), *ceteris paribus*. Consistent with loss aversion, we find a significant increase in the offer premium when target shareholders are at loss, and an insignificant decrease in the offer premium when target shareholders are at a gain on the eve of the merger announcement. In addition, consistent with Prospect Theory, the marginal compensation (extra premium) for small losses is larger than that of medium and large losses, suggesting that the purchase-price effect on the offer premium is behavioral rather than rational. Last, the results hold after controlling for both the target and acquirer 52-week high price effects (Baker, Pan and Wurgler, 2012; Ma, Whidbee and Zhang, 2019), indicating that the purchase-price effect on the offer premium is distinct from the previously documented effect of the 52-week high price.

We also examine offer acceptance likelihood and offer announcements returns. First, we run a Probit analysis and show that once the offer premium is determined, reference prices have practically no effect on target shareholders' accept/reject decision. Reference prices affect accept/reject decisions only via their effect on the offer price. Second, we present evidence suggesting that the extra premium paid to compensate target shareholders for their nominal losses relative to TAPP tends to hurt acquirer shareholders and benefit target shareholders. In our primary analysis we employ a two-stage, least-square regression technique, in which we first estimate the extra premium paid for losses relative to reference prices, and then use the fitted premium in the second stage. We find that the negative acquirer announcement returns correlates with the extra premium paid.

We contribute to the literature in several regards. We are the first to provide a comprehensive study of the effect of all— i.e., both retail and institutional—target shareholder's

purchase price. Previous literature considered only the institutional investors' average purchase price (Ye, 2014). We show that our all shareholders' purchase price measure, TAPP, dominates the institutional purchase price measure, IIAPP, consistent with the notion that all shareholders count in merger deals. It is arguable that each institutional investor holds a larger position and thus individually receives more attention in merger negotiations as well as a higher impact on the offer premium (Grossman and Hart, 1980). However, retail investors are more prone to behavioral biases than institutional investors (Shapira and Venezia, 2001; Barber and Odean, 2002; Dhar and Zhu, 2006; Barber and Odean, 2008; Lauterbach and Mugerman, 2020), suggesting that retail investors' stance may also be relevant and influential. We find that the purchase price of retail investors is taken into account by the bidder when determining the offer premium, especially in situations where retail investor holdings are relatively large. Our indication that retail investors' impact cannot be ignored challenges the view that pre-merger negotiations only regard the professional institutional investors stance—i.e., that retail investors are "free-riders" or "followers"—and have little impact on merger terms (Grossman and Hart, 1980).

Our finding that purchase prices affect merger premiums also suggests that pre-merger negotiations serve the bidder to reveal target shareholders' behavioral reservation prices and take them into account. Several papers focus on private negotiations in the period preceding a merger offer (Boone and Mulherin, 2007; Fich, Cai, and Tran, 2011; Ahern and Sosyura, 2014). We further show that once the offer price premium is adjusted (to the shareholders' behavioral reference prices), these reference prices have no further impact on merger offer acceptance likelihood. The bidder appears to adjust the offer price to a threshold level, presumably revealed during pre-merger negotiations, at which these behavioral reference prices do not hinder offer acceptance by target shareholders.

Our results also show that the extensively studied wealth transfer between bidders and targets is partly attributable to the effect of target shareholders' purchase price. We find that an acquirer stock experiences an additional penalty strictly from premium adjustments based on the target shareholders' historical purchase price. Our results suggest that acquirers could benefit from a milder consideration of target shareholders' loss aversion.

We also contribute to the behavioral finance literature. Prospect Theory (Kahneman and Tversky, 1979) has long argued that individuals use a reference price and react differently to a

potential gain or loss relative to such a price. More relevant to mergers, Barberis and Xiong (2012) develop a model of realization utility in which investors derive utility from realizing nominal gains and losses on assets they own. In particular, sellers are averse to realizing nominal losses. Receiving an acquisition bid is a largely exogenous shock affording a test of realization utility, and the extra premium offered as a compensation for losses supports realization utility. Furthermore, consistent with realization utility, we find that the purchase price has a stronger effect in cash-only deals where realization is immediate and not in acquirer shares.

We contribute to the behavioral literature also by showing that the purchase price effect is distinct from that of the target firm's peak stock price in the 52 weeks preceding a merger offer (52-week high). Baker, Pan and Wurgler (2012), Ma, Whidbee and Zhang (2019), and Lee and Yerramilli (2022) argue that shareholders use the 52-week high as an anchor point in estimating the (unobservable) fundamental value on the offer eve. We find that the purchase price effect on premiums remains after controlling for the 52-week high. Our results thus suggest that the two reference prices may represent two different effects: market participants use the 52-week high as a reference price to estimate whether the bid offer is fair (i.e., whether the target market price on the offer eve is overvalued or undervalued), while current target shareholders use their own historical purchase price to track their nominal gain/loss. Since both effects are based on past prices, we cannot argue that they are orthogonal; however, we do argue, in the spirit of Riley, Summers and Duxbury (2020), that the original purchase price and salient prices along the path are complementary rather than substitutional.

Third, we offer a methodological progress. Several papers have already validated the use of turnover-based price measures (Skinner ,1997; Lowry and Shu, 2002; Grinblatt and Han, 2005). We are the first to rigorously derive a purchase price measure that captures all shareholders and then use it to impute the purchase price of retail investors. We find that our methodology, despite requiring substantial computer work, offers a novel way to estimate retail investors' purchase price of any public firm based on readily available data, free from the restrictions and limitations of proprietary subsamples.

The measures used in previous literature are also limited to represent recent losers/winners (e.g., the last five years, as per Grinblatt and Han, 2005), and assume that daily turnover can be entirely attributed to transactions between long-term investors. We are the first to consider in our

purchase price measure all shareholders and incorporate in our measures the recent rise in high-frequency trading (HFT) by short-term investors (such as day traders or robots which by now account for most of the daily trading volume – see Hendershott, Jones, and Menkveld, 2011). We test alternative estimators based on the existence of a class of "active" short-term investors and a class of long-term investors who determine the response to merger offers. Given that our purchase price estimates perform well in the M&A domain, we believe they can be applied in many other core sub-fields in finance, and in particular, in many corporate finance decisions that require shareholder votes.

The paper is organized as follows. Section 2 reviews extant literature on merger decisions and reference price effects on such decisions. In Section 3, we present the reference prices we attempt and our testable hypotheses. Section 4 describes the sample and the data. Sections 5 and 6 summarize and discuss our empirical results, and Section 7 concludes.

## 2. Background and Previous Literature

### 2.1. Factors Affecting Offer Premiums and Merger Decisions

Neoclassical theory predicts that mergers occur when the two merging companies are worth more together than apart.[1] In such a case, the acquirer should go ahead with the acquisition only if her gains exceed the costs, where costs also include the premium the buyer pays above the seller's stand-alone value. In a rational world, bidders offer a price that reflects the intrinsic value of the target within the combined firm. In turn, target shareholders decide to vote for or against the proposed merger based on the price premium offered (the premium of offer price relative to the target's pre-offer stock price).

Palepu (1986) identified several target firm characteristics correlated with a bidder's decisions. Low-growth, resource-rich firms are natural acquisition targets, as well as high-growth, resource-poor firms (when funding difficulties are due to asymmetric information). Firm size is also a factor, as it correlates with "transaction costs" associated with acquiring a firm. Such costs include those associated with the target's absorption into the acquirer's organizational framework, as well as costs associated with fighting a prolonged battle a target may wage to defend itself. The

[1] In addition to sheer economies of scale, synergistic gains can emanate from complementarity, wherein each party has what the other needs (e.g., a small firm with a unique product and a large company that can produce and market it on a large scale). Mergers also add value when a synergy gain is obtained via replacing an inefficient management.

market-to-book ratio and price-earning multiplier are also used as proxies for "cheap" buys—i.e., firms whose market values are low compared to their book values or earnings per share levels.

In a comprehensive survey on the determinants of merger decisions, Betton, Eckbo, and Thorburn (2008) point at several explanatory variables that may be grouped into target characteristics, bidder characteristics, and deal characteristics. These variables include the target stock's illiquidity (trading volume and exchange listed on), the target stock price runup prior to the initial bid, and the existence of a poison pill (a shareholder rights plan allowing existing target shareholders to dilute a hostile takeover bidder). Other important factors examine whether the target and bidder are related (i.e., same industry), whether the target rejects negotiations (resulting in the bid considered hostile), the form of payment (cash, stock, or combined), and whether rival bidders contest the firm. The authors show that these factors affect offer premiums, completion rates, and offer-announcement stock returns.

### 2.2. Reference Price Effects on Merger Decisions

In the present study we focus on the impact of target shareholders' behavioral biases. Prospect Theory (Kahneman and Tversky, 1979) proposes that individuals use a reference price and react differently to a potential gain or loss relative to such a price. Such gain\loss asymmetry has been confirmed in controlled experiments (see, for example, Brocas, Carrillo, Giga and Zapatero, 2019). Further, the vast empirical literature on the disposition effect (Shefrin and Statman, 1985), and more recently on the cognitive dissonance thesis (Kaustia, 2010; Chang, Solomon, and Westerfield, 2016; Fischbacher, Hoffmann, and Schudy, 2017; Hamdani, Lauterbach, and Mugerman, 2020), suggests that shareholders use their share purchase price as a reference or even reservation price.

The salient and perhaps most distinctive prediction of Prospect Theory is that economic agents are loss averse. Rational theories tend to perceive purchase price as a sunk cost and refer to current market price as the current estimate of fundamental value and the correct anchor for any economic decision. However, evidence on individuals' major economic decisions such as selling a house reveals that individuals are subject to a behavioral loss aversion (Genesove and Mayer, 2001). Barberis and Xiong (2012) formalize the notion that sellers are averse to realizing nominal losses and develop a model of realization utility in which investors derive utility from realizing nominal gains and losses on assets they own.

In the context of merger activity, Ye (2014) uses a measure of institutional investors' purchase price developed by Frazinni (2006) to show that the disposition effect accurately predicts the public's response to a merger offer. Ye (2014) infers whether an institutional investor is prone to the disposition effect by analyzing the investor's historical trading pattern—that is, whether the institutional investor is more ready to sell a winner than a loser. When "disposition-effect inclined" institutional investors are excluded, the impact of institutional investors' purchase price on merger decisions diminishes or disappears.

Another relevant reference price is the 52-week high. Baker, Pan and Wurgler (2012) find that recent peaks in the target stock price (and in particular the 52-week high) affect offer prices and the likelihood of merger completion. The offer premium increases with the ratio of the 52-week high to the pre-offer target stock price, and the offer-acceptance likelihood jumps when the offer price exceeds the 52-week high. Baker et al. (2012) interpret their evidence as suggesting that the 52-week high is an important reference price for the various actors involved in the deal (including even the "neutral" advisors and financiers). For target firm shareholders, the high represents a price at which they could have recently sold. Thus, in order to mitigate any regrets and convince target management and shareholders to accept a merger offer, the bidder has to adjust the offer price according to the ratio of the pre-offer target stock price to the target 52-week-high price. Interestingly, Ma, Whidbee and Zhang (2019) document that a bidder's 52-week high price also affects the offer premium, especially in deals in which bidder's valuation is relatively uncertain.

In the period preceding a merger offer, the bidder and target conduct private negotiations (Boone and Mulherin, 2007; Fich, Cai, and Tran, 2011; Ahern and Sosyura, 2014). Such negotiations probably reveal, at least partly, the bidder and target behavioral-reference prices.

## 3. Measures of the Average Purchase Price and Hypotheses

### 3.1. Estimating the Average Purchase Price of Target Shareholders on the Eve of the Offer

We derive and employ a turnover-based measure of all target shareholders' average purchase price (TAPP). TAPP is a weighted average of all past prices in which the weight of a particular past price approximates the proportion of shareholders that bought the share at that price and held it until the eve of the offer. Our measure is based on the Proportional Trading Model

(PTM), frequently used in class-action suits for assessing damage caused by a security fraud—see Furbush and Smith (1994), Skinner (1997), and Lowry and Shu (2002).

We extend the PTM in the direction of estimating the average purchase price. In our TAPP measure, the weight assigned to a particular past price considers both the daily turnover on that past day as well as the turnover from that past day until the offer eve, wherein the latter accounts for the attrition over time in veteran investors' holdings. In Appendix A we derive TAPP. The resulting formula is:

(1) $\text{TAPP}_{i,T} = \sum_{t=2}^{T} \alpha_{i,t}^{T} \cdot P_{i,t} + \left(1 - \sum_{t=2}^{T} \alpha_{i,t}^{T}\right) \cdot P_{i,1}$ , where

(2) $\alpha_{i,t}^{T} = \text{x}_{i,t} \cdot \prod_{k=t+1}^{T}(1 - \text{x}_{i,k})$,

where t is a counter of stock i's day of trade on the exchange, t = 1 is the stock's first day of trade on the exchange, t = T is the merger offer date, $P_{i,t}$ is the price of stock i on the exchange on day t, and $\text{x}_{i,t}$ is the daily turnover of stock i on day t—i.e., the proportion of stock i's outstanding shares traded on day t.

The TAPP measure, Eq. (1), weights each past trading-day price according to its α, which is its share in shareholding at the focal day T (the merger offer date in our case). The remaining weight, unaccounted by the sum of α's, is then attributed to the price of stock i on its first day of trade on the exchange. Notably, Eq. (1) resembles the turnover-based, purchase price estimator proposed in Grinblatt and Han (2005) Eq. (9). However, Grinblatt and Han (2005) use different assumptions for deriving their formula, and in practice, limit past-price data to five years, which we do not. Our derivation also suggests some interesting extensions of the estimator.

### 3.2. Other Purchase Price Estimators

We examine several other average purchase price estimators besides the TAPP. The first couple of additional estimators are less sophisticated and include the AVG_PP, a simple average of all past stock prices, and the WAVG_PP, a turnover weighted average of all past stock prices. The exact definitions of these simple estimators are:

(3) $\text{AVG\_PP}_{i,T} = \sum_{t=1}^{T} \frac{1}{T} \cdot P_{i,t}$ , and

(4) $\text{WAVG\_PP}_{i,T} = \sum_{t=1}^{T} \text{x}_{i,t} \cdot P_{i,t} \;/\; \sum_{t=1}^{T} \text{x}_{i,t}$ ,

where, as before, $P_{i,t}$ is the price of stock i on the exchange on trading day t, and $x_{i,t}$ is the daily turnover of stock i on day t.

