The Real Merger Gains: Correcting for Partial Anticipation

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This version: March 15, 2021

Abstract

Assuming mergers are unpredictable, previous studies find they create no value for acquirers, while targets gain a hefty bid premium. This paper proposes a new approach to account for partial anticipation, which allows the parameters of the asset pricing model to change in response to anticipation signals. I find that pre-offer alphas capture signals, and so should be part of merger gains. Using matched-control samples, I rule out that marketwide movements and firms' ability to time takeovers may drive these findings. Overall, the gains are larger than a traditional market model indicates, and mergers create substantial value for both firms.

JEL classification: G14; G31; G32; G34
Keywords: Mergers and acquisitions, takeover gains, event studies, partial anticipation, time-varying parameters

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Introduction

The literature on mergers and acquisitions (M&As) documents a puzzling skewed division of gains between target and acquirer firms. Target shareholders gain a disproportionately high share of a merger's expected total synergy, while acquirers' returns are insignificant or slightly negative around bid announcements (e.g., Schwert, 1996; Andrade, Mitchell, and Stafford, 2001; Betton, Eckbo, and Thorburn, 2008). Thus, the question arises, Why do acquirer managers undertake low-benefit or even value-destroying mergers? Some studies posit that acquirers' merger decisions may be an indication of the agency problem (Jensen, 1968), managerial hubris (Roll, 1986; Malmendier and Tate, 2008), or managerial objectives other than value maximization (Morck, Shleifer, and Vishny, 1990).[1] These findings challenge the notion that acquirers have synergy-related motives for M&As and are value-maximizers.

Traditional takeover event studies (such as the market model) usually assume that the parameters of the expected return model are stable and that M&As are unpredictable during the pre-offer period. However, a growing literature documents that private information from merger negotiations can leak to the market, suggesting that some investors anticipate M&As long before the announcement dates.[2]

Betton et al. (2008) argue that addressing partial anticipation is complicated, but crucial for real merger gains. Specifically, early anticipation can bias returns in two ways. First, it can generate instabilities in the parameters, and hence bias the estimates of the abnormal returns (ARs). Second, a part of the total merger gains can be capitalized around the anticipation time. Therefore, econometricians can only capture a fraction of total gains if they do not account for the anticipation effect. To deal with the partial

[1]Moeller, Schlingemann, and Stulz (2004) provide an excellent review of the literature's existing explanations for acquirers' returns in mergers.

[2]For example, Meulbroek (1992) finds that the stock market detects the pre-offer trading activities of insiders, and incorporates this information into the stock prices of takeover targets. Agrawal and Nasser (2012) find that the target's officers and directors trade during the negotiation period, starting on average six months before the announcement date. Cao, Chen, and Griffin (2005), Chan, Ge, and Lin (2015), and Augustin, Brenner, and Subrahmanyam (2019) provide evidence of informed trading in options of merging firms ahead of M&A announcements. Lowry, Rossi, and Zhu (2019) document that the advisor banks also trade in those options.

anticipation issue, I propose a new approach that relaxes the stability and unpredictability assumptions. Using this approach, this paper sheds new light on merger gains and helps reconcile the acquirers' value-creation puzzle.

I observe that the traditional market model (MM) tends to significantly underestimate merger gains. For example, it estimates that the cumulative average abnormal returns (CAARs) to the acquirers, from six months pre- to six months post-announcement date, are -10.34%. This result is in line with prior findings that mergers destroy acquirers' value. However, the anticipation-adjusted method finds the opposite result: The acquirers' gain during that period is 8.55%. Similarly, the anticipation-adjusted average bid premium to target shareholders is 7.9% larger. I also find that the underestimation persists in various subsamples, suggesting the downward bias does not depend on the terms of a deal, the characteristics of the merging firms, or the sample period. Overall, by controlling for partial anticipation, this paper documents that mergers create substantial value for both merging firms.

I develop a simple model to illustrate why failure to incorporate partial anticipation can bias merger gains. Intuitively, the pre-offer alpha is the product of the ex-ante merging likelihood and the deal's total synergistic gains. The synergy is usually non-zero, implying that the alphas should remain zero if a merger remains unexpected pre-announcement. This model predicts that the MM will underestimate the merger gains when alphas are positive, because a portion of the gains is realized around anticipation time. I find that the pre-offer alphas for both merging firms are significantly positive, strongly supporting this prediction.

This paper applies the structural break methodology of Qu and Perron (2007) to detect the two most essential breaks in the pre-offer parameters of the CAPM. I justify this choice based on a finding that the average and median number of breaks is 2.[3] This approach allows changes in the parameters of each return series in response to the arrival of anticipation signals. While the alpha captures the valuation effect, shifts in the beta

[3] The Qu and Perron (2007) test explores the existence of between zero and five significant breaks for each series. As per the results, my main findings remain qualitatively similar when the number of breaks varies across firms (unreported).

and the residual variance reflect the response of the risk measures. I use this two-break model (TBM) to estimate the anticipation-adjusted merger gains.

Moreover, splitting the pre-offer period into three periods (with two breaks) is, to some degree, consistent with my reading of SEC company filings about the private sale process. I refer to them as the *market-timing*, *search*, and *negotiation* periods.

First, many targets and acquirers time a business combination based on the market valuation of their share prices in the first period, the *market-timing* period. Acquirers usually enjoy favorable stock prices, enhancing their ability to finance deals and gives them a competitive edge in bidding contests. However, that is usually not the case for targets since they may be underperforming their peers. Low stock prices make targets more accepting of a business combination or a sale because they cannot raise enough capital to improve their competitiveness. Second, after deciding to engage in a merger, firms usually hire financial and legal advisers to search and identify potential business partners, the *search* period. Finally, in the *negotiation* period (the period closest to the bid announcement), firms contact potential partners to disclose their intentions, conduct due diligence, negotiate terms, and offer a bid. Overall, this split intuitively captures how the ex-ante merging likelihood is updated as new, more relevant information reaches the markets from these three different stages of the private sale process.

Pre-offer alphas are substantial in size, and correspond to the strength of anticipation signals from the three stages. The average monthly alpha for acquirers is 1.74% in the *market-timing* period, 1.65% in the *search* period, and 1.27% in the *negotiation* period. The targets' average alphas in the first two periods are 1.20% and 0.34%, respectively, and lower than those for the acquirers. These findings imply that the anticipation signals in the first two periods are weaker for the targets. However, targets' average monthly alpha jumps significantly to 2.36% in the *negotiation* period, confirming that stronger signals for them come from the private negotiations.[4] The results are robust to using the calendar-time portfolio (CTP) approach with several recently developed asset pricing

[4]This evidence is also consistent with previous studies that have documented a pre-announcement run-up in target share prices (e.g., Meulbroek, 1992; Schwert, 1996; Betton, Eckbo, Thompson, and Thorburn, 2014; Eaton, Liu, and Officer, 2019).

models. CTP results rule out that some missing asset pricing factors (the "bad-model" problem) or clustering of M&As in some industries or across specific periods generate the pre-offer alphas.

Next, I conduct various tests to investigate whether the anticipation signals are the main driver of the observed pre-offer parameters. First, some marketwide factors and firms' ability to time M&As can cause both the takeover activity and the positive pre-offer alphas. To address such concerns, I compare the regime-wise alphas of three different (i.e., randomly selected, industry-size, and M/B-size) matched-control samples with those of the merger sample. I find that the acquirers' average pre-offer alphas exceed those of their peers by 0.30% to 0.75% per month, depending on the control sample. Therefore, marketwide, industrywide, and firm-level overvaluations can not explain their higher alphas. I attribute it to higher ex-ante merging likelihood.

Furthermore, targets underperform their industry-size matches in the first two regimes by 0.30% and 1.08% per month. This finding confirms anecdotal evidence from company filings that low valuations make targets more likely to consider a business combination or a sale. However, targets' alphas increase in the *negotiation* period while those of their matches drop. This causes targets to substantially outperform their peers by 1.67% per month. Hence, the market can anticipate that targets are more likely to get a bid offer than their peers after private negotiations begin, suggesting a leak from the negotiations.

Second, Eaton et al. (2019) document a run-up in target share prices after starting the private sale process. Given that negotiations occur between the potential target and acquirer firms, the market may also anticipate the acquirers. Eaton et al. (2019) study only target firms, while this paper considers both. I hand-collect detailed information from company filings with the SEC related to the M&A transactions. I observe significant positive alphas for both firms during the *negotiation* period. Thus, the price run-ups happen for acquirers as well, and the market anticipates them too.

Third, I examine whether the pre-offer beta dynamics are related to the anticipation signals. Morellec and Zhdanov (2008) document that the target and acquiring firms merge when their restructuring options gain substantial value, generating changes in the firm-level betas. If the break dates happen when the ex-ante merging likelihood is significantly updated, the pre-offer betas should change accordingly. My results support this prediction. Overall, the findings imply that the regime-wise alphas and betas contain anticipation signals about future M&As.

I also perform three alternative tests to examine the presence of partial anticipation. First, suppose the market perceives that acquirers have timed takeover announcements to take advantage of their high pre-offer valuations. In that case, the post-offer CAARs should reverse regardless of the deal outcome. However, I observe the TBM CAARs to the acquirer firms in the failed offers reverse back in the post-offer period, while those for successful bids slightly increase. These differential CAARs reflect only the difference in the ex-ante merging likelihood of successful and failed offers and not the market timing ability of the merging firms. Second, I reconsider the relationship between the pre-offer run-up and the post-offer mark-up in the target's share prices. I find similar results to Betton et al. (2014) when the TBM estimates the merger gains, i.e., the run-ups significantly reduce the mark-ups. This finding constitutes indirect proof of partial anticipation (the "substitution hypothesis"), as the acquirers realize that the run-up contains takeover signals and pay less accordingly. Third, after controlling for various predictors of the acquirer's CAARs, I document that the acquirer's run-up and total gains are significantly positively correlated with those of the target. This confirms that both firms share in the gains when the market anticipates deals with synergistic gains.