Further, we extend TAPP to incorporate the recent rise in high-frequency trading (HFT) by short-term investors (such as day traders or robots). Chordia, Roll and Subrahmanyam (2011) estimate that approximately 50% of the daily volume during 2001-2008 is associated with quantitative trading strategies. Hendershott, Jones, and Menkveld (2011) report that 75% of trading volume in 2009 was conducted through computer-based trading. Merger offers are directed to "long-term" investors that do not flip the stock on the day it was purchased, which suggests that not all reported daily volume should enter into average purchase price calculations. Consider a stock in which half of the daily volume is conducted by robots and day traders. Suppose the daily volume on day t is 1,000 shares. Short-term traders buy 250 shares from long-term investors in the morning, and sell the shares back to other long-term investors later that day. This generates a total volume of 500 shares. Another 500 shares are traded between long-term traders. In such a scenario, the relevant long-term daily trade can be summarized as 750—i.e., the number of shares that eventually changes hands (500 directly and 250 with the intermediation of short-term traders). If long-term shareholders determine the response to merger offers, the relevant volume for assessing the purchase price is 750 shares, 0.75 of the reported daily volume. In our TAPP calculations, we should factor the reported daily turnover $x_{i,t}$ by 0.75.

In sum, if two classes of traders exist, and the abovementioned trading behavior is assumed, a more appropriate estimator of the average purchase price might be:

(5) $\text{TAPP\_75}_{i,T} = \sum_{t=2}^{T} A_{i,t}^{T} \cdot P_{i,t} + \left(1 - \sum_{t=2}^{T} A_{i,t}^{T}\right) \cdot P_{i,1}$ , where

(6) $A_{i,t}^{T} = 0.75x_{i,t} \cdot \prod_{k=t+1}^{T}(1 - 0.75x_{i,k})$.

Computationally, the TAPP_75 formulae are identical to the TAPP formulae in Eqs. (1) and (2) with the daily turnover $x_{i,t}$ replaced by $0.75x_{i,t}$. In our empirical work we also compute and examine the TAPP_87.5 that replaces daily turnover $x_{i,t}$ by $0.875x_{i,t}$. This represents a more modest participation in stock trading by short-term traders. In any case, note that factoring down the reported daily stock turnover has a non-trivial impact on the estimated average purchase price, increasing the weight assigned to remote past trading days at the expense of recent-price weights. This change in weights generates a wedge between the TAPP and the TAPP_75.

Last, we follow Frazzini (2006) and Ye (2014) in estimating the institutional investors average purchase price (IIAPP). This measure relies on quarterly filings of institutional investor holdings. Appendix B provides a detailed derivation of the IIAPP. The IIAPP suggested by Ye (2014) is by construction sectorial and relies on strong assumptions—e.g., that all shares are purchased or sold at the end of the quarter, and that the purchase quarter follows a first-in, first-out inventory rule. Despite this limitation, we suggest that IIAPP is a crucial stepping stone in imputing the purchase price of retail investors—thus far considered out of reach.

Now that we have TAPP (a purchase-price measure for all target shareholders) and IIAPP (a measure for institutional investors), we can compute the Retail_APP—an estimate of the average purchase price of retail investors. If we assume that the TAPP is a weighted average of the IIAPP and Retail_APP, then

(7) $\text{TAPP}_{i,T} = w^{T}_{INST,i,t} \cdot IIAPP_{i,T} + \left(1 - w^{T}_{INST,i,t}\right) \cdot Retail\_APP_{i,T}$,

where $w^{T}_{INST,i,t}$ is the proportion of firm i shares held by institutional investors on merger offer eve (time T). The Retail_APP can be readily extracted from Eq. (7)

### 3.3. Hypotheses

Barberis and Xiong (2012) develop a model of realization utility, in which investors derive utility from realizing nominal gains and losses on owned assets. In particular, sellers are averse to realizing nominal losses. If target shareholders are averse to realizing a nominal loss, their purchase price may play a role in either lower acceptance rates or higher premiums privately negotiated before the offer. Several papers focus on private negotiations in the period preceding a merger offer (Boone and Mulherin, 2007; Fich, Cai, and Tran, 2011; Ahern and Sosyura, 2014). Accordingly, we conjecture that when losses relative to purchase price exist, target shareholders may demand some compensation during M&A negotiations. Practically, we propose that the bidder will adjust the offer price upwards when the pre-offer target price is below the TAPP to mitigate the "loss" feelings of most target shareholders. Conversely, when target shareholders are in profit (the pre-offer target price exceeds the TAPP), the bidder may try to shear off some of the offer premium, capitalizing on the winning sentiment of the target shareholders.

**Hypothesis 1:** The merger offer premium depends on the ratio of the target shareholders' average purchase price (TAPP) to the pre-offer, target-stock price.

One might argue that adjusting the premium with respect to the purchase price is rational. For example, in a world with heterogeneous and slow-adjusting expectations about share values, current shareholders might still place weight on their original purchase-date valuation of the stock. However, note that such a rational model requires the assumption of "stubborn" shareholders that maintain their past valuations (generated at their purchase date) and are slow in adjusting their stock valuations. The consistency of such an assumption with rational behavior is questionable. Thus, it is unclear to us whether a rational model can account for the documented evidence.

To further support the behavioral explanation, we test whether premium adjustments are consistent with Prospect Theory, which, importantly, predicts a non-linear relation between the TAPP and the offer premium, specifically an S-curve utility function. We therefore further divide the loss domain into three equal subsamples (small, medium, and large), and construct a piecewise regression to test whether the marginal increase in offer premium decreases with loss size. If the effect is behavioral, we expect it to be strongest for small nominal losses. We also test whether the effect of small losses is stronger than that of small gains, consistent with loss aversion. We further test whether the purchase price has a stronger effect on cash-only deals, which are more clearly aligned with realization utility.

We next decompose the TAPP into institutional and retail average purchase prices (the IIAPP and the Retail_APP, respectively). It is arguable that only institutional investors' stance is influential in the pre-offer negotiations determining the merger offer price. Although previous scholars (Grossman and Hart, 1980) portray retail investors as "followers," and some even perceive their trading as noise that should be restrained (Heimer and Simsek, 2019), sophisticated retail investors also exist (Bellofatto, D'Hondt and Winne, 2018). Importantly, retail investors are more prone to behavioral biases (Shapira and Venezia, 2001; Barber and Odean, 2002; Dhar and Zhu, 2006; Barber and Odean, 2008; Lauterbach and Mugerman, 2020), potentially exacerbating the purchase price effect. Hence, we propose that retail investors' loss aversion concerns are also considered when determining the merger offer price. This implies the following:

**Hypothesis 2:** Both institutional and retail investors' average purchase price impacts the offer premium.

We next consider the purchase price effect along with other reference prices. Riley, Summers, and Duxbury (2020) show that investors' reference points are created not only by the

purchase price, but also by salient points in the prior share-price path. Baker et al. (2012) demonstrate the effect of the pre-offer 52-week high price on merger decisions and conjecture that it represents a salient anchor point for the unobserved fundamental value on the offer eve. As such, market participants use the 52-week high as a reference price to estimate whether the bid offer is fair (i.e., whether the target market price on the offer eve is overvalued or undervalued). Since the TAPP captures nominal gains or losses since the original purchase date—and the 52-week high price captures the salient peak achieved not long before the offer eve—we conjecture that the two reference prices represent two different behavioral effects. If true, we expect the two reference prices to be complementary rather than substitutionary. Thus, we expect the TAPP to have an impact on shareholders' decisions that is additive to that of the 52-week high price.

**Hypothesis 3:** The TAPP effect on the offer premium is additive to that of the 52-week high.

Once the bid is publicly announced, market participants will evaluate the extent to which the premium offered represents an overpayment. Any behaviorally induced extra premium offered to target shareholders will transfer wealth from acquirer to target firms. That said, the overall scope of the bidders' penalty will depend on both overpayment and the likelihood of deal completion. In particular, if market participants perceive the premium offered as gross overpayment, they will also expect target shareholders to accept such a sweet deal, and hence the expected bidder loss (expected loss times the completion likelihood) will manifest in negative and significant bidder-announcement returns.

**Hypothesis 4:** Behaviorally induced extra-offer premiums increase (decrease) the target (acquirer) stock gain upon a merger offer announcement.

One may argue that acceptance likelihood should be negatively correlated with nominal loss. However, as we note in Hypothesis 1, bidders may utilize negotiations to reveal the shareholders they are required to convince and adjust the offer premium to facilitate a positive target shareholder vote. The marginal TAPP effect on acceptance depends on the extent to which premium adjustments offset the effect of purchasing price concerns. We conjecture that during the pre-bid private negotiations, target shareholders' reservation prices are revealed to the bidder, who in turn adjusts the offer price to the point at which such prices do not affect or hinder offer acceptance by target shareholders.

**Hypothesis 5:** After controlling for the adjusted premium, the effect of TAPP on offer acceptance becomes economically insignificant.

## 4. Sample and Data Description

### 4.1. Sample Construction

We examine all mergers of U.S. public firms between 1990 and 2019 available on the SDC M&A (by Thomson Reuters) database. Our detailed data on the offers and deals (such as offer price, payment form, and more) come from this SDC file. Like previous studies, we exclude divestitures, repurchases, self-tenders, and rumored deals, as well as any offers for which the offer price is missing from the SDC database. Following Bates, Becher, and Lemmon (2008), in cases of multiple deals involving the same target and bidder in the same year, we include only the initial bid. Following Gompers, Ishii and Metrick (2003) and Bebchuk, Cohen, and Ferrell (2009), we exclude deals in which the target firm is dual class, as it is difficult to track the bid structure across share classes.

The all-investor purchase price measures are constructed using daily stock prices and volumes extracted from the Center for Research in Security Prices (CRSP) files. The institutional investor purchase price is constructed using institutional ownership data from 13F filings retrieved from Thomson Reuters. Last, various firm characteristics and accounting data are collected from Compustat.

Our final sample comprises 4,910 merger offers. The final sample includes all offers for which we were able to obtain data from all data sources.[2]

### 4.2. Descriptive Statistics

Figure 1 depicts the yearly distribution of merger offers in our sample, spanning from 1990 to 2019. The number of offers per year varies from 65 in 1992 and 2019 to 427 in 1999. The average (median) number of offers is 164 (125). A surge in merger activity occurred in the late 1990s, followed by a relatively calm activity period in the twenty-first century (with two local spikes in 2007 and 2015).

[2] There are a few well-documented issues with merging our data sources: CRSP only covers major stock exchanges (NYSE, AMEX, NASDAQ), Compustat only covers firms with stock market capitalization above $100 million, and 13F filings do not account for short positions.

[Insert Figure 1 and Table 1 about here]

Table 1 describes the sample firms and merger-offer characteristics. All variables are winsorized at the 2.5% and 97.5% levels and refer to the fiscal year preceding the merger offer. We first review the target firm characteristics. The mean total assets of our target firms are approximately $1.3 billion U.S. dollars, yet the median is only $300 million U.S. dollars. Target firms' profitability is relatively poor, with a mean return on assets of about -0.03 (median is 0.01), yet the mean sales growth of about 20% (median is 10%) appears relatively solid. The mean leverage (debt divided by total assets), 0.16, is relatively modest. Target firm stock prices demonstrate a mean price earnings ratio of 11.1 (median is 12.5) and a mean market-to-book value ratio of 2.5 (median is 1.7). The mean (median) target firm institutional ownership on the offer eve is 43.7% (40.9%). That is, both institutional and retail investors are important in evaluating the weighted purchase price of all target shareholders.

Table 1 next reviews our bidder firms. The sample size decreases to 3,816 because small and/or foreign bidders are not covered by CRSP and Compustat. On average, bidder firms are much larger than target firms, with mean total assets of $12.8 billion U.S. dollars, which is almost ten-fold that of target firms. Bidder-firm mean and median return on assets of 0.03 is also higher than that of target firms. The mean sales growth of bidder firms is 25%, slightly higher than that of target firms. Bidder-firm leverage is similar to that of target firms, with an average debt-to-total asset ratio of 0.16. It is interesting to note that the mean number of previous merger offers made by a bidder firm in our sample is 1.46. Apparently, some bidders are prolific and use mergers repeatedly as a growth strategy. We find that the upper decile of our 2,432 unique bidders made 1,492 (about 30% of the) merger offers, and the top bidder made 29 offers. We control for experienced bidders in our empirical analysis. It is also evident that bidder stock pricing is significantly higher than that of the target, with a mean price-earnings ratio of 19.1 and a mean market-to-book ratio of 3.4 (compared to 11.1 and 2.5 in target firms, respectively). Bidder stock pricing may affect their form of payment and hence we control for it in our empirical analysis.

At the bottom of Table 1 we review some of the merger offer characteristics. Thirty-six percent of the offers are cash-only (promise the entire payment in cash), 35% are share-only offers, and the rest offer some mix of cash and securities, or their method of payment is unknown (missing in the SDC files). In about 33% of the merger offers, the bidder and target are from different

industries, representing "diversifying" merger attempts, and in about 7% of the cases, we find multiple bidders (for the same target firm) contemporaneously. The vast majority of the merger offers, 93.9%, are friendly—i.e., the offers are negotiated, agreed upon, and recommended by target and bidder management and boards of directors. Private negotiations in the period preceding a merger offer may allow the bidder to take target shareholder considerations into account in setting the public bid. Consistent with this premise, most of the merger offers (86.7%) are eventually completed and result in an actual merger deal.

Panel A of Table 2 reviews several price ratios that are potentially relevant for the merger offer. The various price ratios represent how the target-stock market price on the offer eve compares to different reference prices. To mitigate the effect of outliers, we winsorize all price ratios at the 2.5% and 97.5% levels and employ a natural log transformation (Ln) of the price ratios. The first price ratio examined is the commonly used offer premium, assessed as the ratio of the merger offer price to the target-stock market price 21 trading days before the offer announcement date (day A-21, henceforth). We choose the stock price 21 trading days (roughly a calendar month) prior to the offer announcement as our baseline price, following observations of an upward drift in target-company stock price in that month. This drift, probably due to information leaks, is part of the merger premium, and thus we account for it. The mean-offer premium is about 32%, consistent with previous studies (Baker et al., 2012). Interestingly, the mean-offer premium is only slightly and insignificantly higher in accepted offers than in failed ones. This finding indicates that the relation between offer premium and offer-acceptance likelihood is less identifiable than initially perceived.