But are the anticipation signals kept private, or released to the public? I employ two tests to answer this question. Using a measure from Durnev, Morck, and Yeung (2004), I find that public information increases significantly during the pre-offer period, confirming partial anticipation of M&As. I also investigate whether institutional investors' quarterly holdings provide any direct evidence that a large group of investors is employing the anticipation signals in their portfolio management. The data support this claim.

This paper contributes to the takeover literature in two ways. First, relatively few papers thus far have incorporated the anticipation effect into merger gains.[5] One notable

[5]Schipper and Thompson (1983), Malatesta and Thompson (1985), Eckbo, Maksimovic, and Williams

study is Wang (2018), who uses a structural estimation model to show that a part of total acquirers' gains is realized in the pre-offer period due to partial anticipation. My paper complements that study with some important differences. First, the TBM is a model-free approach that empirically measures the anticipation effect without imposing any assumptions required in a structural model. Second, using three different matched-control samples allow me to differentiate any marketwide, industrywide, and firm-level misvaluation from the anticipation effect. Third, my paper documents that the anticipation effect varies over the pre-offer period, providing new insights into the private sale process.

Relatedly, Eaton et al. (2019) document that the MM underestimates the targets' premium because it fails to control for the leakage of information from the private sale process. I extend that study by documenting that the anticipation signals can release even earlier than the negotiation starts, such as in the *market-timing* and *search* periods. My proposed two-break model is also more convenient as it does not require hand-collecting data from the SEC filings to account for the anticipation effects.

Second, the MM makes several restrictive assumptions (detailed in the next section) to estimate CAARs. The TBM relaxes all of them by incorporating alphas as a part of the abnormal returns and allowing the parameters to change with the updates of ex-ante merging likelihood. Similar to the TBM, Schwert (1996, 2000) incorporates the intercept as part of the ARs to correct the market model's failure in estimating the acquirer's CAARs. One key difference is that the TBM also allows the beta to be time-varying. More importantly, my paper documents that the regime-wise alphas contain anticipation signals. Schwert applies its correction only to acquirers, while I use the TBM for both merging firms. In sum, TBM generalizes the event study approach's design and can be applied to other types of (corporate) events.

The remainder of the paper proceeds as follows. Section 1 develops the theoretical

(1990), Song and Walkling (2000), Bhagat, Dong, Hirshleifer, and Noah (2005), and Cai, Song, and Walkling (2011) use some special sample (such as serial acquirers), peculiar empirical designs, or theoretical models to control for the anticipation effect. However, their approaches are challenging to apply to a large-scale sample.

framework for the regime-wise approach. Section 2 describes my empirical framework, while Section 3 documents non-stationarities in the return-generating process. Section 4 provides evidence that the regime-wise parameters contain merger signals. Section 5 reports how the MM underestimates the merger gains. Results of whether the anticipation signals are kept private or released to the public are in Section 6. Section 7 provides additional tests for partial anticipation, and the robustness checks are in Section 8. Section 9 concludes. The Internet Appendix contains some additional results.

1 Theoretical framework

This section first presents the theoretical foundation for the most widely used market model (MM) in event studies, as suggested by Brown and Warner (1985). Then, I introduce a new regime-wise method that relaxes MM's assumptions, which can estimate the abnormal performance more reliably around a corporate event.

1.1 Market model versus CAPM

To estimate the expected (normal) returns, the MM takes the following form:

$$E(R_{i,t}) = \alpha_i^{MM} + \beta_i^{MM} R_{m,t}, \tag{1}$$

where $E(R_{i,t})$ and $R_{m,t}$ are the expected returns for stock i and the market portfolio returns at day t, respectively; α_i^{MM} and β_i^{MM} are the fixed parameters of the expected return model and estimated using a linear regression over an estimation window. Those parameters are then used to project the out-of-sample abnormal (unexpected) returns around an event.

$$AR_{i,t} = R_{i,t} - E(R_{i,t}), \tag{2}$$

where $R_{i,t}$ and $AR_{i,t}$ are the realized and abnormal returns.

Event studies of the 1970s used the Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965) to generate the expected excess returns of a stock as follows (see MacKinlay, 1997, for further details):

$$E(R_{i,t}) - r_{f,t} = \beta_i[E(R_{m,t}) - r_{f,t}], \tag{3}$$

where $r_{f,t}$ is the risk-free rate at day t. The CAPM is an equilibrium model that relates the risk premium of a risky asset to the risk premium of the market. Later event studies, however, employ the MM, since the CAPM restricts the intercept of the OLS model to zero, leading to a non-zero mean for the regression residuals. Relaxing this requirement makes the MM statistically more appealing, because it generates unbiased parameters and forecast errors (ARs).

The ARs of the MM correspond to those of the CAPM if $\alpha_i^{MM} = (1 - \beta_i)\bar{r}_f$, where $\bar{r}_f$ is the average risk-free rate over the estimation period for stock i. Suppose the market anticipates an M&A deal with synergistic gains that will be split between the shareholders of both firms, and so incorporates part of those gains into the returns of the potential merging firms in the pre-offer period. In this case, the intercept in the MM could be larger than the above theoretical value. The intercept, α_i^{MM}, would have two components: $(1-\beta_i)\bar{r}_f$ and α_i, which would capture a deviation from the expected returns due to early anticipation. The MM assumes that both components are part of the expected return model. The latter component, however, should be considered as a measure of abnormal performance because it is related to the forthcoming event. To directly measure α_i, we can use Jensen's (1968) model:

$$E(R_{i,t}) - r_{f,t} = \alpha_i + \beta_i[E(R_{m,t}) - r_{f,t}], \tag{4}$$

where α_i is a constant (Jensen's alpha) for stock i. A positive (negative) α indicates that a stock has overperformed (underperformed) relative to its level of systematic risk.

1.2 Regime-wise return-generating process

Event studies assume that the parameters of the expected return model are stable and that M&As in the estimation window are unpredictable. However, when the market anticipates a potential M&A, both the alpha and beta of merging firms can change. Hackbarth and Morellec (2008) find that an increase in merging likelihood affects the "moneyness" of the restructuring option, which in turn shifts the firms' beta in the pre-offer period. Before the merger, acquirers may also strategically retire part of their debt to improve the chance of winning a bid competition (see Morellec and Zhdanov, 2008, and references therein), which leads to a lower beta. Hence, a time-varying beta captures changes in the ex-ante merging likelihood.[6] Furthermore, the arrival of new signals about future M&A can affect the valuation of the merging firms, which in turn can shift the alpha in the pre-offer period.

To capture time variation in the parameters of the expected return model, I use the following regime-wise return-generating process.

$$R_{i,t} - r_{f,t} = \alpha_{i,j} + \beta_{i,j}[R_{m,t} - r_{f,t}] + \epsilon_{i,t}, \qquad t\ (= T_{i,j-1} + 1, \ldots, T_{i,j}), \tag{5}$$

for j (= 1, 2, 3), where j is the regime index. In this two-break model (associated with three regimes), $\alpha_{i,j}$ and $\beta_{i,j}$ are the regime-wise (time-varying) parameters, $\sigma^2_{i,j}$ is the regime-wise residual variance, and $\epsilon_{i,t}$ is the disturbance at day t for stock i, which has zero mean and variance $\sigma^2_{i,j}$. The two break dates ($T_{i,1}$, $T_{i,2}$) for stock i are treated as unknown.[7] I also use the convention that $T_{i,0} = 1$ and $T_{i,3} = T_i$ (i.e., the number of observations for stock i). Note that model (4), which assumes no significant break in the return process, is a special case of model (5). Figure 1

[6]Ferson, Kandel, and Stambaugh (1987), Harvey (1989), and Adrian, Crump, and Moench (2015), among others, find that a model that captures time variation in the risk premium can better explain the observed asset prices.

[7]Doidge, Karolyi, and Stulz (2013) use a structural break methodology to test for a break in the IPO rate for U.S. firms. My test differs significantly from theirs because it allows for a residual variance change when detecting break dates. This is necessary since M&As can affect firms' riskiness. See also Smith and Timmermann (2020, and references therein) about applying structural break approaches in forecasting models of the equity risk premium.

Figure 1 illustrates the timeline for the two-break model. Based on the SEC company filings related to the M&A transactions, I divide the pre-offer private takeover process into three periods: *market-timing*, *search*, and *negotiation* periods. This split illustrates how the ex-ante merging likelihood is updated as new, more relevant information reaches the market, which in turn shifts the parameters.

Regime 1 contains observations from the [1 to T_1] interval, which are used to estimate α_1, β_1, σ_1^2. The intuition behind the *market-timing* period is as follows. The SEC filings provide abundant anecdotal evidence that the boards of many targets and acquirers time a business combination based on their share prices in the pre-offer period. When the acquirer's stock is upward-trending, its managers have more incentive to acquire another firm. This is because higher market valuations relax M&A financing constraints (Harford, 2005). Acquirers also have a competitive edge in bidding contests because they can offer a higher bid premium. However, when target firms' stock is downward-trending, it is more difficult to compete with peers because the low prices reduce their ability to raise capital. At those times, target firms may consider selling or merging with another firm.

The price pattern of the merging firms in this period is consistent with two distinct theories of mergers. Both the neoclassical (Q) theory (Jovanovic and Rousseau, 2002) and the misvaluation theory of mergers (Shleifer and Vishny, 2003; Rhodes-Kropf and Viswanathan, 2004) predict that overvalued (high market-to-book) acquirers tend to bid relatively undervalued (low market-to-book) target firms. If the M/B ratios are positively correlated with the pre-offer alphas, we expect high-alpha firms to acquire low-alpha firms. Both fundamental cash flow news (related to the Q-theory) and pure sentiment (related to the misvaluation theory) can drive the pre-offer period's valuations. Although both drivers may seem unrelated to future M&As, over- and under-valuations can induce firms to consider business combinations and generate M&A signals to the market, i.e., high and low pre-offer alphas.

The second stage for firms is to search and identify potential merger partners. The *search* period (Regime 2) contains returns from the [T_1+1 to T_2] interval. Given that M&As are crucial investment decisions, with potentially adverse consequences for firms and their top executives, firms usually hire financial and legal advisers to find the best match. This can help guard against future shareholder lawsuits. The notion of search is consistent with Rhodes-Kropf and Robinson (2008), who explicitly model merger activity as a search process to find a merger partner.

After completing the search, the firm contacts potential merger partners to disclose its intentions, conduct due diligence, negotiate deal terms, and offer a bid (see Boone and Mulherin, 2007, for further details). The third stage is the *negotiation* period (Regime 3), which contains returns from [T_2+1 to T].

The more firms and advisers involved in the private sale process, the more likely it is that credible information about future M&As can leak. But the market sometimes receives more direct signals about future M&As. For example, firms can release news about their M&A intentions, and the potential acquirer can file a 13D form, suggesting interest in acquiring the target by becoming a blockholder. Overall, the ex-ante merging likelihood increases in the pre-offer period, when part of the relevant information leaks or is disclosed to the market.

Note that my use here of the regime-wise return-generating process has several appealing features over the MM. First, detecting break dates in the pre-offer period allows me to relate changes in α, β, and σ^2 to changes in the ex-ante merging likelihood. While the alpha captures the anticipation signals' valuation effect, shifts in β and σ^2 show the response of the risk measures. If the anticipation signals are unique to the merging firms because of the deal's potential synergies, the firm-specific risk may also change.

Second, the presence of significant break dates in Model (5) indicates that, not only does the regime-wise model present a better fit of the observed returns, but the coefficients and residual variance estimated by OLS are biased. Hence, the MM may estimate inaccurate abnormal returns and possibly unreliable t-statistics.

Third, the MM assumes that alpha is part of the expected returns, thus removing it from the abnormal returns. However, several results in Section 4 indicate that the regime-wise alphas in equation (5) contain material information about forthcoming M&As. Thus, they should be part of abnormal returns. Otherwise, an econometrician is only capturing a fraction of total merger gains.

2 Empirical framework

2.1 Data

I employ three different takeover samples in this paper. The accounting data and institutional investors' quarterly stock holdings come from the Compustat database and the Thomson Financial CDA/Spectrum database of 13F filings, respectively.

2.1.1 Main M&A sample: Public acquirers

I obtain takeover bids between U.S. firms announced between January 1980 and December 2017 from the mergers and acquisitions database of Securities Data Company (SDC) Platinum. To ensure that the acquirer gains the controlling shares of the target firm, I consider acquisitions in which the deal is classified as a "Merger" (M) or an "Acquisition of majority interest" (AM). There are 54,514 such bids.

Following Moeller, Schlingemann, and Stulz (2004), I further require that: 1) the deal value in SDC is greater than $1 million, 2) a public firm, a private firm, or a non-public subsidiary of a public or private firm is acquired, 3) the acquirer is a public firm listed in the Center for Research in Security Prices (CRSP) during the event window, 4) the deal value relative to the market value of equity of the acquirer is at least 1%, and 5) the number of days between the announcement and completion dates is between 0 and 1,000. These requirements lower the sample to 15,583 bids.

I then merge these data with those from the CRSP to obtain the stock returns. To ensure the structural break test can reliably estimate the break dates, I also require that: 1) the share price during the pre-offer period is higher than $1, which ensures the results are not driven by financially distressed firms or by market structure noises in the return series of penny stocks, 2) no firms have missing daily returns, and 3) firms have less than 120 daily zero returns (having too many zeros in a return series can cause the test not to converge or to generate misleading estimates).

Internet Appendix Table 1 summarizes the steps taken to construct the final sample, which consists of 10,998 bids. It involves 4,785 private targets, 4,083 publicly listed targets, and 2,130 subsidiary target firms.

2.1.2 Public acquirer and target sample

Detecting the location of breaks for the target firms requires them to be public with qualified returns. In those cases, applying my filters shrinks the public target sample from 4,083 to 2,933 bids.

Moreover, my analysis in this paper requires collecting detailed information on the private sale process from the SEC's Electronic Data Gathering and Retrieval (EDGAR) website, whose coverage begins in 1993. Imposing this requirement obtains a sample of 1,938 public bids. I closely follow Eaton et al. (2019), and read through the background section of each deal's merger document to collect information on when negotiations for each deal were first initiated. To keep the hand-collecting data manageable, I focus only on deals with a transaction value of at least $150 million. This sample, with enough information from the SEC filings, contains 1,029 observations.[8]

2.2 Estimating abnormal returns

I use Schwert's (1996) traditional market model to estimate the benchmark abnormal returns. I then compare them with those based on the regime-wise model. Note that using the event window of Schwert (1996) in this paper can generate more conservative results, because he allows M&As to be anticipatable within six months pre-announcement. Other papers in the takeover literature do not.

[8] These are economically the most important transactions for asset reallocation in the economy. If the market can anticipate M&As, it should at least be able to do so for such deals. Also, imposing the size filter leads to a practical sample size, which makes hand-collecting data feasible. This sample is still one of the largest employed in takeover studies (for details of other samples, see Eaton et al., 2019).

2.2.1 The benchmark market model

The estimation window ranges from Day -379 to Day -127, yielding 253 daily returns to estimate the parameters of the market model (1). The main event window is from Day -126 to Day 126, for which the ARs and the CAARs are estimated. However, some target and acquirer firms are delisted from a stock exchange before Day 126. In those cases, the event window stops at the delisting date during the post-offer period. Let $A^b_{i,t}$ denote AR based on the benchmark market model for stock i at day t, which is estimated as follows:

$$A^b_{i,t} = R_{i,t} - \hat{\alpha}^b_i - \hat{\beta}^b_i R_{m,t}, \ \ t = [-126, \ldots, 0, \ldots, 126], \text{ Benchmark Event Window}, \quad (6)$$

$$R_{i,\tau} = \alpha^b_i + \beta^b_i R_{m,\tau} + \nu_{i,\tau}, \ \ \tau = [-379, \ldots, -127], \text{ Benchmark Estimation Window}, \quad (7)$$

where the CRSP value-weighted return represents the return on the market portfolio, R_m. OLS regression is performed over the benchmark estimation window to obtain estimates $\hat{\alpha}^b_i$ and $\hat{\beta}^b_i$ of α^b_i and β^b_i, respectively.

Let $\bar{A}^b_t$ and $CAAR^b_{t_1,t_2}$ denote the daily average abnormal return (AAR) at day t and the CAAR computed from day t_1 to t_2 via the benchmark market model, respectively. The AARs and CAARs are estimated over an event window around the public bid announcement date as follows:

$$\bar{A}^b_t = \frac{1}{N_t} \sum_{i=1}^{N_t} A^b_{i,t}, \qquad t = [-126, \ldots, 0, \ldots, 126], \quad (8)$$

$$CAAR^b_{t_1,t_2} = \sum_{t=t_1}^{t_2} \bar{A}^b_t, \quad (9)$$

where N_t is the number of securities whose ARs are available at day t.

2.2.2 The two-break model (TBM)

I use a time series test developed by Qu and Perron (2007) to identify the unknown locations of the first and second break dates of stock i in model (5), i.e., $T_{i,1}$ and $T_{i,2}$ ($T_{i,0} < T_{i,1} < T_{i,2} < T_{i,3}$). In order to assign all changes in the last regime to the anticipation effect, $T_{i,3}$ should be located before the announcement date. Otherwise, the anticipation and the announcement effects are confounded in this period. Therefore, $T_{i,3}$ = -2. Also, $T_{i,0}$ = -379, so both the benchmark and the two-break model (TBM) begin on the same date relative to the announcement date. I apply the test separately to each of the target and acquirer firms in the sample, so their break dates may differ.