[Insert Table 2 about here]

The rest of the price ratios in Panel A are related to potential reference prices. The mean (median) Ln of the TAPP ratio to the target stock price on day A-21 is 0.052 (-0.028). Similarly, the mean of the six other Ln (average purchase-price ratio to the target stock price on day A-21) are slightly positive, while the medians of these ratios are negative, which suggests that roughly half of the merger offers arrive when target shareholders are at a loss. That is, our sample is well-balanced, with roughly equal weight for offers above and below our purchase price measure. The prevalence of offers made to target firms that experienced a persistent drop in their market price also alleviates any self-selection concerns by which bidders refrain from reluctant targets whose

shareholders insist on a higher reservation price (Lee and Yerramilli, 2022). Last, the mean Ln of the ratio of the target-stock, pre-offer 52-week high price to the target stock price on day A-21 is 0.338, consistent with 0.348 in Baker et al. (2012), which demonstrates that many stocks trade markedly below their yearly high at the time of a merger offer.

Panel A next shows the mean reference price ratios in failed and accepted offers. If target shareholders are averse to realizing nominal losses, failed deals are then expected to be associated with deeper target shareholder losses and hence higher price ratios. We find that—for all reference price ratios—the mean is significantly higher in failed offers. That is, the unconditional completion likelihood diminishes with target shareholder loss. Later in the analysis, we test whether this result remains when we control for the bidders' offer price, which may incorporate compensation for target shareholder loss.

The bottom row in Panel A reports a bidder reference price ratio, which is the ratio of the bidder-stock, pre-offer 52-week high price to the bidder-stock price 21 trading days before the offer announcement (day A-21). Ma et al. (2019) find that the merger premium is negatively correlated to this price ratio, and the effect emanates from the subsample of offers involving payment in shares (see Table 6 in their paper). It appears that the bidders whose stock trades close to its 52-week high price are more generous to target shareholders, perhaps because they believe their stock price is inflated and do not mind paying others with it. Interestingly, in failed offers, this bidder price ratio is significantly higher than in completed merger deals, suggesting that target shareholders are more reluctant to merge with a bidder company that is far below its peak. However, no conclusions can be drawn without a more rigorous formal analysis.

Panel B of Table 2 documents the correlations between some key price ratios in Panel A. The correlation between the TAPP and the IIAPP ratios to the target-stock market price on the offer eve is high at 0.82, which is not surprising given that all investors subsume institutional investors (and hence the purchase price of the former subsumes that of the latter). It is worth noting that the correlation between the TAPP and the 52-week-high price ratios is sizable, about 0.8, warning us about potential collinearity problems. One potential explanation is excess trading around peaks (Huddart, Lang, and Yetman, 2009), which means the peak price will have a high weight in TAPP. The correlation between the TAPP and the offer premium ratios to the target-

stock market price on the offer eve is about 0.25 and statistically significant at the 1% level, consistent with potential compensation for target shareholder loss.

## 5. The Effect of Target Shareholders' Purchase Price on the Offer Premium

### 5.1. The Impact of Target Shareholders' Reference Prices

Table 3 examines the reference price effects on the merger offer premiums, using each reference price separately. The main regression specification is:

$$(8) \qquad Offer_{Prem} = \beta_0 + \beta_1 Ref\_Price_{Prem} + D'\gamma + T'\delta + Fixed + \varepsilon,$$

where the dependent variable $Offer_{Prem}$ (offer premium) is defined as $\text{Ln}(\frac{\text{offer price}}{\text{stock price A}-21})$, and stock price A-21 is the stock price 21 trading days prior to the offer announcement date. The key explanatory variable, $Ref\_Price_{Prem}$, is the premium of the reference price relative to stock price A-21—for example, *TAPP_Prem* = $\text{Ln}(\frac{TAPP}{\text{stock price A}-21})$.[3] For brevity, in Table 3 we examine only two reference prices: the TAPP and the 52-week high. Among the control variables employed, $D'$ is a vector of deal characteristics, $T'$ is a vector of target firm characteristics, *Fixed* represents calendar year fixed effects and industry fixed effects, and $\varepsilon$ is an error term clustered at the target firm level.[4]

The first column in Table 3 examines the effect of various deal and target characteristics on the offer premium. Employing the non-behavioral explanatory variables mentioned in previous research (see our review in Section 2.1), we find that target characteristics such as target size, as well as deal components such as payment form, affect the offer premium. For parsimony, we carry over only the explanatory variables that appear statistically significant.

[Insert Table 3 about here]

Columns (2) and (3) review the effect of the TAPP premium on the offer premium, essentially testing Hypothesis 1. In Column (2) we show that consistent with Hypothesis 1, the TAPP premium (the natural logarithm of the TAPP ratio to the pre-offer stock price) is

[3] One concern is that normalizing both the dependent variable and the key explanatory variable by the market price might create a spurious correlation. We note that all our results remain qualitatively the same without this normalization.

[4] We note that all our results remain qualitatively the same when we cluster by industry-year, alleviating any concern stemming from merger waves.

significantly positively correlated with the offer premium. This finding establishes that the shareholders' purchase price, approximated by the TAPP, is a relevant reference price with material effects on the offer premium.

The positive relation between the offer premium and the TAPP_Prem implies that when shareholders are in a "loss" situation (the average purchase price is higher than the pre-offer price), the bidder offers a higher premium *ceteris paribus*. Behavioral explanations for the relation of TAPP to offer premium suggests sharp predictions. First, the loss-aversion of target shareholders is consistent with an upward revision in the offer premium when investors are in loss (the TAPP_Prem is positive). Further, assuming an S-curve utility function (per Prospect Theory), shareholders' marginal utility loss diminishes as the loss increases, which implies higher marginal compensation for small (close to zero) losses. In short, behavioral models predict a non-linear relation between the TAPP_Prem and the offer premium.

We estimate the non-linear effect of reference prices on the offer premium using a piecewise regression. Accordingly, we divide all cases with gains (pre-offer price larger than the TAPP) into three equal subsamples (small, medium, and large gains), in which the cutoffs between them are gains of 0.109 and 0.241. Similarly, we divide all loss cases (pre-offer price smaller than the TAPP) into three equal subsamples, with cutoff losses of 0.121 and 0.366 that separate them. We then construct six TAPP_Prem variables, three for positive TAPP_Prem (loss situations) and three for negative TAPP_Prem (gain situations). These new explanatory variables are denoted as Positive_TAPP_Prem_X where X is small, medium, or large, and Negative_TAPP_Prem_X where X is small, medium, or large. This piecewise specification results in six incremental gradients bounded by their lower/upper cutoffs, and thus the fit line looks like a "broken stick" comprised of six contiguous lines with different slopes.[5]

The results of the piecewise regression, reported in Column (3), are consistent with prospect theory. The coefficient of (or marginal compensation for) small losses is larger than that

[5] To illustrate, Positive_TAPP_Prem_Small is set equal to 0 when TAPP_Prem is negative, equal to TAPP_Prem when $0 < \text{TAPP\_Prem} \leq 0.121$, and equal to 0.121 when $\text{TAPP\_Prem} > 0.121$; Positive_TAPP_Prem_Medium is set equal to 0 when $\text{TAPP Prem} \leq 0.121$, equal to TAPP_Prem minus 0.121 when $0.121 < \text{TAPP\_Prem} \leq 0.366$, and equal to 0.245 (=0.366-0.121) when $\text{TAPP\_Prem} > 0.366$; Positive_TAPP_Prem_Large is set equal to 0 when $\text{TAPP Prem} \leq 0.366$, and equal to TAPP_Prem minus 0.366 when $\text{TAPP\_Prem} > 0.366$. Similar logic governs the construction of the piecewise Negative_TAPP_Prem variables in which the cutoffs between small, medium, and large Negative_TAPP_Prems are -0.109 and -0.241.

of medium and large losses, supporting diminishing marginal compensation for losses. Only the marginal compensation for small and medium losses are statistically significant at the 1% and 10% levels, respectively. This evidence adds to the basic evidence in Column (2) by demonstrating that the relation between target shareholder losses and the offer premium is non-linear: the marginal compensation (increase in offer price) diminishes with loss size.

In Columns (4) and (5) we present results of regular- and piecewise-offer premium regressions that employ the 52-week-high premium (HIGH_Prem) advocated by Baker et al. (2012). Note that the HIGH_Prem is by definition non-negative because the pre-offer 52-week-high price is always at least equal to the pre-offer target price. Accordingly, in the piecewise regressions we use only three positive HIGH_Prem variables, representing small, medium, and large perceived losses relative to the 52-week high, with cutoffs of 0.100 and 0.349 between them.

Column (4) verifies Baker et al.'s (2012) evidence that the 52-week-high price is a relevant reference price. The higher the HIGH_Prem—i.e., the more undervalued the target is perceived—the higher the offer premium, *ceteris paribus*. Alternatively, bidders may partially compensate target shareholders for missing the recent opportunity of selling their holdings at the 52-week-high price. The piecewise regression results, summarized in Column (5), show that the coefficient of small losses relative to the 52-week high is larger than that of medium and large losses, supporting diminishing marginal compensation for such perceived losses.

In Column (6) we present the results of a piecewise regression employing both the TAPP and the 52-week-high premiums as explanatory variables. This regression tests Hypothesis 3 proposition that the TAPP and the 52-week-high price effects are complementary. Despite the collinearity between the two reference prices (see Panel B of Table 2), the coefficients representing the compensation for small losses remain positive and statistically significant at the 1% level. The coefficients representing the marginal compensation (premium increase) for medium losses are also statistically significant at the 5% and 10% levels. Evidently, both losses relative to purchase price and perceived losses relative to the 52-week-high increase the premium offered by the bidder. Hypothesis 3 predictions are confirmed: The effects of TAPP and the 52-week-high are orthogonal, at least in part.

Last, we attempt both more primitive, as well as more advanced, alternatives for TAPP: the AVG_PP, a simple average of past stock prices; the WAVG_PP, the turnover weighted average

of past prices; the TAPP_75, a TAPP-like measure factoring down daily turnover by 0.75 (to emulate the existence of short-term, high-frequency traders); and the TAPP_87.5, a TAPP-like measure factoring daily turnover by 0.875. For brevity, these results are not tabulated (but available from the authors). We find that the "primitive" average purchase price measures lag far behind in their explanatory power, as the regressions using the AVG_PP and the WAVG_PP attain a markedly lower adjusted R-squared. TAPP also achieves slightly higher adjusted R-squared than the two more elaborate TAPP-style measures that consider the class of short-term traders. The latter result is consistent with Barclay and Torchio (2002) who conclude that elaborating the PTM model by introducing short-term trading does not improve prediction quality (in their case, damage assessment).

Panel B of Table 3 offers a glimpse into the relative importance of institutional and retail investors' purchase prices, by disaggregating the TAPP into its components—Retail_APP and IIAPP. Recall that we impute Retail_APP under the assumption that the TAPP is a weighted average of the Retail_APP and the IIAPP. Our sample size decreases to 4,464 mergers, as we exclude mergers with minute (less than 5%) retail holdings in which the Retail_APP cannot be reliably computed.

Column (1) examines the effect of the Retail_APP, retail investors' average purchase price, as the sole purchasing price indicator. Retail investors' losses relative to their average purchase price are compensated in a way that conforms to Prospect Theory's S-curve utility—i.e., the marginal compensation for small losses appears to be higher. In particular, the coefficient representing the compensation (premium increase) for small retail investors' losses, 0.222, is statistically significant at the 1% level. This is despite the "error in variable" problem, which suppresses statistical significance, and is probably most severe at Retail_APP (as the institutional investors' average purchase price is estimated directly whereas the retail investors' average purchase price is imputed after TAPP and IIAPP are computed).

Column (2) summarizes piecewise regressions with both the Retail_APP and the IIAPP. Consistent with Ye (2004), we find that institutional investors' losses significantly impact the offer premium. Also, consistent with Prospect Theory, the compensation for institutional investors' losses decreases in loss size. Last, the coefficient of retail investors' small losses decreases, yet remains statistically significant at the 10% level.

Column (3) replicates the regression of Column (2) after adding the collinear 52-week-high. The coefficients of institutional investors' small losses and retail investors' small losses decrease relative to Column (2), and the coefficient of retail investors' small losses becomes statistically insignificant.

In both Columns (2) and (3), the compensation for institutional investor losses appears larger than the respective coefficient of retail investors' small losses. This finding may indicate that during merger negotiations, the institutional investor stance is more heavily weighted. To further investigate the effect of institutional investors, we split the sample by institutional ownership in Columns (4) and (5). We find that while the compensation for retail investor losses is negligible when institutional ownership is high (above the median – see Column (5)), the compensation for retail investors' small losses is positive and statistically significant when institutional investor holdings are low (below the median – see Column (4)). Correspondingly, the compensation for institutional investors' losses is relatively large and statistically significant only when the institutional investor holdings are relatively high.

In sum, the findings in Panel B suggest that both retail and institutional investors purchase prices impact the offer premium. Institutional investors are more professional than retail investors, and each institutional investor holds a larger position and thus receives more attention in merger negotiations. Hence, as Columns (2) and (3) document, institutional investor's stance generally has a higher impact on offer premium. Nevertheless, the purchase price of retail investors is also taken into account by the bidder when determining the offer premium, especially in situations where retail investor holdings are relatively large - Column (5), consistent with the notion that behavioral biases have a stronger effect on retail investors than on institutional investors. This evidence is novel and important as it demonstrates that although retail investor positions are in general secondary in importance relative to those of institutional investors, retail investors' impact cannot be ignored.

The rest of the empirical analysis employs TAPP, all investors' average purchase price, as this variable (TAPP) best represents the purchase price effects, that is consistently achieves the maximum R-squares and the most significant coefficients.