The Qu and Perron (2007) test uses a dynamic search algorithm to detect one break candidate at a time, and then multiple breaks (here, two) that globally maximize the quasi-maximum likelihood estimate (QMLE) of the above time series regression. Qu and Perron (2007) also develop a sequential test statistic of ℓ versus $\ell + 1$ breaks (here, two breaks vs. one break), as well as tests for no break versus some unknown number up to a maximum number (here, no break vs. one break, and no break vs. two breaks). As required by the test, I select a trimming factor of 0.15, which indicates that the size of each regime for a given stock is at least 15% of its sample period (378 * 0.15 = 57 business days). This factor enables the parameters to be estimated rather precisely.[9]

Let $A_{i,t}^{TBM}$ denote AR based on the two-break model in (5) for stock i at day t, which is estimated as follows:

$$A_{i,t}^{TBM} = \begin{cases} R_{i,t} - R_{f,t} - \hat{\beta}_{i,1}^{TBM}\,[R_{m,t} - R_{f,t}], & -379 \leqslant t \leqslant T_{i,1}, \quad \text{Regime 1}, \\ R_{i,t} - R_{f,t} - \hat{\beta}_{i,2}^{TBM}\,[R_{m,t} - R_{f,t}], & T_{i,1} + 1 \leqslant t \leqslant T_{i,2}, \quad \text{Regime 2}, \\ R_{i,t} - R_{f,t} - \hat{\beta}_{i,3}^{TBM}\,[R_{m,t} - R_{f,t}], & T_{i,2} + 1 \leqslant t \leqslant 126, \quad \text{Regime 3}, \end{cases} \tag{10}$$

where $\hat{\alpha}_{i,j}^{TBM}$ and $\hat{\beta}_{i,j}^{TBM}$ are the OLS coefficients of model (5) for stock i estimated from regime j (=1, 2, 3); $R_{f,t}$ is the one-month Treasury bill rate on day t.

[9] I am grateful to Qu and Perron (2007) for generously sharing the Gauss code for their test. It is available at http://blogs.bu.edu/perron/codes/.

Note that the ARs in the pre-offer period are the sum of the regime-wise alpha and the regime-wise residuals from equation (5), i.e., $A_{i,t}^{TBM} = \hat{\alpha}_{i,j}^{TBM} + \epsilon_{i,t}$. Hence, using in-the-sample estimates to measure ARs is an advantage of TBM over the MM.[10] Nevertheless, both approaches estimate ARs around the announcement date (any date after Day -2) using out-of-sample projections.

Let $\bar{A}_t^{TBM}$ and $CAAR_{t_1,t_2}^{TBM}$ denote the AAR at day t and the CAAR computed from day t_1 to t_2 via the two-break model, respectively. Their estimates are as follows:

$$\bar{A}_t^{TBM} = \frac{1}{N_t} \sum_{i=1}^{N_t} A_{i,t}^{TBM}, \qquad t = [-379, \ldots, 0, \ldots, 126], \tag{11}$$

$$CAAR_{t_1,t_2}^{TBM} = \sum_{t=t_1}^{t_2} \bar{A}_t^{TBM}. \tag{12}$$

2.3 Unpredictability bias in the market model

I formulate below how the MM may misestimate CAARs when the ex-ante merging likelihood is updated during the pre-offer period. The new anticipation signals can affect both the riskiness (i.e., the beta and the residual variance) and the valuation (i.e., the alpha) of the merging firms. Note that the valuation effects are not impacted by whether new information is received discretely or diffused gradually.

Let S_i denote the expected synergistic return for firm i from the takeover transaction, which is constant. Also, let $\pi_{i,j}$ denote a change in the average ex-ante merging likelihood for firm i in regime j relative to regime *j-1*. If the market is efficient, any new anticipation signals should affect the merging likelihood instantaneously, and, in turn, can shift the parameters. Moreover, the deal is not fully anticipated in the pre-offer period, so total merging likelihood ($\pi_i = \sum_{j=1}^{3} \pi_{i,j}$) < 1. When the market updates the total likelihood after receiving a new signal, $\pi_{i,j} \neq 0$, $\alpha_{i,j}$ becomes significant. Only some of the expected synergy will be incorporated into the regime-wise alphas, so we have:

[10]In contrast, the MM uses estimates from the estimation window to predict ARs, so it may suffer from issues related to out-of-sample forecasting (see, e.g., Patell, 1976).

$$\alpha_{i,j} \approx \pi_{i,j}\, S_i. \tag{13}$$

Equation (13) suggests that $\alpha_{i,1}, \alpha_{i,2}$, and $\alpha_{i,3}$ are zero when total merging likelihood is trivial in the pre-offer period ($\pi_i \approx 0$), or when a share of a firm from the total deal synergy (S_i) is negligible. By letting the alpha vary across regimes, equation (13) indicates that the merging likelihood may get updated during the pre-offer period.

Next, consider how the MM's unpredictability assumption ($\pi_{i,j} = 0$) can generate biased ARs. Suppose the market receives some signals during the *negotiation* period about future takeover transaction i, which increases the average merging likelihood, for example, from 0.3 in the second regime to 0.5 in the third regime. Also, assume that the first day of the third regime is $T_{i,2}+1 = -126$ to make it compatible with the start of the benchmark event window. Now, compare how each of the two approaches incorporates the increase in the merging likelihood into the Cumulative Abnormal Return (CAR) from Day t_1 to Day t_2 during the third regime, where θ denotes their difference:

$$\theta = CAR^{b}_{i,t_1,t_2} - CAR^{TBM}_{i,t_1,t_2}, \tag{14}$$

where $CAR^{\,b}_{i,t_1,t_2} = \sum_{t=t_1}^{t_2} A^{b}_{i,t}$ and $CAR^{\,TBM}_{i,t_1,t_2} = \sum_{t=t_1}^{t_2} A^{TBM}_{i,t}$. Inserting ARs from equations (6) and (10) into equation (14), respectively,

$$\theta = \sum_{t=t_1}^{t_2} (R_{i,t} - \hat{\alpha}^{b}_{i} - \hat{\beta}^{b}_{i}\, R_{m,t}) - \sum_{t=t_1}^{t_2} (R_{i,t} - R_{f,t} - \hat{\beta}^{TBM}_{i,3}\, [R_{m,t} - R_{f,t}]). \tag{15}$$

After some simple rearrangements:

$$\theta = -\sum_{t=t_1}^{t_2} \hat{\alpha}^{b}_{i} + \sum_{t=t_1}^{t_2} (\hat{\beta}^{TBM}_{i,3} - \hat{\beta}^{b}_{i})\, R_{m,t} + \sum_{t=t_1}^{t_2} (1 - \hat{\beta}^{TBM}_{i,3})\, R_{f,t}. \tag{16}$$

The last two terms in equation (16) capture how a change in beta contributes to the bias of the benchmark market model. On average, both terms are economically small, on the order of 0.15 and 0.15 basis points per day (0.03% and 0.03% per month) for acquirers, and 0.05 and 0.54 (0.01% and 0.11% per month) for targets.[11] Then,

$$\theta \approx -\sum_{t=t_1}^{t_2} \hat{\alpha_i^b} = -(t_2 - t_1 + 1)\, \hat{\alpha_i^b}. \tag{17}$$

I denote the average merging likelihood during the estimation window of the benchmark market model (in this case, 0.3) by π_i. Then, using equation (13), the right-hand side of equation (17) is:

$$\theta \approx -(t_2 - t_1 + 1)\, \pi_i\, S_i. \tag{18}$$

Equation (18) provides new insights about the determinants of unpredictability bias in the traditional event study. The bias will be zero if either the ex-ante merging likelihood or the expected synergy is zero. Given that mergers are usually value-increasing ($S_i > 0$), and the market can anticipate partially future M&As ($\pi_i > 0$), the traditional MM is likely to underestimate the true wealth effect of mergers. The longer the event window, the larger the underestimation will be.

Two factors determine the magnitude of daily bias ($\pi_i\, S_i$): the strength of the anticipation signals (π_i), and the share from the total synergy of a takeover transaction (S_i). Previous literature has shown that target shareholders receive the lion's share of total synergies. If that holds, we would expect the daily bias to be larger for target firms than for acquirer firms. However, the reverse can also happen if the ex-ante merging likelihood is stronger for the acquirers. Whether the measurement of gains to the acquirer or target shareholders suffers more from this bias is hence an empirical question.[12]

[11] The average annual market return during the sample period of this paper is around 13%, so $R_{m,t}$ is about 5 basis points per trading day. While the beta for an individual firm can change substantially after each break, the average beta remains stable across regimes. I find that the average $(\hat{\beta_{i,3}^{TBM}} - \hat{\beta_i^b})$ for the acquirer sample here is 0.03. So, the average bias in the second term is equal to 5 * 0.03 = 0.15 basis points. The average annual T-bill rate is around 4.35%, so $R_{f,t}$ is about 1.7 basis points per trading day. The average $(\hat{\beta_{i,3}^{TBM}})$ for the acquirer sample in this paper is 0.91. Therefore, the average bias due to the last term is also equal to (1 - 0.91) * 1.7 = 0.15 basis points. Similar calculations show that these terms for the target firms are approximately 0.05 and 0.54 basis points, respectively.

[12] I illustrate the bias for only one firm. We can easily generalize the intuition to a sample of M&A deals, however, in order to obtain the aggregate impact of partial anticipation on the estimates of CAARs.

3 Non-stationarities in the return-generating process

This section examines any non-stationarities in each merging firm's pre-offer return-generating process. First, I allow the Qu and Perron (2007) test to determine the exact number of breaks, which can be between 0 and 5. The average and median number of breaks for both firms is around 2 (unreported). The test finds that 6,100 of 10,998 (55.5%) acquirers have at least two significant breaks, while 3,867 (35.1%) have only one. The test cannot reject the null hypothesis of stability for 1,031 (9.4%) acquirers. These numbers for the targets are 62.1%, 30.1%, and 7.8%, respectively. Overall, the existence of multiple structural breaks in the majority of merging firms implies that the stability assumption of the traditional MM is significantly rejected.