### 5.2. The Impact of Adding Bidder Attributes and Reference Prices

Bidder characteristics such as size, profitability, growth and leverage might shape a bidder's perspective and opportunity set and thus impact the offer premium and form of payment (Betton et al., 2008). Table 4 summarizes offer premium regressions on deal-, target- and bidder-characteristics. Deal and target characteristics are the same as in Table 3, and bidder characteristics include: bidder size, leverage, ROA, sales growth, price-earnings ratio, market-to-book ratio, and merger experience (= number of previous merger offers). The premium of the bidder's 52-week high price relative to the bidder's stock price 21 days before the offer, which is possibly a behavioral effect, is also added as an explanatory variable.

[Insert Table 4 about here]

The added requirement for non-missing acquirer information reduces the sample size. Recall that although all bidders are public firms, some are foreign, and others are small and thus not covered by CRSP or Compustat. Hence, prior to adding bidder characteristics, we first verify that the sample size decrease does not change our previous findings. Column (1) thus replicates the piecewise regression with TAPP_Prem and HIGH_Prem of target firms, but within the sample of non-missing bidder information. The results are almost identical to those documented in Column (6) in Panel A of Table 3 for the larger sample, alleviating any sample-selection concerns.

Column (2) adds bidder characteristics and Column (3) presents the parsimonious form. Comparing Columns (3) and (1), we see that upon addition of the bidder-related variables, the explanatory power (adjusted-$R^2$) improves substantially. Bidder characteristics affect the offer premium. We find that experienced bidders slightly decrease their offer premium, perhaps in response to the negative-bidder abnormal returns typically recorded around merger offer proposals. High bidder leverage also lowers the offer premium, possibly because of creditor restrictions. In contrast, relatively large, profitable, and highly valued bidder firms (that manifest relatively high total assets, ROA, and market-to-book ratios) tend to offer higher premiums, possibly because such strong firms can extract larger synergistic gains from the merger deal.

However, the most important result is that the introduction of bidder-related variables considerably strengthens our inference and conclusions regarding the impact of losses relative to the various reference prices. In Column (3), all three Positive_TAPP coefficients are positive and statistically significant, and two out of three High_Prem coefficients are positive and statistically

significant. Further, the coefficients diminish with loss size, indicating that consistent with Prospect Theory, the marginal compensation for loss decreases with loss size.

We also include the bidder 52-week high, as well as its interaction with cash offers. Ma et al. (2019) document that the premium offered in non-cash M&A deals is higher the closer the bidder's stock price is to its 52-week high. This phenomenon may be routed in both bidder and target perspectives. When the bidder stock pre-offer price is close to its 52-week high, it might be overvalued, and thus bidders willingly offer (and target shareholders rationally demand) a higher premium in deals involving payment in bidder shares. In addition, when the bidder's stock is close to its 52-week high, bidder managers are more prone to hubristic behavior that can lead them to offer inflated premiums (Roll, 1986).

Consistent with Ma et al. (2019), we find: (1) the coefficient of Bidder_High_Prem, the premium of the bidder stock's 52-week-high price over the bidder's pre-offer stock price, is negative and statistically significant, indicating that when the bidder stock is close to its 52-week high just before the merger offer, the bidder's offer tends to be more generous; and (2) the coefficients of Bidder_High_Prem and its interaction with cash-only deals are opposite in sign and about the same magnitude, implying that the effect of bidder 52-week-high is limited to non-cash deals.

The payment form offered by the bidder may also attenuate the loss-aversion effect of target shareholders. When the bidder offers its own stock, target shareholders do not actually realize their investment, but rather become shareholders in the combined firm. A cash-only offer, on the other hand, is an offer to target shareholders to sell their shares and realize their nominal loss/gain. If target shareholders are averse to realizing nominal losses, their realization utility will then have the strongest effect in cash-only deals.

In Column (4), we replicate the regression of Column (3) in the cash-only subsample. We find that the compensation (increase in offer premium) for small losses relative to the TAPP is higher in cash-only mergers. Compared with the pooled sample in Column (3), Positive_TAPP_Prem_Small is doubled (the coefficients of Positive_TAPP_Prem_Small increases from 0.46 to 0.88). We can also report that the difference between Positive_TAPP_Prem_Small and Negative_TAPP_Prem_Small—which was not statistically significant in the pooled sample—becomes statistically significant (t=2.59) in the cash-only

subsample. The stronger effect of small losses than that of small gains is consistent with a local kink in the utility function around zero. Consistent with realization utility, more concrete realizations such as cash deals appear to sharpen the loss-aversion attitude and impact of target shareholders.

### 5.3. The Economic Impact of Losses Relative to Reference Prices

Our most-developed empirical analysis, summarized in Column (3) of Table 4, can be used to examine the economic significance of the reference price effects—i.e., level estimates of the extra premium offered when target shareholders are in a loss situation. The magnitude of the compensation for a loss of Y% relative to TAPP (52-week high) is assessed by multiplying the corresponding levels of the three Positive_TAPP_Prem_X (HIGH_Prem_X) variables by their regression coefficients reported in Column (3). Recall that the specification of the three levels is incremental by design to capture the marginal effect in each of the three regions.[6]

Figure 2 plots the extra premium offered for various levels of losses relative to our two reference prices. Several observations are noteworthy. First, the compensation offered for a loss of Y% relative to the TAPP (TAPP_Prem line) is almost identical to the compensation offered for an equal loss relative to the 52-week high (High_Prem line). It appears that the bidder perceives both the nominal loss with respect to the historical purchase price and the perceived loss with respect to the recent high to be of equal importance for target shareholders, and offers an identical schedule of compensation for each of the two reference prices.

[Insert Figure 2 about here]

Second, the extra premium exhibits diminishing marginal compensation for losses. Figure 2 demonstrates the magnitude of the phenomenon. For example, in a loss of 10% relative to the 52-week high, the extra premium offered is 5.4%, while in a five-fold loss of 50% relative to the 52-week high, the total extra premium offered is less than double, 9.2%. The higher marginal compensation for small losses is consistent with Prospect Theory and its S-shaped utility function

[6] For example, suppose on the eve of the offer, target shareholders are in a loss of 10% relative to the TAPP and 15% relative to the 52-week high. In this case: Positive_TAPP_Prem_Small = 10%, Positive_TAPP_Prem_Medium = 0, and Positive_TAPP_Prem_Large = 0; HIGH_Prem_Small = 10%, HIGH_Prem_Medium = 5%, and HIGH_Prem_Large = 0. Given the coefficients in Column (3), the assessed increase in offer premium attributed to the loss relative to the TAPP is 0.460 × 10% = 4.60%, while the assessed increase in offer premium due to the loss relative to the 52-week high is 0.549 × 10% + 0.130 × 5% = 6.14%. Thus, in our example, the total increase in offer premium due to losses relative to reference prices, 10.74%, is economically significant.

of economic agents (target shareholders in our case). It might also indicate a limit to the bidder's generosity and her willingness to compensate target shareholders for their losses. Thus, it is possible that both sides of the deal are responsible for the diminishing marginal compensation phenomenon.

Third, it is interesting that the sum of the coefficients of Positive_TAPP_Prem_Small, 0.460, and HIGH_Prem_Small, 0.549, is very close to 1. The implication is that if target shareholders are in a 10% loss relative to our estimate of their purchase price (TAPP), as well as a 10% loss relative to the 52-week high, they are offered an extra merger premium of about 10%. In such a case we can argue that they receive full compensation for their losses. In short, it can be argued that sometimes the bidder fully compensates target shareholders for small losses relative to their two pertinent reference prices—namely, purchase price and 52-week high.

Last, the magnitude of the extra premium offered in response to losses relative to the reference prices is nontrivial. If the mean merger offer premium is about 32% (see Table 2), an extra premium for perceived losses of 10% (like in the example above) constitutes a nontrivial fraction of it.

## 6. Additional Evidence

### 6.1. Reference Prices and Market's Response to the Merger Announcement

Our Hypothesis 4 proposes that the extra premium offered to target shareholders in cases in which they are in loss relative to their average purchase price, promotes (diminishes) the target (acquirer) shareholders' return upon offer announcement. That is, we expect a wealth transfer between bidders and targets attributable, at least in part, to premium adjustments based on the historical purchase price of current target shareholders.

We estimate acquirer and target stock responses to the merger offer announcement, using two benchmark models: (1) the market model with the CRSP value-weighted market index, and (2) the Fama-French 5-factors model with factor returns data downloaded from Ken French's website (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html). In both models, the parameter estimation period spans days A-250 through A-21, where day A is the merger announcement day.

Consistent with previous studies of mergers, we approximate the offer announcement stock response by the cumulative abnormal return (CAR) over three days (day A-1 through A+1)—see Betton et al. (2008)'s review. We compute the CAR(-1,1) as the average of individual stocks' $CAR_i(-1,1)$, where the $CAR_i(-1,1) = \prod_{T=-1}^{T=1}(1 + AR_{i,T})$, $AR_{i,T}$ is the abnormal return of stock i on day T, and day 0 is the offer announcement date. For robustness checks, we also compute the CAR (-5,5). Also important, we exclude failed merger offers because their low success probability might have been evident from the start—i.e., the response to these offers might not be representative.

Table 5 presents the results. Panel A documents that target shareholders experience large positive revaluations (CARs) upon merger announcements. Further, these announcement gains are significantly higher when target shareholders are in loss relative to their average purchase price, the TAPP. For example, when target shareholders are in loss relative to the TAPP, their average abnormal return on merger announcements is about 32%, much higher than the 19% mean abnormal return of targets that are in gain relative to TAPP. Notably, the CAR estimates of the Fama-French 5 factor methodology and the market model methodology are very similar, probably due to the large offer announcement-date revaluation of the target stock. The extended 11-day CAR, CAR(-5,5), also manifests little difference relative to our main revaluation estimate, CAR(-1,1). It appears that pre-announcement losses of target shareholders relative to our two reference prices amplify the positive response of the target stock to the merger offer announcement.

[Insert Table 5 about here]

The acquirer CAR statistics are summarized in Panel B. Acquirer sample size is smaller because some acquirers are foreign, and some are not covered by CRSP. We find that, on average, acquirer shareholders lose on merger offer announcements and these losses are significantly higher when target shareholders are in loss relative to the TAPP. The higher premiums paid to target shareholders as compensation for their losses appear to significantly hurt acquirer shareholders. The mean CAR(-1,1) when extra premiums are paid (the TAPP is higher than target's pre-offer stock price) is approximately -1.6%, significantly more negative than the mean response of approximately -0.9% documented for cases in which no extra premium is needed (TAPP is lower than the target's pre-offer price). Similar evidence is obtained when below and above median "losses" relative to the target 52-week high price are compared. Larger losses relative to the 52-week high are associated with deeper acquirer shareholders' losses on offer announcements.

The CAR results in Panels A and B are consistent with previous evidence on samples of public bidders and targets like ours. For public firm mergers, existing literature records negative (positive) acquirer (target) CARs—see Betton et al. (2008) and de Bodt et al. (2018).However, it remains unclear whether and to what extent the wealth transfer from bidders to targets evident in Panels A and B is driven by premium adjustments based on the historical purchase price of current target shareholders. In particular, does the extra premium paid due to reference prices reflects overpayment?

The evidence in Panels A and B tends to support Hypothesis 4 that the extra premium offered to target shareholders in compensation for their losses relative to TAPP and the 52-week high are at least partly overpayments that transfer wealth from acquirer- to target-shareholders. To further examine this hypothesis, we conduct a Two-Stage-Least-Squares analysis, like the one in Table 8 of Baker et al. (2012). Panel C presents our results. In the first stage we estimate the offer premium attributable to our two reference prices, and in the second stage we run a regression of CAR(-1,1) on the fitted offer premium and various control variables. As Baker et al. (2012) explain, this methodology cleans out the effect of synergy gains and leaves us with the effect of reference prices on announcement CARs.

Panel C reports that the fitted offer premium has a negative and significant effect of acquirer's CAR(-1,1) and a positive and significant effect on target's CAR(-1,1). The results are similar when CAR(-5,5) is employed (unreported results available from the authors). Thus, in sum, the more elaborate analysis of Panel C reinforces our conclusion that the extra premium paid for losses relative to reference prices is a behavioral phenomenon that tends to hurt acquirer shareholders and benefits target shareholders.

### 6.2. Reference Price Effects on Offer-acceptance Likelihood

Our Hypothesis 5 proposes that during the pre-bid private negotiations, target shareholders' reservations and reference prices are revealed to the bidder, who in turn adjusts the offer price to a point at which these prices do not affect or hinder offer acceptance by target shareholders. Recall that Panel A of Table 2 suggests that the unconditional deal-completion likelihood diminishes with target shareholder loss. In this section, we test whether the effect of the purchase price on deal completion persists after controlling for the bidders' offer price.

Table 6 presents the results of Probit analyses of offer acceptances. We employ a full suite of controls including deal controls, target- and bidder-firm controls, and industry- and fiscal year-fixed effects. Most importantly, we add the following as explanatory variables: (1) the offer premium (a full quartic polynomial of the offer premium, following the specification in Table 7 of Baker et al., 2012), and (2) two dummy variables, Dum_High and Dum_TAPP, that equal 1 in cases in which the offer price exceeds the 52-week high price and TAPP respectively. The coefficient of Dum_TAPP in the above-suggested specification will inform us whether any residual effect of a loss relative to TAPP remains after controlling for premium adjustments to such loss as well as the 52 week-high price.

[Insert Table 6 about here]

Columns (1) and (2) report the benchmark Probit analysis without the presence of any reference prices. From Column (2), the parsimonious form of the Probit results, we can see that several of the control variables affect the offer-acceptance likelihood. It appears that relatively large targets demonstrating relatively high sales-growth rates are more likely to reject merger offers. On the other hand, offers of large and highly valued bidders are more likely to be accepted. Thus, offer-acceptance likelihood appears to depend on the relative size and relative "success" of the bidder and target. Deal characteristics also have a nontrivial impact on offer-acceptance likelihood. Friendly offers are more likely to be accepted, while diversifying offers proposing to combine firms from different industries are less convincing and more often rejected. In addition, rivalry between several bidders for the firm naturally reduces any likelihood of offer success.

Column (3) adds Bidder_High_Prem, the premium of bidder stock's 52-week high price over the bidder stock's pre-offer level, as an explanatory variable. The Bidder_High_Prem effect on the offer-acceptance likelihood is negative and statistically significant. Consistent with Ma et al.'s (2019) evidence on offer success in public firms (see their Table 8, specifically the last set of tests), the closer the bidder pre-offer price is to its 52-week high price (i.e., the lower is our Bidder_High_Prem), the more likely an offer acceptance. Perhaps when the bidder's pre-offer price is close to its peak, public shareholders are somewhat enthusiastic about the bidder firm, and target shareholders are less inimical towards merging with it, thus increasing the offer-acceptance likelihood.

In Column (4), we add Dum_High to estimate the effect of the offer price exceeding the 52-week high price of target stock (specifically, Dum_High equals 1 when the offer price ≥ target's 52-week high price and 0 otherwise). Consistent with Baker et al. (2012), the coefficient of Dum_High is positive and statistically significant at the 1% level, indicating that when the offer price exceeds the 52-week high price of the target stock, the offer-success likelihood increases significantly. Given the point estimate of the Dum_High coefficient, we assess a 3.8% jump in acceptance probability when the offer price exceeds the target stock's 52-week high.

Column (5) employs our main variable of interest, Dum_TAPP. The effect of offer price exceeding the TAPP on the offer-acceptance likelihood is positive and significant at the 10% level. However, the magnitude of the purchase price effect on offer acceptance is modest relative to that of Dum_High documented in Column (4). The weaker effect of Dum_TAPP than that of Dum_High on offer-acceptance likelihood is reinforced by the Probit analysis of Column (6) in which we toss together these dummy variables. Interestingly, only the coefficient of Dum_High is statistically significant. The Dum_TAPP coefficient is positive yet minute and statistically insignificant. The disparate effect of the 52-week high price and TAPP on offer acceptance is consistent with the notion that the two reference prices are not mere substitutes; rather, they capture two separate underlying motives. Arguably, premium adjustments by bidders with respect to target shareholders historical purchase price capture compensation for target shareholder nominal losses, while premium adjustments by bidders with respect to the target 52-week high price capture target undervaluation.

Overall, the most important takeaway from Table 6 is that once the offer premium is adjusted for the reference prices, TAPP and the 52-week-high, the residual effect of reference prices on the offer-acceptance decision is practically negligible. Most notably, the Probit analysis Pseudo $R^2$ increases very slightly, from 0.372 in a model without any behavioral effects, summarized in Column (2), to 0.379 in a model with all behavioral effects, summarized in Column (6). In untabulated tests, we further confirm the meagre residual effect of the reference prices on acceptance likelihood by comparing the number of correct predictions of Probit models with and without reference price dummies. Arguably, the pre-deal negotiations reveal to the bidder the offer price required to neutralize the effect of target shareholder losses on offer completion likelihood. The acquirer appears to raise the bid price to a point where these losses do not hinder anymore merger completion chances. That is, the premium adjustments offered by the bidder equalize

acceptance likelihood, in which case target shareholders will no longer care about surpassing their reservation price.

## 7. Summary and Conclusions

We test whether and how a measure of shareholders stock purchase price—the TAPP—performs as a reference price in merger offers. In a large sample of all merger offers for U.S. public firms from 1990 to 2019 in which the bidder firm is also public, we find that the ratio of the TAPP to the pre-offer target stock price impacts the merger offer premium significantly. Consistent with Prospect Theory, the offer premium increases when target shareholders are in loss (relative to their purchase price) on the eve of the offer, and the marginal compensation for a loss decreases with the loss size. Thus, the TAPP appears to represent well the "mental accounting" considerations of target shareholders—that is, their aversion to realize nominal losses.

Interestingly, in our sample, the TAPP dominates the effect of institutional investors' average purchase price (Frazzini, 2006; and Ye, 2014), an indication that retail investors' purchase price is also taken into account when determining the offer premium. Nevertheless, our findings also suggest that institutional investors' stance is more influential than retail investors' position during the merger premium determination.

In further tests we show that the TAPP complements the effect of another reference price—the target stock's pre-offer 52-week high price (Baker et al., 2012). We show that both the TAPP and the 52-week high significantly impact the merger offer premium. The premium adjustment for a loss relative to TAPP is about equal to the adjustment for a perceived loss relative to the 52-week high. Apparently, both loss aversion (TAPP) and regrets (52-week high) impact merger offer premiums.

The extra premium offered as compensation to target shareholders for losses relative to their purchase price and perceived losses relative to the 52-week high price have significant wealth effects. On average, acquirer stock declines and target stock increases as a result of the reference-price-induced addition to the offer premium. It appears that acquirers could benefit from a milder consideration of the target shareholders' reference prices.

Last, we find that when the offer premium is used as an explanatory variable in the Probit offer-acceptance likelihood, our two reference prices have a negligible residual impact on target

shareholders' decision to accept or reject an offer. It appears that behavioral reference prices impact merger offers primarily (or practically even solely) via their effect on the merger premium.

## Appendix A: Estimating the Average Purchase Price of All Shareholders

Suppose we have data on daily prices, volumes of trade, and outstanding number of shares for a specific stock, and we are interested in computing a measure of the average purchase price of its current (say day T) shareholders. The ideal estimate is a weighted average of past prices in which the weight of a particular past price (price on day t) approximates the proportion of current shareholders that bought the share at that price and held it till day T. An immediate plausible assumption is that the higher the turnover (volume divided by outstanding shares) on a specific past date (day t), the higher its weight. However, a second factor must be considered, as shareholders who purchased the stock further back in time (on day t=T- $\tau$, where $\tau$ is large) are more likely to have sold it by day T. Therefore, an appropriate measure of current shareholders' average purchase price should also discount more heavily prices that are further back in time.

Our method for discounting more heavily further-away prices is based on the Proportional Trading Model (PTM) frequently used by courts in class-action suits for assessing the damage caused by security fraud. Furbush and Smith (1994) discussed this model and its application in litigation.

The PTM postulates that on trading day t, each existing shareholder of stock i sells a proportion $x_{i,t}$ of her holdings regardless of their longevity. Accordingly, $x_{i,t}$ can be estimated as the proportion of stock i's outstanding shares traded on day t, that is:

(A1) $x_{i,t} = \frac{Number\ of\ shares\ of\ i\ traded\ on\ day\ t}{Total\ number\ of\ shares\ of\ i\ outstanding\ on\ day\ t}$ .

We define the average purchase price of share i at time T as the weighted average of past share prices in which the share price on each trading day t in the past receives a weight according to the proportion of existing shareholders at time T that bought and held stock i since day t. For example, if the total outstanding shares of stock i is constant at 1 million shares, 1,000 shares were bought on day t, yet 600 of these shares were sold by day T, then $\alpha_{i,t}^{T}$, the proportion of outstanding shares of i at time T purchased on day t in the past is: (1000-600)/1,000,000 = 0.0004.

Returning to our specific problem of estimating the average target stock purchase price at the merger offer date, suppose we are at market close on the day of an offer (day T) and wish to assess the series of $\alpha_{i,t}^{T}{}'s$, the proportion of outstanding shares of i at time T (offer date) purchased

on day t in the past. First, according to Eq. (A1), the proportion of outstanding shares at the end of day T purchased during day T is:

(A2) $\alpha_{i,T}^{T} = x_{i,T}$ .

For example, if 0.5% of the outstanding shares were traded on day T, then, at the end of day T, 0.5% of the shares were purchased at the day T price. Progressing backwards to day T-1,

(A3) $\alpha_{i,T-1}^{T} = x_{i,T-1} \cdot (1 - x_{i,T})$ .

To demonstrate, if 0.6% (0.006) of outstanding shares were traded on day T-1, 99.5% of them were still held on day T close (0.5% were sold on day T; see above). Thus, among all shareholders of i on day T close, the fraction of shares bought on day T-1 is 0.006 times 0.995 = 0.000597. More generally,

(A4) $\alpha_{i,t}^{T} = x_{i,t} \cdot \prod_{k=t+1}^{T}(1 - x_{i,k})$.

Given the series of α's, the average purchase price of the shares of stock i held at the end of day T, $TAPP_{i,T}$ , can be calculated as the following weighted average:

(A5) $TAPP_{i,T} = \sum_{t=2}^{T} \alpha_{i,t}^{T} \cdot P_{i,t} + \left(1 - \sum_{t=2}^{T} \alpha_{i,t}^{T}\right) \cdot P_{i,1}$ ,

where t is a counter of stock i's day of trade on the exchange, t = 1 is the stock's first day of trade on the exchange, and $P_{i,t}$ is the price of stock i on the exchange on day t. In Eq. (A5), each trading-day price is weighted according to its α, which is its share in shareholding at focal day T (the merger offer date in our case). The remaining weight, unaccounted by the sum of α's, is then attributed to the price of stock i on its first day of trade on the exchange.

In retrospective, TAPP accomplishes our initial conditions for an adequate purchase price estimator. By its definition in Eq. (A4), the weight α assigned to a particular past price considers both the daily turnover on that past day, $x_{i,t}$ , and the attrition over time in veteran investor holdings (the fact that they might have sold the shares by our focal time T). This attrition in holdings is accounted for by setting a diminishing weight to earlier prices, the $\prod_{k=t+1}^{T}(1 - x_{i,k})$ factor in Eq. (A4), in which the discount on an early date (say day t) price depends on the trading activity or turnover in the stock during the period between day t and day T. By Eq. (A4), the higher the turnover in the stock, the heavier the discount of past prices—i.e., the lower the weight of the price on a particular day t in the past. This discounting method appears plausible, hence the TAPP, as defined in Eq. (A5), appears as a legitimate purchasing price estimator.

In practice, our calculations employ several simplifying assumptions. For example, in Eq. (A5), we should have used the IPO price for the remaining weight ($1-\sum\alpha_{i,t}$).[7] We instead use the stock price on its first day of trade on the exchange. However, the error created by this deviation is relatively small, as most stocks are veterans on the exchange, hence the weight assigned to the first day of trade is typically minute. Another practical deviation is that although we correct prices for splits, we ignore cash dividends and other distributions that may affect the shareholders' perceived purchase price.

## Appendix B: The Average Purchase Price of Institutional Investors

Frazzini (2006) developed the Institutional Investors Average Purchase Price (IIAPP, in short). Institutional investors are required to report their equity holding information on a quarterly basis. These data are available on SEC Form 13F (s34 files on WRDS). Frazzini (2006) assessed the number of shares of stock i purchased or sold by institutional investor Y during quarter t by computing the difference in the number of i shares held by institutional investor Y between the end of quarter t and the end of quarter t-1. Stock i's price at the report date (end of the quarter) is used as a proxy for the institutional investor's purchase price. For each stock-institutional investor combination, Frazzini generated a queue of all purchases and sales over time. Holdings that are purchased first are assumed to be sold first (a first-in-first-out inventory system). This process affords an assessment of the purchase date and price of each share of stock i held by each institutional investor at the end of each quarter. Next, for each institutional investor, we compute the weighted purchase price for the inventory of shares of stock i held by this institutional investor at the end of the quarter preceding the merger announcement date:

(B1) $\text{APP}_{Y,i,T} = \sum_{t=0}^{T} \alpha_{Y,i,t}^{T} \cdot P_{i,t}$ ,

where $\text{APP}_{Y,i,T}$ is the average purchase price of the i shares held by institutional investor Y at time T (end of the quarter preceding the merger offer date), $\alpha_{Y,i,t}^{T}$ is the proportion of institutional investor Y's holdings of stock i at time T that was purchased in quarter t in the past,[8] and $P_{i,t}$ is

[7] If IPO price is known, the following formula is appropriate: $\text{TAPP}_{i,T} = \sum_{t=1}^{T} \alpha_{i,t}^{T} \cdot P_{i,t} + \left(1 - \sum_{t=1}^{T} \alpha_{i,t}^{T}\right) \cdot P_{i,0}$ , where $P_{i,0}$ is the IPO price, and $P_{i,1}$ is the stock i closing price on its first day of trade on the exchange.

[8] $\alpha_{Y,i,t}^{T}$ is computed based on the inventory book of institutional investor Y as $N_{Y,i,t}^{T}/N_{Y,i}^{T}$, where $N_{Y,i,t}^{T}$ is the number of shares of i that were bought by institutional investor Y on quarter t and held until the end of quarter T, and $N_{Y,i}^{T}$ is the total number of shares of i held by institutional investor Y at the end of quarter T.

the price of stock i on the exchange at the end of quarter t. For example, if institutional investor Y's current inventory consists of 500 shares bought in quarter T-2 and 250 shares bought in quarter T-1, Eq. (6) tells us that the average purchase price by institutional investor Y is two-thirds of the stock price at the end of quarter T-2 plus one-third of the stock price at the end of quarter T-1.

Last, following Ye (2014), we estimate the IIAPP as a weighted average of all institutional investors' purchase prices. The weight assigned to institutional investor Y's purchase price is its proportion of the total institutional investors' holdings of stock i at the end of the quarter preceding the merger announcement date. The resulting estimate is as follows:

(B2) $\text{IIAPP}_{i,T} = \sum_{Y=1}^{N} w_{Y,i,t}^{T} \cdot APP_{Y,i,T}$ ,

where $\text{IIAPP}_{i,T}$ is institutional investors' (weighted) average purchase price of stock i shares as of time T, $\text{APP}_{Y,i,T}$ is the corresponding average purchase price of institutional investor Y, $w_{Y,i,t}^{T}$ is the proportion of institutional investor Y in the total institutional investors holdings at time T, and N is the number of institutional investors holding stock i.