3.1 Distribution of break dates in the two-break model

Table 1 provides the summary statistics for the distribution of the first and second break dates. The average (median) first break date is Day -247 (-257) for acquirers and Day -244 (-254) for targets. Also, 98% of merging series' *market-timing* period (Regime 1) ends much earlier than Day -127. The second regime for 49.3% of acquirers and 44.5% of targets precedes that date. Hence, the MM may misestimate the parameters, since most of them changed during the benchmark estimation window (-379, -127). Moreover, there is substantial cross-sectional variation in break dates, which disproves the MM's use of a fixed estimation window for all event firms. Table 1

3.2 Parameters of the two-break model

This section documents the behavior of α, β, and σ^2 around both the first and second break dates. It aims to provide insights into the dynamics of these parameters in the *market-timing*, *search*, and *negotiation* periods.

Table 2

3.2.1 Alpha: Main source of unpredictability bias in the market model

Twin Tables 2 and 3 present the summary statistics of the parameters based on the MM and the TBM for the acquirer and target firms, respectively.[13] The average daily α over the three regimes is significantly positive for the acquirers. It is 8.30 basis points (hereafter bps), in the *market-timing* period, and decreases slightly across periods, reaching 6.05 bps in the *negotiation* period. The average monthly alpha ranges between 1.27% (= 6.05 bps * 21) and 1.74% (= 8.30 bps * 21) in the pre-offer period, suggesting it is also economically substantial. Based on the discussion in equation (13), these results suggest that the market partially anticipates acquirers. In contrast to the acquirers' value-creation puzzle, positive alphas here indicate that their expected synergy is significantly positive. Furthermore, part of it is incorporated into share prices long before the event window of previous studies.

The average alpha in the *market-timing* and *search* periods for the targets in Table Table 3
3 are 5.72 bps (1.20% per month) and 1.64 bps (0.34% per month), respectively. They are significantly positive, but lower than those for acquirers. These results imply that the anticipation signals in these periods are weaker for targets. Consistent with the SEC filings, when targets face less favorable market valuations, they are more likely to seek a business partner or a sale. In particular, this is the case in the *search* regime with the lowest average alpha. However, their average alpha jumps significantly to 11.24 bps (2.36% per month) in the third regime, indicating that the strongest anticipation signals about future targets exist in the *negotiation* period.[14]

The MM assumes that the intercept is equal to $(1 - \bar{\beta})\bar{r}_f$ and, Jensen's α is zero (see Section 1 for further details). This risk-free component for the acquirers and targets should be about 0.20 bps and 0.54 bps, respectively.[15] However, the MM's intercepts in Tables 2 and 3 are much larger: 7.65 bps for acquirers and 3.94 bps for targets. Thus, I

[13] To improve the readability of results throughout the paper, I report the daily volatility of the residuals (instead of the daily variance) and the daily alphas based on basis points (*10,000).

[14] This result is also consistent with many papers that have documented a run-up in target share prices a few months prior to announcements (e.g., Schwert, 1996; Betton et al., 2014; Eaton et al., 2019).

[15] $\bar{r}_f$ during the sample period of this paper is around 1.7 bps per trading day. The average $\bar{\beta}$ for the acquirers and targets based on MM is 0.88 and 0.68, respectively.

posit that the MM's intercept contains Jensen's alphas, which capture the valuation effect of the ex-ante deal anticipation (detailed in the next section). Moreover, as predicted by equation (17), these unusually high alphas suggest that the traditional MM is likely to underestimate the merger gains.

3.2.2 Beta: Systematic risk

The average beta for both firms remains almost constant across the three regimes, except for an increase in acquirers' beta in the third regime. However, this stability should not lead us to conclude that the beta stays unchanged, or that the deal anticipation does not affect merging firms' systematic risk. The beta increases for some firms and decreases for others, so average beta remains stable after a break. Section 4 provides evidence of this.

3.2.3 Volatility: Firm-specific risk

In general, updates in the merging likelihood have a minimal impact on the average idiosyncratic risk of merging firms. However, they cause the average σ for acquirers to drop significantly and to increase for targets in the third (*negotiation*) regime. While shifts in volatility do not matter for measurement of the CAARs, they are relevant in testing significance. The results here suggest that the MM, which uses σ from the estimation window, may underestimate the t-stat for acquirers' CAARs, and overestimate for targets' CAARs around the announcement date.

Overall, while the ex-ante merging likelihood can change any of the three parameters, results show that the alpha moves the most. Also, the zero Jensen alpha assumption of the MM is strongly rejected here for both the target and acquirer firms.

4 Do regime-wise parameters contain M&A signals?

As motivated theoretically above, the primary source of any shift in the pre-offer parameters is the dynamics of the ex-ante merging likelihood. I conduct several analyses in this section to investigate whether this is the case and rule out other explanations.

4.1 Placebo analysis

Some unobserved marketwide factors and firms' ability to time M&As can drive both the takeover activity and the observed positive pre-offer alphas. Therefore, findings that relate the alphas to future M&As can be spurious. To address such concerns, I consider three different matched-control (placebo) samples and compare their regime-wise parameters with those of the merger sample. If some marketwide, industrywide, and firm-level misvaluations produce those shifts in parameters of the main sample, similar shifts should also exist in the placebo samples. Hence, the placebo analyses here serve as the empirical identification strategy.

A placebo firm is a firm that has not experienced any takeover activity during the sample period of this paper. Or, if a firm had some M&A activity, I remove it from the placebo samples for seven years surrounding each of its takeover attempts, three years pre- and post-announcement year. I then construct three different placebo samples: a randomly selected match (control 1) and a control firm based on pre-merger characteristics: industry-size match and M/B-size match (controls 2 and 3). The random sample accounts for the marketwide misvaluation factors. The industry-size match and the M/B-size match examine whether industrywide and firm-level misvaluations cause the pre-offer alphas. Twin Tables 2 and 3 provide the summary statistics for the parameters of the matched firms.

4.1.1 Random matches: Testing marketwide misvaluation

I randomly select a firm from the above population of non-merging firms. Acquirers outperform their random matches in each of the three regimes, as their average regime-wise alphas are significantly higher by 3.51 bps (0.74% per month) to 3.87 bps (0.81% per month). These results rule out the possibility of some marketwide factors driving observed higher alphas for the acquirers.

The targets' average alpha in the first regime is statistically indistinguishable from their random matches. Surprisingly, their average alpha in the second regime is considerably lower by 2.42 bps (0.51% per month), suggesting that targets may consider M&As when they underperform a random firm in the market. However, their average alpha dramatically surpasses random matches in the *negotiation* period by 9.13 bps (1.92% per month). This indicates the market assigns a substantially higher merging likelihood to the targets in this period.

4.1.2 Industry-size matches: Testing industrywide misvaluation

The main matching characteristics are industry and size. M&As are more likely to cluster in some industries due to economic, regulatory, and technological shocks (Harford, 2005). Because acquirers tend to be larger than targets, firm size is one of the most important determinants of future M&A activity (e.g., Cremers, Nair, and John, 2009).

I select a matched-control firm from the same industry as the M&A firm, where the industry classification is based on three-digit SIC codes. If there is no observation in a given industry-year, I expand the industry classification to two-digit SIC codes. This occurred for 799 of 10,998 acquirers, and for 239 of 2,933 public target firms. The matched-control firm is then the one closest in size to the merging firm, where size is the market capitalization of equity in the calendar year-end before the announcement year.

Acquirers overperform their peers significantly in each of the three regimes, where their average alphas are higher by 1.43 bps (0.30% per month) to 2.37 bps (0.50% per month). I note that, if some factors are driving an industrywide overvaluation, they should affect both the merger and peer firms similarly. The results here reject this possibility, and suggest that the merging likelihood should be higher for acquirers than their industry-size matches.

Peer firms' average beta is less than acquirers' beta by at least 0.10, suggesting that the difference would be even larger if the average beta of the two samples were similar. Also, acquirers have significantly less idiosyncratic risk than their peers. The increased merging likelihood lowers the σ of the acquirers through diversifying part of their firm-specific risk. This is because the market perceives acquirers' stock somewhat as a portfolio of acquirer and target stocks, which should have a lower σ than the acquirer's stand-alone stock.

Table 3 shows that the target firms perform poorly relative to their peers in both the *market-timing* and the *search* regimes (1.45 bps (0.30% per month) and 5.12 bps (1.08% per month), respectively). This result confirms the anecdotal evidence in the SEC filings that targets are more likely to seek a merger or sale when they underperform significantly compared to their peer group. However, target firms overperform their peers significantly by 7.94 bps (1.67% per month) in the *negotiation* period, confirming the market receives the most reliable anticipation signals during this period. Interestingly, the alpha for the peer group declines significantly by 3.46 bps (0.73% per month) at the same time. This implies that the market anticipates that targets are more likely to receive a bid offer than their peers.

Similarly to the acquirers' case, the main targets are more exposed to systematic risk than the placebo targets, although the difference is minor. The σ of target firms does not follow a similar pattern. This suggests that either their ex-ante merging likelihoods are lower, or the acquirers recognize the major part of the diversification benefit.

4.1.3 M/B-size matches: Testing firm-level misvaluation

Long-run event studies use the M/B and size characteristics to compute buy-and-hold abnormal returns (Mitchell and Stafford, 2000). Also, both the misvaluation theory (Shleifer and Vishny, 2003; Rhodes-Kropf and Viswanathan, 2004) and the Q-theory of mergers (Jovanovic and Rousseau, 2002) posit that high-M/B firms tend to acquire low-M/B firms. Hence, these theories can explain why the pre-offer alphas of acquirers exceed those of targets in the *market-timing* and *search* periods.