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**Table 1: Sample Descriptive Statistics**

The table describes our sample of 4,910 merger offers for U.S. public firms from 1990 to 2019. Target and bidder characteristics are computed using Compustat utilizing data for the fiscal year preceding the offer. Return on assets is income before extraordinary items (IB) divided by total assets (AT); sales growth rate is the rate of sales growth over the prior fiscal year; leverage is long-term debt total (DLTT) divided by total assets (AT); market-to-book ratio is market equity, computed by multiplying common shares outstanding and price at fiscal year-end (PRCC_F*CSHO), divided by common/ordinary shareholders' equity at fiscal year-end (CEQ); price-earnings ratio is the ratio of year-end stock price (PRCC_F) to earnings per share for that year (EPSPX). All characteristics are winsorized at the 2.5% and 97.5% levels. The merger offer characteristics: form of payment (all-cash, all-stock), bidder attitude (friendly), existence of rival bids (offers with more than one bidder), diversifying offers (the bidder and target have different 2-digit Standard Industrial Classification codes), and deal completion indicator, are from the SDC file (Thomson Reuters).

| | Number of observations | Mean or proportion | Median | Standard deviation |
|---|---|---|---|---|
| ***Target firm characteristics*** | | | | |
| Total assets (in million dollars) | 4,832 | 1,322.99 | 300.85 | 2,805.74 |
| Sales growth rate | 4,713 | 0.1996 | 0.0995 | 0.4210 |
| Return on assets | 4,832 | -0.0289 | 0.0121 | 0.1728 |
| Debt divided by total assets | 4,803 | 0.1565 | 0.0788 | 0.1826 |
| Market-to-book ratio of the stock | 4,808 | 2.4993 | 1.7302 | 2.3795 |
| Price-earnings ratio of the stock | 4,814 | 11.13 | 12.50 | 31.86 |
| Institutional ownership | 4,703 | 0.4373 | 0.4085 | 0. 2884 |
| ***Bidder firm characteristics*** | | | | |
| Total assets (in million dollars) | 3,816 | 12,761.28 | 2,432.28 | 26,488.70 |
| Sales growth rate | 3,739 | 0.2498 | 0.1285 | 0.4408 |
| Return on assets | 3,811 | 0.0283 | 0.0313 | 0.0917 |
| Debt divided by total assets | 3,798 | 0.1615 | 0.1137 | 0.1601 |
| Market-to-book ratio of the stock | 3,755 | 3.4064 | 2.3145 | 3.0745 |
| Price-earnings ratio of the stock | 3,747 | 19.1018 | 16.7079 | 32.2015 |
| Bidder experience (number of previous bids) | 4,303 | 1.46 | 0 | 2.75 |
| ***Merger offer characteristics*** | | | | |
| Proportion of completed deals | 4,910 | 0.8668 | | |
| Proportion of diversifying offers | 4,910 | 0.3275 | | |
| Proportion of rival bids | 4,910 | 0.0725 | | |
| Proportion of "all cash" offers | 4,910 | 0.3613 | | |
| Proportion of "all stock" offers | 4,910 | 0.3452 | | |
| Proportion of "friendly" offers | 4,910 | 0.9385 | | |

## Table 2: Various Price Ratios on the Eve of Merger Offer

Panel A documents the mean and median of some potentially relevant price ratios on the eve of merger offers, including a partition by deal completion. The sample includes 4,910 merger offers for U.S. public firms from 1990 to 2019. TAPP is the average purchase price measure we develop; AVG_PP is a simple average of all past stock prices; WAVG_PP is a turnover-weighted average of all past stock prices; TAPP_75 (TAPP_87.5) is a TAPP-style measure with daily turnover multiplied by 0.75 (0.875) (more details in the text); IIAPP is the institutional investors' average purchase price (see Appendix B); Retail_APP is the retail investors' average purchase price (see Equation 7), and the price on day A-21 is the price 21 trading days (about a month) before the offer announcement. Winsorizing is performed on each of the ratios at the 2.5% and 97.5% levels. The last column reports the difference in the mean price ratio between completed and failed deals, as well as its statistical significance (derived from a two-sided t-test of mean differences). ***, **, and * indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively. Panel B documents the correlations of key price ratios.

Panel A: Mean and Median of Various Price Ratios

| Price ratio | Number of obs. | Mean (median) for all offers | Mean (median) for completed deals | Mean (median) for failed offers | Difference in means between completed and failed offers |
|---|---|---|---|---|---|
| Ln (offer price / target stock price on day A-21) | 4,910 | 0.316<br>(0.293) | 0.318<br>(0.294) | 0.302<br>(0.285) | 0.016 |
| Ln (TAPP / target stock price on day A-21) | 4,910 | 0.052<br>(-0.028) | 0.040<br>(-0.037) | 0.126<br>(0.042) | -0.086*** |
| Ln (AVG_PP / target stock price on day A-21) | 4,910 | 0.013<br>(-0.119) | -0.001<br>(-0.136) | 0.105<br>(-0.035) | -0.106*** |
| Ln (WAVG_PP / target stock price on day A-21) | 4,910 | 0.101<br>(-0.082) | 0.083<br>(-0.095) | 0.220<br>(0.046) | -0.137*** |
| Ln (TAPP_75 / target stock price on day A-21) | 4,910 | 0.066<br>(-0.033) | 0.051<br>(-0.045) | 0.158<br>(0.054) | -0.107*** |
| Ln (TAPP_87.5 / target stock price on day A-21) | 4,910 | 0.058<br>(-0.031) | 0.045<br>(-0.041) | 0.142<br>(0.048) | -0.097*** |
| Ln (target's IIAPP / target stock price on day A-21) | 4,795 | 0.084<br>(-0.024) | 0.070<br>(-0.035) | 0.179<br>(0.056) | -0.109*** |
| Ln (target's Retail_APP/ target stock price on day A-21) | 4,640 | 0.125<br>(-0.0003) | 0.109<br>(-0.013) | 0.230<br>(0.097) | -0.121*** |
| Ln (target's pre-offer 52-week high price / target stock price on day A-21) | 4,910 | 0.338<br>(0.193) | 0.329<br>(0.186) | 0.401<br>(0.257) | -0.072*** |
| Ln (bidder's pre-offer 52-week high price / bidder's stock price on day A-21) | 4,130 | 0.194<br>(0.111) | 0.185<br>(0.103) | 0.257<br>(0.173) | -0.072*** |

Panel B: Pearson Correlations of Key Price Ratios

| Price ratio | | [1] | [2] | [3] | [4] | [5] | [6] |
|---|---|---|---|---|---|---|---|
| Ln (offer price / target stock price on day A-21) | [1] | 1 | | | | | |
| Ln (TAPP / target stock price on day A-21) | [2] | 0.2566*** | 1 | | | | |
| Ln (TAPP_75 / target stock price on day A-21) | [3] | 0.2497*** | 0.9801*** | 1 | | | |
| Ln (target's pre-offer 52-week high price / target stock price on day A-21) | [4] | 0.2455*** | 0.7996*** | 0.7767*** | 1 | | |
| Ln (target's IIAPP / target stock price on day A-21) | [5] | 0.2399*** | 0.8225*** | 0.8000*** | 0.7768*** | 1 | |
| Ln (target's Retail_APP / target stock price on day A-21) | [6] | 0.0987*** | 0.5105*** | 0.4877*** | 0.3022*** | 0.1705*** | 1 |

**Table 3: Target Shareholders' Average Purchase Price Effect on the Offer Premium**

Panel A reports results of OLS regressions seeking to explain the merger offer premiums (Offer_Prem). The offer premium is defined as Ln(offer price/stock price A-21) in which stock price A-21 is the target stock price 21 trading days (about a month) before the offer announcement date. Regarding our reference price explanatory variables, HIGH_Prem measures the impact of the 52-week-high price, and is defined as Ln(the pre-offer 52-week-high price/stock price A-21); and TAPP_Prem measures the impact of TAPP (target shareholders average purchase price) and is defined as Ln(TAPP/stock price A-21). Columns (3), and (6) report the results of piecewise regressions estimating the marginal effects of the size of the reference price premium. For example, TAPP_Prem is divided into three loss regions: small, medium, and large losses on the offer eve (relative to TAPP) and three gain regions with a separate marginal coefficient estimated for each of these six regions. (More details in the text.)

In Panel B we further break TAPP into two components, institutional investors' average purchase price (IIAPP) and retail investors' average purchase price (Retail_APP), to compare institutional vs. retail investors impact on the offer premium.

All merger deal characteristics are from the SDC: Friendly is a dummy variable equal to 1 if the deal attitude is friendly and equal to 0 if not; All_Cash is a dummy variable equal to 1 if the deal consideration structure is cash only and equal to 0 if not; All_Stock is a dummy variable equal to 1 if the deal consideration structure is shares only and equal to 0 if not; Diversified is a dummy variable equal to 1 if the bidder and target are from different industries (as defined by their 2-digit Standard Industrial Classification codes) and equal to 0 if not; Rival_Bid is a dummy variable equal to 1 if a target has more than one bidder at the time of the offer and equal to 0 if not. Target firm characteristics employed as explanatory variables include: Target_Size is the natural logarithm of the firm's total assets (in millions of U.S. dollars) at the end of the fiscal year preceding the offer; Sales_Growth is the rate of sales growth over the prior fiscal year; DA is the ratio of long-term debt to total assets at the end of the fiscal year preceding the offer; ROA is a ratio of income before extraordinary items to total assets at the end of the fiscal year preceding the offer; MB is the ratio of year-end market value of common stock to the book value of equity for the prior fiscal year; PE is the ratio of year-end stock price to earnings per share for the prior fiscal year. All continuous variables are winsorized at the 2.5% and 97.5% levels, and all specifications include calendar year and industry fixed effects (using the Fama-French 48 industry classification). Robust standard errors, clustered at the target firm level, are in parentheses. $^{*}$, $^{**}$ and $^{***}$ denote significance at the 10%, 5% and 1% levels, respectively.

Panel A: The TAPP and the 52-week-high Effects on the Offer Premium

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Friendly | -0.0172 | -0.0217* | -0.0179 | -0.0223* | -0.0198 | -0.0188 |
| | (0.0135) | (0.0123) | (0.0121) | (0.0122) | (0.0122) | (0.0121) |
| All_Cash | 0.0386*** | 0.0427*** | 0.0424*** | 0.0409*** | 0.0409*** | 0.0424*** |
| | (0.00854) | (0.00810) | (0.00803) | (0.00813) | (0.00809) | (0.00803) |
| All_Stock | -0.0309*** | -0.0384*** | -0.0377*** | -0.0440*** | -0.0436*** | -0.0405*** |
| | (0.00886) | (0.00858) | (0.00852) | (0.00857) | (0.00851) | (0.00852) |
| Diversified | 0.00567 | | | | | |
| | (0.00755) | | | | | |
| Rival_Bid | 0.00345 | | | | | |
| | (0.0150) | | | | | |
| Sales_Growth | -0.00656 | | | | | |
| | (0.00982) | | | | | |
| DA | 0.0295 | | | | | |
| | (0.0233) | | | | | |
| ROA | -0.0111 | | | | | |
| | (0.0298) | | | | | |
| MB | -0.00397** | -0.0000674 | | | | |
| | (0.00171) | (0.00158) | | | | |
| PE | -0.000129 | | | | | |
| | (0.000109) | | | | | |
| Target_Size | -0.0160*** | -0.00950*** | -0.00998*** | -0.0108*** | -0.00997*** | -0.00860*** |
| | (0.00236) | (0.00220) | (0.00224) | (0.00223) | (0.00222) | (0.00225) |
| TAPP_Prem | | 0.142*** | | | | |
| | | (0.0125) | | | | |
| Positive_TAPP_Prem_Large | | | 0.0403 | | | 0.0318 |
| | | | (0.0346) | | | (0.0379) |
| Positive_TAPP_Prem_Medium | | | 0.138* | | | 0.127* |
| | | | (0.0737) | | | (0.0764) |
| Positive_TAPP_Prem_Small | | | 0.416*** | | | 0.343*** |
| | | | (0.119) | | | (0.125) |
| Negative_TAPP_Prem_Small | | | 0.246** | | | 0.0711 |
| | | | (0.117) | | | (0.120) |
| Negative_TAPP_Prem_Medium | | | 0.235** | | | 0.0765 |
| | | | (0.0995) | | | (0.103) |
| Negative_TAPP_Prem_Large | | | 0.0811 | | | 0.0734 |
| | | | (0.0531) | | | (0.0525) |
| HIGH_Prem | | | | 0.128*** | | |
| | | | | (0.0125) | | |
| HIGH_Prem_Large | | | | | 0.0611*** | 0.0116 |
| | | | | | (0.0196) | (0.0247) |
| HIGH_Prem_Medium | | | | | 0.271*** | 0.0988* |
| | | | | | (0.0439) | (0.0521) |
| HIGH_Prem_Small | | | | | 0.642*** | 0.553*** |
| | | | | | (0.0985) | (0.110) |
| Industry and year fixed effects | YES | YES | YES | YES | YES | YES |
| Observations | 4647 | 4808 | 4832 | 4832 | 4832 | 4832 |
| Adjusted $R^2$ | 0.096 | 0.137 | 0.146 | 0.130 | 0.143 | 0.151 |