To address this concern, I construct an alternative placebo sample where I replace the industry match with an M/B match. The population of U.S. public firms in a given year is independently assigned to quintiles of M/B and size (market capital of equity). I then randomly choose a placebo firm from the same quintiles of M/B ratio and size of the merging firm. The results based on this alternative placebo sample are similar to those based on the industry-size matches, and are not reported here for the sake of brevity.

In general, comparisons based on characteristics-based (industry-size and M/B-size) matches relative to random matches are more stringent. The average regime-wise alphas for the industry-size matches are considerably larger than those for the random samples, by 1.19 bps (0.25% per month) to 2.21 bps (0.46% per month). The higher ex-ante merging likelihood of a peer than a random firm explains this difference, because these characteristics are significant cross-sectional predictors of firms' future M&A activity. In other words, the probability of merger activity for random matches is much lower, so their alphas are also lower.

In summary, the parameters (particularly the alphas) differ among the three placebo and merger samples. The placebo results reject that some marketwide and industrywide factors and firms' ability to time takeovers drive both the dynamics in the parameters and the M&A activity.

4.2 Do breaks correspond to the initiation of the private sale process?

Eaton et al. (2019) document a run-up in the share price of the target firms when the merging firms initiate private negotiations. This run-up implies a substantial increase in the ex-ante merging likelihood long before the first public bid announcement. Thus, there is likely to be some information leakage about a forthcoming deal from the private sale process, causing the market to anticipate the target firm and to incorporate part of the bid premium during the negotiation period. Given that the negotiation occurs between the target and acquirer firms, the market is likely to anticipate both at the same time. This prediction is consistent with Betton et al.'s (2014) rational market anticipation theory. They posit that, when takeover anticipation signals inform investors about potential deal synergies, both the acquirers' and the targets' prices will increase in the run-up period. I extend Eaton et al. (2019) by investigating whether there is a similar price run-up for the acquirer firms.

The beginning of the negotiation dates also serve as alternative break dates. I divide the pre-offer period into two periods, and investigate how the parameters behave in the pre-negotiation and negotiation periods. Consistency of these results with those based on the TBM provides additional robustness to my main findings. Also, if the detected break dates of the TBM lie at a reliable distance from the start of the negotiation dates, they can be attributed to a substantial increase in the ex-ante merging likelihood.

Table 4

4.2.1 Location of break dates relative to negotiation dates

Panel A in Table 4 reports the statistics about the initiation date of private negotiations and the first and second break dates based on the TBM for merging firms. The private negotiation begins, on average, 119 days before the announcement date, with a median of 96 trading days. These statistics are similar to the findings of Eaton et al. (2019), who report an average (median) for their sample of 112 (93) days. Figure 2

The first break dates occur much earlier than the start date of negotiations. Thus, private negotiations are less likely to be related to the first break dates. Figure 2 illustrates the distribution of the second break date of merging firms relative to the start date of negotiations (Day 0). This figure shows that the majority of the second breaks are clustered within the three-month interval from Day 0, verifying that the third regime overlaps with the negotiations period for most series. Thus, the second break date captures an increase in the ex-ante merging likelihood.

4.2.2 Alphas during pre-negotiation and negotiation periods

Panel B in Table 4 presents the average regime-wise alphas and the average alpha during the pre-negotiation and negotiation periods. Similarly to the main results, I find that the acquirers' alphas remain significantly positive in both negotiation-related periods, with an average of 5.59 bps (1.17% per month) and 4.94 bps (1.04% per month), respectively. Contrary to the value-creation puzzle, this indicates that the market perceives that a forthcoming M&A can create value for acquirer firms, incorporating part of it through a positive alpha in the private negotiation period.

Just as with the results of the TBM, I find that the targets' alpha jumps, on average, from 2.33 bps (0.49% per month) in the pre-negotiation period to 15.42 bps (3.24% per month) afterward.

4.3 Time series of merging likelihood

Equation (13) proposes a theoretical relation between the regime-wise alphas and the ex-ante merging likelihoods. This section aims to empirically examine whether this is true.

If the size of the total premium is known a priori, we can calculate the probability of a successful merger for any given deal based on how much prices move in the direction of the final bid price. Employing this intuition, Brown and Raymond (1986) and Samuelson and Rosenthal (1986) develop a measure for this takeover probability that I use here (further details are in Section 1 of the Internet Appendix). Figure 3

Figure 3 depicts the average takeover probability around the bid announcement (Day 0), from Day -379 to Day 126. The merging likelihoods for both firms trend positively over this period. This suggests that the market receives stronger signals about future M&As as time passes, and incorporates them by three positive regime-wise alphas. The positive trends confirm that the theoretical relation holds in the data.

Furthermore, the average likelihood is much higher for the acquirer than the target firms throughout the pre-offer period. This result supports earlier findings in this paper that the acquirers' average alphas are significantly larger than those of the target firms in the *market-timing* and *search* regimes. In general, these results suggest that the acquirers' anticipation signals are stronger, released more steadily, and begin earlier in the pre-offer period. The targets' signals are weaker but intensify more dramatically closer to the announcement date, filling the gap between the two average series.

I also examine whether alpha has any cross-sectional power in predicting future M&A activities. Section 2 of the Internet Appendix reports that the alpha, relative to established predictors in the extant literature, provides additional explanatory power in cross-sectional M&A predictions. Overall, both the time series and the cross-sectional results support the idea that pre-offer alphas are positively associated with the ex-ante merging likelihood.

4.4 Are beta dynamics related to the anticipation signals?

Hackbarth and Morellec (2008) find that target and acquiring firms tend to merge when their restructuring options gain substantial value, which generates dynamics in the firm-level betas. They also find that the change in beta is path-dependent. In particular, the acquirer's beta increases (decreases) relative to that of the target firm if the former beta was smaller (greater) than the latter one. If the break dates occur when the ex-ante merging likelihood is significantly updated, the beta should change accordingly.

To examine this claim empirically, I use the subsample of M&As between public firms, and divide the deals into two groups based on whether the acquirer's beta is larger or smaller than the target's beta in the first regime. I then examine whether the betas' dynamics in the subsequent two regimes are consistent with the above prediction. Table 5

Table 5 reports the average beta for the merging firms over the three regimes. In general, the results agree with the prediction. For deals in which $\beta_{acq,1} > \beta_{trg,1}$, the average beta of the acquirer firms declines significantly by 0.14 after the first break date, while the targets' average beta increases significantly by 0.23. The opposite result is evident for deals in which $\beta_{acq,1} < \beta_{trg,1}$. The average beta of the acquirer (target) firms increases (decreases) significantly from 0.66 (1.19) in the first regime to 0.89 (0.78) in the second regime. The average change in beta in the third regime relative to the first $(\bar{\beta}_3 - \bar{\beta}_1)$ is similar in sign and significance to that from the second to the first $(\bar{\beta}_2 - \bar{\beta}_1)$, suggesting that an average change in the third regime relative to the second $(\bar{\beta}_3 - \bar{\beta}_2)$ is economically negligible. Overall, these results show that the beta moves in the pre-offer period in response to updates in the ex-ante merging likelihood.

In summary, the results in this section illustrate that the regime-wise alphas and betas contain anticipation signals about future M&As.

5 Evidence on the bias of the market model

Equation (17) and the findings of positive alphas predict that the MM underestimates merger gains. I examine the validity of this prediction by comparing the CAARs of the MM with those of the TBM. The four panels in Figure 4 illustrates the CAARs to the acquirer and target shareholders over the (-379, 126) and (-126, 126) intervals. These intervals cover twenty-four and twelve months around the announcement date.

The MM underestimates the CAARs to the acquirer shareholders. The size of the bias is substantial: 38.05% over the (-379, 126) interval, and 18.89% over the (-126, 126) interval. Assuming that the alpha does not contain anticipation signals and that the parameters are constant leads the MM to conclude that the acquisitions are value-destroying. For example, the CAAR over the (-126, 126) interval is -10.34%. By relaxing these assumptions, the TBM reveals the opposite: The acquirer shareholders gain significantly from restructuring decisions, as their CAAR is 8.55% over the same interval. Figure 4

The MM also markedly underestimates the CAARs to the target shareholders, by 16.81% and 7.91% over the twenty-four- and twelve-month intervals, respectively. The size of this bias, however, is more moderate. This result is expected, because earlier findings show that the ex-ante merging likelihood and the regime-wise alphas for the targets are lower than for the acquirers.

One criticism of the regime-wise alphas is that the pre-offer TBM's CAARs may be greater because of the overvaluation, not the anticipation, signals. To address this issue, I compare the acquirers' TBM CAARs with those of their industry-size matches (unreported). Differencing the CAARs should remove any market- and industrywide overvaluations that affect both samples, and capture only how the merging likelihood between them differs. I find that the peers' CAARs is 19.30% over the (-379, -2) interval, while that for the acquirers is 27.01%. Similarly, the target firms overperform their peers dramatically by 3.90% in the pre-offer period. In summary, the anticipation signals drive the TBM's CAARs to the merging firms in the pre-offer period.

Event studies usually measure the CAARs over a short event window (a few days) around the announcement date. I consider both short- and long-term event windows in the hypothesis testing here in order to examine whether the bias occurs systematically across all event windows, or if it is specific only to some.