Panel B: Separating the Effects of Retail and Institutional Average Purchase Prices

| | **Average purchase price measure used for explaining the offer premium** | | | | |
|---|---|---|---|---|---|
| | **RETAIL** | **RETAIL+ IIAPP** | **RETAIL+ IIAPP+HIGH** | **RETAIL+ IIAPP+HIGH (INST._LOW)** | **RETAIL+ IIAPP+HIGH (INST._HIGH)** |
| Deal and firm controls | YES | YES | YES | YES | YES |
| Positive_Retail_Prem_Large | -0.0192 | 0.00202 | 0.00234 | 0.0178 | 0.00576 |
| | (0.0142) | (0.0145) | (0.0143) | (0.0410) | (0.0134) |
| Positive_Retail_Prem_Medium | 0.0460 | 0.00640 | 0.000635 | 0.0332 | 0.0102 |
| | (0.0470) | (0.0479) | (0.0478) | (0.0839) | (0.0558) |
| Positive_Retail_Prem_Small | 0.222*** | 0.158* | 0.132 | 0.231* | 0.0539 |
| | (0.0847) | (0.0837) | (0.0841) | (0.136) | (0.106) |
| Negative_Retail_Prem_Small | 0.139 | 0.0563 | -0.0103 | 0.0412 | -0.00245 |
| | (0.0963) | (0.0957) | (0.0953) | (0.149) | (0.124) |
| Negative_Retail_Prem_Medium | 0.112* | 0.0603 | 0.0273 | -0.0601 | 0.143 |
| | (0.0667) | (0.0661) | (0.0657) | (0.103) | (0.0920) |
| Negative_Retail_Prem_Large | -0.0133 | 0.0625** | 0.0720** | 0.125* | 0.0608* |
| | (0.0293) | (0.0295) | (0.0290) | (0.0666) | (0.0327) |
| Positive_IIAPP_Prem_Large | | 0.0230 | 0.0164 | 0.00439 | 0.0834 |
| | | (0.0239) | (0.0267) | (0.0358) | (0.0510) |
| Positive_IIAPP_Prem_Medium | | 0.0510 | 0.0316 | 0.00354 | 0.0659 |
| | | (0.0533) | (0.0548) | (0.0836) | (0.0779) |
| Positive_IIAPP_Prem_Small | | 0.322*** | 0.238** | 0.124 | 0.313** |
| | | (0.103) | (0.106) | (0.169) | (0.136) |
| Negative_IIAPP_Prem_Small | | 0.138 | 0.0307 | 0.224 | -0.120 |
| | | (0.0939) | (0.0947) | (0.151) | (0.123) |
| Negative_IIAPP_Prem_Medium | | 0.135** | 0.0732 | -0.105 | 0.216*** |
| | | (0.0648) | (0.0650) | (0.109) | (0.0826) |
| Negative_IIAPP_Prem_Large | | 0.0355 | 0.0305 | 0.0715 | 0.0193 |
| | | (0.0407) | (0.0402) | (0.0623) | (0.0513) |
| HIGH_Prem_Large | | | 0.0187 | 0.00472 | 0.00801 |
| | | | (0.0268) | (0.0365) | (0.0419) |
| HIGH_Prem_Medium | | | 0.140*** | 0.103 | 0.150** |
| | | | (0.0521) | (0.0882) | (0.0636) |
| HIGH_Prem_Small | | | 0.542*** | 0.439** | 0.541*** |
| | | | (0.110) | (0.181) | (0.139) |
| Industry and year fixed effects | YES | YES | YES | YES | YES |
| Observations | 4464 | 4464 | 4464 | 2232 | 2232 |
| Adjusted $R^2$ | 0.116 | 0.145 | 0.153 | 0.111 | 0.231 |

**Table 4: Adding Bidder Characteristics to the Merger Offer Premium Analysis**

The table reports the results of OLS regressions seeking to explain the merger offer premiums (Offer_Prem), employing reference prices and an expanded set of controls. Offer premium is defined as Ln(offer price/stock price A-21), where stock price A-21 is target stock price 21 trading days (about a month) before offer announcement date. Regarding reference price explanatory variables, HIGH_Prem measures the impact of the 52-week high price, and is defined as Ln(the pre-offer 52-week-high price/stock price A-21); and TAPP_Prem measures the impact of TAPP (target shareholders average purchase price), and is defined as Ln(TAPP/stock price A-21). The sample size shrinks by about a quarter relative to the analysis in Table 3 because of missing bidder information. (All bidders are public, yet some of them are foreign and some are not covered by CRSP or Compustat.) All columns report the results of piecewise regressions estimating the marginal effect of the size of the reference price premiums. For example, TAPP_Prem is divided into three loss regions: small, medium, and large losses on the offer eve (relative to TAPP) and three gain regions with a separate marginal coefficient estimated for each of these six regions. (More details in the text.). Column 4 restricts the sample to the cash-only offers.

Deal controls include: Friendly (a dummy variable equal to 1 if the deal attitude is friendly and equal to 0 if not); All_Cash (a dummy variable equal to 1 if the deal consideration structure is cash only and equal to 0 if not); All_Stock (a dummy variable equal to 1 if the deal consideration structure is shares only and equal to 0 if not. Based on Table 3 evidence, target firm controls include only Target_Size (the natural logarithm of the target firm's total assets (at the end of the fiscal year preceding the offer). Bidder controls include: Bidder_experience is bidder's number of previous mergers; Bidder ROA is a ratio of the bidder's income before extraordinary items to bidder's total assets at the end of the fiscal year preceding the offer; Bidder sales growth is the bidder's rate of sales growth over the prior fiscal year; Bidder DA is the bidder's ratio of long-term debt to total assets at the end of the fiscal year preceding the offer; Bidder MB is the ratio of bidder's year-end market value of common stock to the bidder's book value of equity in the prior fiscal year; Bidder PE is the ratio of year-end bidder's stock price to bidder's earnings per share for the prior fiscal year; Bidder size is the natural logarithm of the bidder firm's total assets at the end of the fiscal year preceding the offer; Bidder High_Prem is Ln(bidder's stock pre-offer 52-week high price/bidder's stock price A-21); Bidder_High_Prem_Cash is an interaction term between cash deals and Bidder_High_Prem. All continuous variables are winsorized at the 2.5% and 97.5% levels, and all specifications include calendar year and industry fixed effects (using the Fama-French 48 industry classification). Robust standard errors, clustered at the target firm level, are in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Friendly | -0.0191 | -0.0375*** | -0.0375*** | -0.0192 |
| | (0.0142) | (0.0142) | (0.0142) | (0.0207) |
| All_Cash | 0.0466*** | -0.00570 | -0.00575 | |
| | (0.00933) | (0.0115) | (0.0115) | |
| All_Stock | -0.0410*** | -0.0389*** | -0.0389*** | |
| | (0.00947) | (0.00934) | (0.00931) | |
| Target size | -0.00652** | -0.0194*** | -0.0194*** | -0.00782 |
| | (0.00263) | (0.00320) | (0.00320) | (0.00536) |
| Bidder_experience | | -0.00245** | -0.00245** | 0.000169 |
| | | (0.00122) | (0.00122) | (0.00227) |
| Bidder ROA | | 0.135** | 0.136** | 0.0814 |
| | | (0.0634) | (0.0626) | (0.137) |
| Bidder sales growth | | 0.00133 | | |
| | | (0.0100) | | |
| Bidder DA | | -0.0660** | -0.0660** | 0.0397 |
| | | (0.0271) | (0.0271) | (0.0457) |
| Bidder MB | | 0.00477*** | 0.00481*** | -0.00203 |
| | | (0.00149) | (0.00146) | (0.00239) |
| Bidder PE | | 0.0000136 | | |
| | | (0.000134) | | |
| Bidder size | | 0.0181*** | 0.0181*** | 0.0155*** |
| | | (0.00286) | (0.00283) | (0.00413) |
| Bidder High_Prem | | -0.146*** | -0.146*** | -0.0343 |
| | | (0.0286) | (0.0284) | (0.0381) |
| Bidder_High_Prem_Cash | | 0.132*** | 0.132*** | |
| | | (0.0437) | (0.0437) | |
| Positive_TAPP_Prem_Large | 0.0533 | 0.0723* | 0.0722* | -0.0396 |
| | (0.0431) | (0.0422) | (0.0422) | (0.0611) |
| Positive_TAPP_Prem_Medium | 0.153* | 0.168* | 0.168* | 0.0898 |
| | (0.0899) | (0.0881) | (0.0880) | (0.134) |
| Positive_TAPP_Prem_Small | 0.399*** | 0.461*** | 0.460*** | 0.882*** |
| | (0.144) | (0.141) | (0.141) | (0.227) |
| Negative_TAPP_Prem_Small | -0.0535 | 0.0163 | 0.0168 | -0.121 |
| | (0.138) | (0.137) | (0.137) | (0.216) |
| Negative_TAPP_Prem_Medium | 0.0328 | 0.0695 | 0.0686 | 0.250 |
| | (0.116) | (0.114) | (0.114) | (0.196) |
| Negative_TAPP_Prem_Large | 0.0240 | 0.0550 | 0.0556 | 0.220** |
| | (0.0590) | (0.0576) | (0.0575) | (0.107) |
| HIGH_Prem_Large | -0.00218 | 0.0271 | 0.0273 | 0.103** |
| | (0.0282) | (0.0279) | (0.0280) | (0.0409) |
| HIGH_Prem_Medium | 0.119** | 0.130** | 0.130** | 0.0830 |
| | (0.0593) | (0.0591) | (0.0591) | (0.0955) |
| HIGH_Prem_Small | 0.606*** | 0.548*** | 0.549*** | 0.580** |
| | (0.125) | (0.123) | (0.123) | (0.227) |
| Industry and year fixed effects | YES | YES | YES | YES |
| Observations | 3547 | 3547 | 3547 | 1165 |
| Adjusted $R^2$ | 0.157 | 0.194 | 0.195 | 0.250 |

## Table 5: Reference Prices' Effect on Market Reaction to Merger Announcements

The table examines the effect of our two reference prices on the cumulative abnormal returns (CARs) of target and acquirer shares around the merger offer announcement. Only completed deals are included. The 3-day (A-1, A+1) and the 11-day (A-5, A+5) CARs of the target (Panel A) and the acquirer (Panel B) are reported, using the Fama-French 5-factor model and the market model for parameter estimation over the period (A-250, A-21). Panel C estimates the combined effect of the reference prices using the two-stage least square procedure suggested by Baker et al. (2012).
TAPP_Prem measures the impact of TAPP (target shareholders average purchase price), and is defined as Ln(TAPP/target stock price on day A-21). HIGH_Prem measures the impact of target's 52-week high price, and is defined as Ln(target's pre-offer 52-week-high price/target stock price on day A-21). *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Panel A: Target CARs (N=4187)

| | | | TAPP_Prem | | | High_Prem | | |
|---|---|---|---|---|---|---|---|---|
| | | All mergers | Negative or zero | Positive | Difference in CAR | Below (or equal to) the median | Above the median | Difference in CAR |
| The Fama-French 5-factor model | Average CAR(-1,+1) | 0.2453 | 0.1894 | 0.3151 | 0.1256*** | 0.2087 | 0.3043 | 0.0956*** |
| | Average CAR(-5,+5) | 0.2712 | 0.2096 | 0.3481 | 0.1386*** | 0.2312 | 0.3357 | 0.1045*** |
| Market Model (CRSP value-weighted index) | Average CAR(-1,+1) | 0.2456 | 0.1897 | 0.3157 | 0.1259*** | 0.2090 | 0.3049 | 0.0959*** |
| | Average CAR(-5,+5) | 0.2717 | 0.2101 | 0.3488 | 0.1387*** | 0.2321 | 0.3359 | 0.1038*** |

Panel B: Acquirer CARs (N=3207)

| | | | TAPP_Prem | | | High_Prem | | |
|---|---|---|---|---|---|---|---|---|
| | | All mergers | Negative or zero | Positive | Difference in CARs | Below (or equal to) the median | Above the median | Difference in CARs |
| The Fama-French 5-factor model | Average CAR(-1,+1) | -0.0121 | -0.0093 | -0.0157 | -0.0064*** | -0.0093 | -0.0149 | -0.0056** |
| | Average CAR(-5,+5) | -0.0100 | -0.0071 | -0.0139 | -0.0068** | -0.0074 | -0.0127 | -0.0053* |
| Market Model (CRSP value-weighted index) | Average CAR(-1,+1) | -0.0122 | -0.0092 | -0.0161 | -0.0069*** | -0.0091 | -0.0153 | -0.0062*** |
| | Average CAR(-5,+5) | -0.0108 | -0.0073 | -0.0153 | -0.0080** | -0.0072 | -0.0143 | -0.0071** |

Panel C: Two-Stage Least Squares Estimation of the Reference Prices' Effect on Announcement CAR

At the first stage we run the piecewise linear specification of the offer premium:

$$\text{Offer\_premium} = \alpha + \beta_1 \text{HIGH\_Prem\_Large} + \beta_2 \text{HIGH\_Prem\_Medium} + \beta_3 \text{HIGH\_Prem\_Small} + \beta_4 \text{Positive\_TAPP\_Prem\_Large} + \beta_5 \text{Positive\_TAPP\_Prem\_Medium} + \beta_6 \text{Positive\_TAPP\_Prem\_Small} + \beta_7 \text{Negative\_TAPP\_Prem\_Small} + \beta_8 \text{Negative\_TAPP\_Prem\_Medium} + \beta_9 \text{Negative\_TAPP\_Prem\_Large} + \varepsilon,$$

with robust standard errors clustered at the target firm level; and at the second stage we estimate:

$$\text{CAR}(-1,+1) = a + b\,\text{Offer\_premium(fitted value)} + \text{Controls} + \varepsilon$$

All merger, acquirer (=bidder) and target controls are described in Table 1. Robust standard errors, clustered at the acquirer firm level (Columns 1 and 2) or at the target firm level (Columns 3 and 4), are in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

| | (1) CAR_Acquirer | (2) CAR_Acquirer | (3) CAR_Target | (4) CAR_Target |
|---|---|---|---|---|
| Offer premium (fitted value) | -0.0521** | -0.0528** | 0.993*** | 1.012*** |
| | (0.0229) | (0.0211) | (0.0834) | (0.0843) |
| Friendly deal | -0.00218 | | -0.0466 | |
| | (0.0115) | | (0.0399) | |
| Rival_Bid | -0.00124 | | -0.0312* | -0.0324** |
| | (0.00674) | | (0.0169) | (0.0163) |
| Diversified merger | -0.00178 | | -0.0108 | |
| | (0.00282) | | (0.0111) | |
| All_Cash deal | 0.0225*** | 0.0225*** | 0.0806*** | 0.0803*** |
| | (0.00357) | (0.00341) | (0.0121) | (0.0118) |
| All_Stock deal | -0.00315 | -0.00305 | -0.0403*** | -0.0374*** |
| | (0.00357) | (0.00341) | (0.00960) | (0.00933) |
| Target size | -0.00469*** | -0.00476*** | -0.0263*** | -0.0279*** |
| | (0.00113) | (0.000958) | (0.00439) | (0.00433) |
| Target sales growth | -0.00549 | | -0.0413*** | -0.0428*** |
| | (0.00508) | | (0.0131) | (0.0124) |
| Target DA | -0.00427 | | -0.00737 | |
| | (0.00947) | | (0.0353) | |
| Target PE | -0.0000308 | | -0.000151 | |
| | (0.0000480) | | (0.000148) | |
| Target MB | -0.00226*** | -0.00267*** | -0.00899*** | -0.00902*** |
| | (0.000711) | (0.000669) | (0.00236) | (0.00228) |
| Target ROA | -0.00488 | | -0.0380 | |
| | (0.0113) | | (0.0510) | |
| Acquirer experience | -0.0000883 | | 0.00148 | |
| | (0.000350) | | (0.00189) | |
| Acquirer ROA | -0.00279 | | 0.193** | 0.138** |
| | (0.0269) | | (0.0781) | (0.0657) |
| Acquirer DA | 0.0254** | 0.0253*** | -0.00430 | |
| | (0.0111) | (0.00943) | (0.0343) | |
| Acquirer MB | -0.00173*** | -0.00194*** | 0.00335* | 0.00298* |
| | (0.000606) | (0.000556) | (0.00173) | (0.00165) |
| Acquirer size | 0.00235** | 0.00265*** | 0.0304*** | 0.0322*** |
| | (0.00103) | (0.000851) | (0.00446) | (0.00426) |
| Acquirer PE | -0.0000346 | | -0.0000301 | |
| | (0.0000496) | | (0.000152) | |
| Acquirer sales growth | -0.00441 | | -0.00893 | |
| | (0.00468) | | (0.0113) | |
| Observations | 3012 | 3157 | 3043 | 3107 |
| Adjusted $R^2$ | 0.055 | 0.056 | 0.176 | 0.173 |