Table 6

Table 6 summarizes the results of testing whether the MM and the TBM CAARs to the merging shareholders are similar across various event windows around the announcement date: (-379, 126), (-379,-127), (-126, 126), (-126, -2), (-63, -2), (-42, -2), (-20, -2), (-10, 10), (-5, 5), (-1, 1), (-1, 20), (-1, 42), (-1, 63), and (-1, 126), where 0 is the announcement date.

The tests in Table 6 verify the bias observed in Figure 4, and indicate it is statistically significant at the 1% level across all event windows (t-stats are not tabulated). Consistent with equation (18)'s prediction, the average daily underestimation of CAARs (see column "AAR") to acquirer shareholders is almost constant at around -7 bps across the event windows. This suggests that the bias in measuring CAARs gets larger with the size of an event window, and explains why most takeover studies use a shorter event window (although such bias still exists). For example, the MM estimate of CAARs (-5, 5) is 0.17%, while the TBM estimate is 0.94%, implying an underestimation of 0.77%. The bias in CAARs (-1, 1) is 0.20%.

Using the MM, several studies (e.g., Smith and Kim, 1994; Schwert, 1996) find that, in the pre-offer period, the target's stock price begins to increase, but the acquirer's stock price remains nearly flat. Thus, this evidence shows no significant run-up in the share price of the acquirers. Similarly, I find that acquirers' CAARs based on the MM are -1.67% for the period (- 126, -2). The reason for this apparent underperformance is that this model assumes the intercept does not contain M&A anticipation information, and so subtracts it from the abnormal returns. The average MM intercept is large (7.65 bps per day), and reduces the six-month CAARs by 9.64% (= 7.65 bps * 126). However, after accounting for the anticipation signals, the TBM estimates a significant run-up in CAARs of 7.73%. These findings suggest that the acquirers' gains are sizable, and are mostly incorporated into their stock prices during the pre-offer period.

On a related note, Schwert (1996) reports an average MM intercept of 1.8 bps for the acquirers in his sample, which leads to a significant downward trend in his CAARs throughout (-126, -2).[16] He recognizes that this average intercept from the benchmark estimation window is unusually high. To manage this problem, Schwert (1996, 2000) sets the intercept to 0, $A_{i,t} = R_{i,t} - \hat{\beta}_i^b R_{m,t}$, when he calculates the acquirers' CAARs. This crude correction is similar to the TBM approach, where the intercept is part of the ARs.

There are several important differences between these two approaches. First, the positive pre-offer alphas and CAARs here indicate that the market anticipates merging firms even during the estimation window (-379, -127).[17] Therefore, all three regime-wise intercepts should be part of the total merger gains. Second, the TBM allows the beta to vary in response to the anticipation signal. Overall, Schwert's (1996, 2000) estimates deviate from those of the TBM if the event firms' average beta changes dramatically during the pre-offer period, and/or if the average beta is different from 1. This potential bias makes that approach less suitable for the target firms (since their average beta is 0.68), while the TBM is applicable for both merging firms.[18]

Most of the results in Table 6 for the target firms are similar to those for the acquirer firms — the MM underestimates CAARs significantly. There are two notable differences, however. First, the size of the average daily bias, which ranges between -2.54 and -3.79 bps, is almost half that for the acquirers. This is because the anticipation signals in the pre-offer period, and therefore the alphas, are much stronger for the acquirers than for the targets. Second, there are considerable variations in the daily bias across the event windows of target firms. The closer an event window is to the announcement date, the smaller the size of the daily underestimation. The MM's daily intercept is small (3.94

[16] The average intercept (7.65 bps) is larger here because of differences in the sample. I consider the acquisition of public, private, and subsidiary target firms; Schwert (1996) studies only public targets. The average intercept is larger for private and subsidiary targets than for public ones. The sample periods also differ.

[17] Assuming takeovers are unpredictable during this window, the MM sets CAARs mechanically to 0 in Table 6. However, the TBM estimates significant CAARs of 19.16% for acquirers and 8.89% for targets.

[18] Suppose ϕ denotes the difference between the CAR based on Schwert's correction and the CAR of the TBM over the (t_1, t_2) interval. The potential bias is as follows, which is similar to that in equation (16), except the alpha part is 0: $\phi = \sum_{t=t_1}^{t_2} (\hat{\beta}_i^b - \hat{\beta}_i^{TBM})\, R_{m,t} + \sum_{t=t_1}^{t_2} (\hat{\beta}_i^{TBM} - 1)\, R_{f,t}$.

bps) relative to the jump in share price around the announcement date (i.e., a cumulative raw return of 21% in the (-1, 1) interval), which explains this result.

Takeover studies usually incorporate CAARs over a pre-offer period as part of the total bid premium in order to capture the run-up in target stock prices. This period begins from Day -63 in Schwert (2000) and Day -42 in Schwert (1996) and Betton et al. (2014). However, Eaton et al. (2019) find that the private negotiation between merging firms begins, on average, six months ahead of the announcement date. They thus recommend measuring the run-up from Day -126 in order to avoid significantly underestimating the total premium.

The results in Table 6 show that the MM underestimates the CAARs of the acquirers and targets considerably in the run-up period (-126, -2), by 9.40% and 4.70%, respectively. In unreported results, I also find that the total premium (CAARs over the (-126, 126) interval) offered to the target firms is similar between the TBM and the negotiation-adjusted approach of Eaton et al. (2019). This finding confirms that researchers can use TBM without hand-collecting data from the SEC, which is necessary for the negotiation-adjusted approach.

I conduct various subsample analyses to examine whether the unpredictability bias varies with the terms of a deal, the characteristics of the merging firms, or the sample period. For the sake of brevity, I report those results in Section 3 of the Internet Appendix. I find that the downward bias of the MM persists regardless of the subsample considered. Notably, the TBM finds larger CAARs in deals with higher perceived ex-ante merging likelihood, such as successful deals, merger offers, and within-wave deals. These results further support the TBM's ability to account for partial anticipation.

In summary, these results reveal that the MM generates both economically and statistically significant errors in measuring the effects of takeovers on the wealth of shareholders. The TBM considerably improves the merger returns by incorporating the dynamics of the ex-ante merging likelihood into the abnormal return estimates.

6 Anticipation signals: Private or public?

Thus far, my results show that the market incorporates anticipation signals in the pre-offer share price of merging firms. In this section, I use two tests to explore whether the signals are private or available publicly for some investors, such as institutional investors. Publicity would indicate that at least one group of investors anticipates the forthcoming mergers and/or that the information is leaked somehow during the private sale process.

6.1 Traders with private information

I decompose the variation of a firm's stock return into a systematic and a firm-specific component. Roll (1988) and Durnev et al. (2004) show that firm-specific variation is mostly unassociated with public announcements and related mainly to trading by investors with private information. If a considerable portion of investors receives the anticipation signals, the firm-specific residual variance of merging firms should decrease in the pre-offer period.

Given that the total return variance varies across firms due to differences in beta, Roll (1988) suggests using R^2 instead of the residual variance. Hence, higher R^2 indicates more intensive informed trading due to M&A anticipation. I use the regime-wise parameters of both merging and industry-size matched samples to examine this conjecture.

Roll (1988) and Durnev et al. (2004) use market and industry returns to estimate the systematic portion of return variations. Here, instead of industry returns, I explicitly employ an industry-size matched firm with more similarity to the merging firm than an average firm in an industry. Apart from this difference, my measure of firm-specific return variation relative to the marketwide return variation is similar to that used in Durnev et al. (2004). Let $\psi_{i,j}$ denote relative firm-specific stock return variation of firm i during regime $j(= 1, 2, 3)$, which equals:

$$\psi_{i,j} = ln\left(\frac{1 - R^2_{i,j}}{R^2_{i,j}}\right) = ln\left(\frac{\sigma^2_{\epsilon,i,j}}{\sigma^2_{m,i,j}}\right) = ln(\sigma^2_{\epsilon,i,j}) - ln(\sigma^2_{m,i,j}), \tag{19}$$

where $\sigma^2_{\epsilon,i,j}$ is the firm-specific return variation and $\sigma^2_{m,i,j}$ is the systematic return variation for stock i during regime j, which are estimated using the TBM from equation (5). I interpret a decline in ψ following a break date as an increase in public information due to the release of new signals about a potential merger.

Table 7 summarizes that statistics about the ψ of the acquirer, target, and industry-size-matched firms across the three regimes. The average acquirers' relative private information declines significantly after the first break date, from 2.32 to 2.18, and remains unchanged after the second break date. However, the matched control firms' average measure increases significantly after the second break date. Also, comparing average measures between the acquirer and placebo samples indicates that the acquirers' stock returns have significantly less relative private information than those of the matched-control firms across all three regimes. This implies that the acquirers' intention to buy another firm reaches the market after the first break date, suggesting signals are actually revealed or leaked from the beginning of the *search* process.

Table 7

Like the acquirer firms, investors obtain private information about potential target firms after the first break date. However, in contrast, the average target's ψ increases significantly after the second break date, from 2.87 to 3.01. A significant run-up in target stock prices during the *negotiation* period confounds ψ in this period, which means it is less reliable to compare with the ψ from the *search* period. Overall, the results indicate that the market obtains anticipation signals for both merging firms when they begin searching for potential business partners.

6.2 Institutional investors' ownership

If the anticipation signals are revealed to the public in the pre-offer period, then institutional investors, arguably as sophisticated and informed traders, should trade on the new information. I investigate here whether the holdings of institutional investors provide any direct evidence that they are using the anticipation signals in their portfolio management decisions.