## Table 6: The Effect of Reference Prices on the Offer-acceptance Likelihood

The table reports results of the Probit analyses. The dependent variable equals 1 if the merger is completed and 0 otherwise. The independent variables include: a quartic polynomial of the offer premium over the target stock price 21 days before the announcement day; Dum_High is a dummy variable equal to 1 if offer price > = the target highest price in the period from day -21 to day -250 preceding the offer (equals 0 otherwise); Dum_TAPP is a dummy variable based on our estimate of target shareholders average purchase price, and it equals 1 if offer price >= TAPP (equals 0 otherwise). Deal controls include: Friendly is a dummy variable equal to 1 if the deal attitude is friendly and equal to 0 if not; All_Cash is a dummy variable equal to 1 if the deal consideration structure is cash only and equal to 0 if not; All_Stock is a dummy variable equal to 1 if the deal consideration structure is shares only and equal to 0 if not; Diversified is a dummy variable equal to 1 if the bidder and target are from different industries (as defined by their 2-digit Standard Industrial Classification codes) and equal to 0 if not; Rival_Bid is a dummy variable equal to 1 if the target has more than one bidder at the time of the offer and equal to 0 if not. Target firm characteristics are also employed as explanatory variables: Target_Size is the natural logarithm of the firm's total assets (in millions of U.S. dollars) at the end of the fiscal year preceding the offer; Sales_Growth is the rate of sales growth over the prior fiscal year; DA is the ratio of long-term debt to total assets at the end of the fiscal year preceding the offer; ROA is a ratio of income before extraordinary items to total assets at the end of the fiscal year preceding the offer; MB is the ratio of year-end market value of common stock to the book value of equity for the prior fiscal year; and PE is the ratio of year-end stock price to earnings per share in the prior fiscal year. Bidder controls include: Bidder_experience is the number of bidder previous mergers; Bidder ROA is a ratio of the bidder's income before extraordinary items to the bidder's total assets at the end of the fiscal year preceding the offer; Bidder sales growth is the bidder's rate of sales growth over the prior fiscal year; Bidder DA is the bidder's ratio of long-term debt to total assets at the end of the fiscal year preceding the offer; Bidder MB is the ratio of the bidder's year-end market value of common stock to the bidder's book value of equity for the prior fiscal year; Bidder PE is the ratio of the year-end bidder's stock price to bidder's earnings per share for the prior fiscal year; Bidder size is the natural logarithm of the bidder firm's total assets at the end of the fiscal year preceding the offer; Bidder High_Prem is Ln(bidder's stock pre-offer 52-week high price/bidder's stock price A-21). All continuous variables are winsorized at the 2.5% and 97.5% levels, and all specifications include calendar year and industry fixed effects (using the Fama-French 48 industry classification). Robust standard errors, clustered at the target firm level, are in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Offer_Prem | 0.335* | 0.413** | 0.363** | 0.153 | 0.237 | 0.125 |
| | (0.194) | (0.181) | (0.183) | (0.189) | (0.194) | (0.196) |
| Offer_Prem$^2$ | -0.145 | -0.0533 | 0.0138 | 0.0574 | 0.0946 | 0.0809 |
| | (0.264) | (0.256) | (0.259) | (0.260) | (0.262) | (0.264) |
| Offer_Prem$^3$ | -0.107 | -0.126 | -0.121 | -0.0604 | -0.0886 | -0.0538 |
| | (0.0950) | (0.0932) | (0.0928) | (0.0901) | (0.0912) | (0.0907) |
| Offer_Prem$^4$ | 0.0184 | -0.00946 | -0.0220 | -0.0420 | -0.0455 | -0.0482 |
| | (0.0844) | (0.0815) | (0.0815) | (0.0794) | (0.0804) | (0.0797) |
| Friendly | 2.338*** | 2.239*** | 2.244*** | 2.272*** | 2.259*** | 2.276*** |
| | (0.132) | (0.130) | (0.130) | (0.132) | (0.130) | (0.131) |
| All_Cash | 0.112 | | | | | |
| | (0.0999) | | | | | |
| All_Stock | -0.127 | | | | | |
| | (0.0852) | | | | | |
| Diversified | -0.149* | -0.171** | -0.171** | -0.169** | -0.173** | -0.169** |
| | (0.0774) | (0.0748) | (0.0748) | (0.0751) | (0.0749) | (0.0751) |
| Rival_Bid | -1.281*** | -1.227*** | -1.232*** | -1.246*** | -1.240*** | -1.248*** |
| | (0.106) | (0.101) | (0.101) | (0.102) | (0.101) | (0.102) |
| Sales_Growth | -0.213*** | -0.231*** | -0.212*** | -0.194** | -0.207*** | -0.194** |
| | (0.0814) | (0.0780) | (0.0782) | (0.0783) | (0.0778) | (0.0782) |
| DA | 0.00132 | | | | | |
| | (0.245) | | | | | |
| ROA | 0.0131 | | | | | |
| | (0.256) | | | | | |
| MB | -0.0200 | | | | | |
| | (0.0155) | | | | | |
| PE | 0.000726 | | | | | |
| | (0.00110) | | | | | |
| Target_size | -0.102*** | -0.107*** | -0.110*** | -0.112*** | -0.111*** | -0.112*** |
| | (0.0320) | (0.0293) | (0.0293) | (0.0291) | (0.0293) | (0.0291) |
| Bidder_experience | -0.00762 | | | | | |
| | (0.0218) | | | | | |
| Bidder ROA | 0.0592 | | | | | |
| | (0.432) | | | | | |
| Bidder sales growth | -0.0505 | | | | | |
| | (0.0840) | | | | | |
| Bidder DA | -0.351 | | | | | |
| | (0.253) | | | | | |
| Bidder MB | 0.0410*** | 0.0278** | 0.0272** | 0.0271** | 0.0260** | 0.0266** |
| | (0.0148) | (0.0131) | (0.0130) | (0.0129) | (0.0129) | (0.0129) |
| Bidder PE | -0.00172 | | | | | |
| | (0.00106) | | | | | |
| Bidder size | 0.211*** | 0.222*** | 0.210*** | 0.204*** | 0.205*** | 0.203*** |
| | (0.0289) | (0.0241) | (0.0242) | (0.0240) | (0.0242) | (0.0241) |
| Bidder High_Prem | | | -0.379*** | -0.228 | -0.295** | -0.209 |
| | | | (0.144) | (0.149) | (0.149) | (0.152) |
| Dum_High | | | | 0.289*** | | 0.273*** |
| | | | | (0.0791) | | (0.0845) |
| Dum_TAPP | | | | | 0.179* | 0.0584 |
| | | | | | (0.0954) | (0.100) |
| Industry and year FE | YES | YES | YES | YES | YES | YES |
| Observations | 3339 | 3432 | 3432 | 3432 | 3432 | 3432 |
| Pseudo $R^2$ | 0.378 | 0.372 | 0.374 | 0.379 | 0.375 | 0.379 |

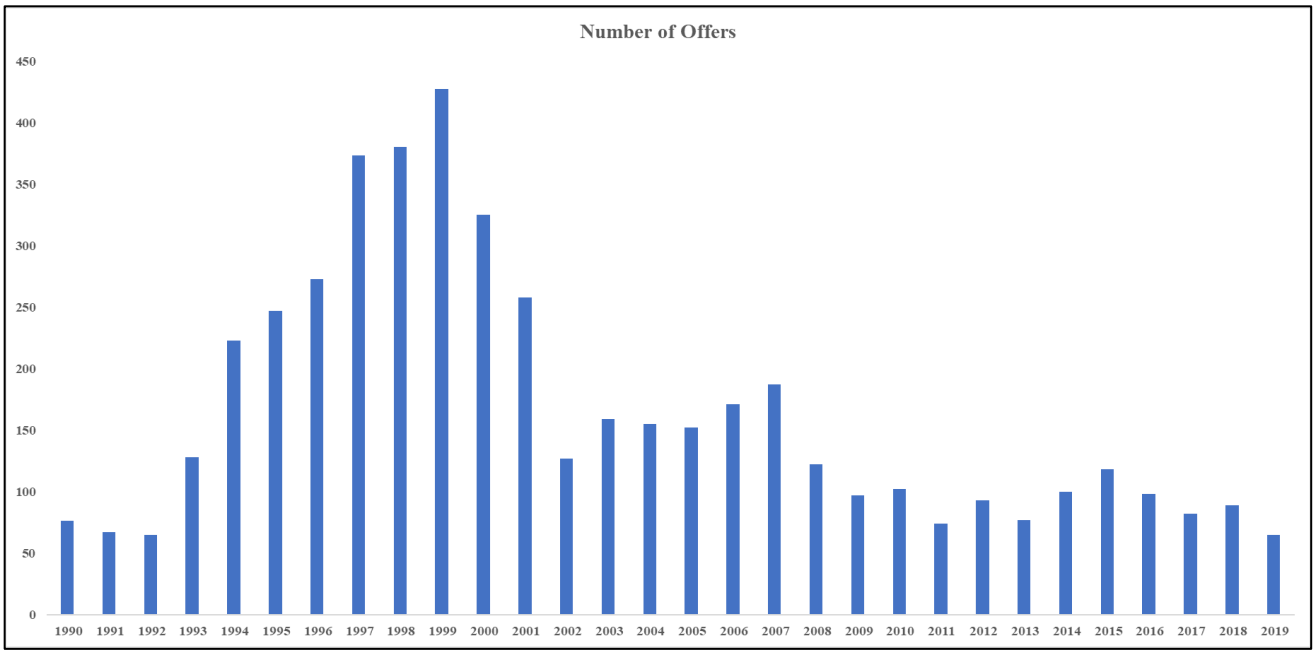


**Figure 1: Yearly Distribution of Merger Offers in our Sample**

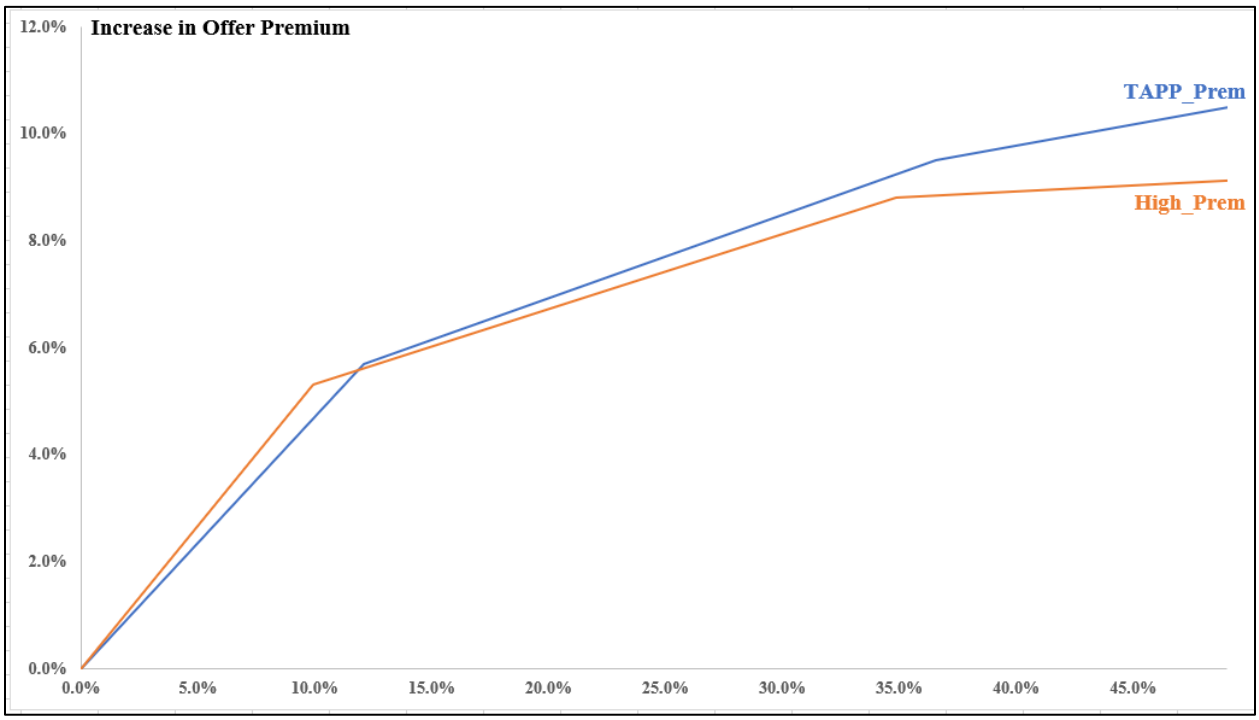


**Figure 2: The Extra Premium in Loss Situations**

The figure is based on the piecewise offer premium regression presented in Table 4 Column (3). We compute, and show in the figure, the extra premium offered to target shareholders when they are in a loss situation, as a function of the loss magnitude. The TAPP_Prem line represents the compensation offered to target shareholders for their loss relative to our estimate of their average purchase price (TAPP), while the High_Prem line represents compensation for the loss relative to the pre-offer 52-week high price of the target stock (more details in Table 4 and the text). The total compensation for losses relative to reference prices is the sum of the appropriate compensation for each of the losses. The cutoff losses between the three segments of the TAPP_Prem (High_Prem) line is 12.1% and 36.6% (10% and 34.9%, respectively).