Figure 5 depicts the average quarterly institutional investor ownership (IO) of stocks

Figure 5

of merging and industry-size-matched firms beginning six quarters before and ending one quarter before the public bid announcement date. The average IO for the acquirer firms is trending positively, and increases significantly, by 4.6% from 36.1% in Quarter -6, to 40.7% in Quarter -1. However, the average IO for the placebo firms increases much more moderately, from 31.2% to 33.1% over the same period. The steeper trend for the acquirers over their peers suggests that institutional investors react to the anticipation signals by investing more aggressively in the potential acquirers. In contrast, the positive trend in the average IO of target firms is moderate and comparable overall to that of their peers, suggesting their anticipation signals are weaker in the pre-offer period. I also find that institutional investors invest considerably more in stocks of successful deals than failed deals, in mergers than in tender offers, and in within-wave deals than in off-wave deals (unreported). Overall, my results suggest that institutional investors buy more on the anticipation signals.

7 Additional tests for partial anticipation

One may criticize that the above-documented significant positive alphas and CAARs of the merging firms (mainly the acquirers) reflect that these firms are engaging in takeover transactions when their market valuations are higher, i.e., they are timing the M&A transactions. However, I find that the pre-offer CAARs of merging firms exceed those of their matched-control firms, implying that a part of the CAARs is attributable solely to partial takeover anticipation. In this section, I perform three alternative tests to reassess this finding.

7.1 CAARs of successful vs. failed deals

The valuation of merging firms around bid announcement dates contains two components: the stand-alone (normal) value and an additional (abnormal) value due to the partial takeover anticipation. If the ex-ante merging likelihood for the successful deals exceeds that of failed deals, their CAARs should also be higher. To examine this notion, I compare the CAARs of the merging firms in the successful and failed bids. Figure 6

Figure 6 plots CAARs over the (-126, 126) interval for the acquirers (Panel A) and targets (Panel B). The pre-offer CAARs based on the MM are indistinguishable between successful and failed bids for both merging firms, suggesting their ex-ante merging likelihood is similar. However, the TBM shows that the market distinguishes offers that are more likely to be consummated by greater pre-offer gains. The CAAR (-126, -2) for the acquirers in the successful bids is 7.89%, while it is 6.05% in failed ones. Similarly, the targets' CAAR (-126, -2) in successful bids is significantly higher, by 7.52%, than that in failed offers.

We may still argue that the higher pre-offer CAARs to the acquirer firms in successful bids indicate overvaluations of those firms, and not necessarily their higher ex-ante merging likelihood. If this is true, however, their CAARs should reverse after the announcement regardless of deal outcome. This is because the market should perceive that such firms have timed takeover announcements to take advantage of their high valuations.

Figure 6 shows that the acquirers' TBM CAARs for the successful bids slightly increased in the post-offer period. But the TBM CAARs for failed offers reversed back to their initial level (0) within four months after the bid announcement. Overall, Figure 6 suggests that the differential run-up in the share prices of successful and failed offers reflects only the difference in their ex-ante merging likelihood, and not the market timing ability of the merging firms.

7.2 Run-ups and mark-ups in targets' stock prices

The results suggest that assuming M&As are unpredictable can cause the MM to underestimate the merging gains. To illustrate that this bias has important implications for financial economics research, I next reconsider the literature that examines the relationship between the run-up and mark-up in targets' share prices around the bid announcement.

Schwert (1996) studies whether the pre-offer run-up reduces (the rational deal-anticipation hypothesis) or increases (the mark-up pricing hypothesis) the total premium paid to the target shareholders. He finds the total premium (the sum of the run-up and mark-up returns) increases one-for-one with the run-up, which is consistent with the mark-up pricing hypothesis. However, Betton et al. (2014) find evidence in support of the alternative hypothesis. They argue that the run-up contains takeover signals that inform investors about both the merging likelihood and the deal-specific synergies. Thus, the rational anticipation of a deal causes the mark-ups in the run-ups to decrease.

I test whether using anticipation-adjusted (TBM) CAARs can affect the documented run-up and mark-up relation. I regress the mark-up on the run-up as follows:

$$markup_i = a + bRunup_i + \epsilon_i. \tag{20}$$

As suggested by Betton et al. (2014, p. 1718), $-1 < b \leqslant 0$ would reject the mark-up pricing hypothesis while supporting the rational deal-anticipation hypothesis. The mark-up is CAARs from one day before the bid announcement (Day -1) through delisting, or 126 trading days after the bid, whichever comes first.[19]

Betton et al. (2014) assume that the deal anticipation begins from Day -41, so they use the share price on Day -42 as the unaffected price to measure the bid premium. Schwert (1996) also estimates the run-up CAARs from Day -42. However, the results here and in the existing literature (e.g., Eaton et al., 2019) indicate that investors receive the deal-anticipation signals much earlier. Hence, I use two periods to estimate the run-ups: the CAARs over (-126, -2) and (-42, -2) intervals.

Table 8 presents the estimated coefficients of equation (20) for the public target sample and various subsamples. Most of the results based on the MM CAARs imply that the run-ups increase acquirers' takeover costs. For example, a $1 run-up significantly increases the mark-up, so the bid premium is higher by 12.1 and 34.7 cents, depending on the sample characteristic and the measurement interval. These results are consistent with those in Schwert (1996). However, using the TBM estimates, I find strong support for the Table 8

[19]My results continue to hold when I use a shorter event window to estimate the mark-up returns, namely, CAARs over the (-1, 42) interval.

deal-anticipation hypothesis. The run-up reduces the mark-ups significantly in the main sample and in most of the subsamples. Although I use a different approach and sample, and longer event windows, my results are in line with those in Betton et al. (2014).

Overall, Table 8 suggests that the target's run-up gains contain the partial anticipation signals, which in turn lowers the target's mark-up returns paid by the acquirers. Relaxing the unpredictability assumption is critical for the run-up and mark-up relationship.

7.3 Do acquirers share in run-up and total merger gains?

Equation (13) proposes that the pre-offer regime-wise alphas are a product of the ex-ante merging likelihood and the expected share of a merging firm from the total takeover synergies. The results indicate that the average pre-offer alphas are significantly positive for both the target and acquirer firms, suggesting the following three conclusions: 1) The ex-ante merging likelihood is positive for both firms, confirming the partial anticipation of M&As; 2) the expected total synergistic gains are positive, so the takeovers are value-increasing; 3) both the target and acquirer firms share a fraction of the positive total synergies, so the M&A decisions are value-maximizing for both.

The last finding is contrary to the well-documented evidence in the takeover studies that M&As do not create value for the acquirers. Betton et al. (2014) provide an alternative approach to test the validity of this claim. Proposition 3 in their paper predicts that when the market anticipates deals with synergistic gains, in which those gains are split between both merging firms, the acquirer's total gains will be positively correlated with both the target's run-up and the total gains. Betton et al. (2014) provide empirical evidence supporting this prediction (see their Table VII).

To examine whether this prediction holds in this sample, I run the following regression: regression:

$$CAAR_{Acq,i}^{TBM} = \alpha + \beta CAAR_{Trg,i}^{TBM} + \gamma X_i + \eta_i, \tag{21}$$

where $CAAR_{Acq}$, the dependent variable, is estimated over (-42, -2), (-42, 1), and (-42, 42) intervals, while $CAAR_{Trg}$, the main independent variable, is measured over (-42, -2) and (-42, 1) intervals. The (-42, -2) interval captures the run-up in the returns, while the (-42, 1), and (-42, 42) intervals measure total gains.[20] I also include the well-established predictors of the acquirer's CAARs in the regression analysis (X_i): relative size, toehold size, 1999 to 2000 indicator, cash, equity, tender offer, hostile, target defense, same industry, and M&A wave indicator. I do not report those coefficients for the sake of brevity. [21]

Table 9

Table 9 reports the coefficient estimates from regressing the acquirers' gains on the targets' gains. Interestingly, Model (1) shows that the acquirer's run-up CAARs are positively correlated with the target's CAARs: The coefficient on the target CAAR (-42, -2) is 0.131 with a t-stat of 7.60. Consistent with Betton et al. (2014), I find in Models (2) to (4) that the acquirer's total gains increase significantly with both the target's run-up and total gains.

Overall, the significantly positive correlations between the acquirer and target gains in Table 9 provide further support that investors obtain takeover anticipation signals that contain important information about potential deal synergies. Both firms share in the merger synergies, which rejects the notion that acquirers are pursuing value-destroying transactions.

8 Robustness checks

I examine the robustness of results for alternative specifications. This paper uses the CAPM to document positive pre-offer alphas for the merging firms. However, those alphas can be a product of some missing asset pricing factors (the "bad-model" problem), or a result of the clustering of M&As in some industries or across specific periods.[22]

To address these concerns, I use the calendar-time portfolio approach with several recently developed asset pricing models (such as the Fama-French five-factor model and the Hou-Xue-Zhang Q-factor model) to estimate the alphas. Similarly to the results for

[20] Betton et al. (2014) use (-42, -2) and (-42, 1) intervals. Beyond those intervals, I estimate the total gains over a longer event window, the (-42, 42) interval, to test how the results are sensitive to this choice.

[21] The main results hold when I exclude these control variables.

[22] Kothari and Warner (2007) provide an excellent discussion of these two problems. Harford (2005), among others, documents merger clusters over calendar time and specific industries.

the CAPM, I find that the calendar-time intercepts are economically and statistically significant and positive for both merging firms regardless of the employed asset pricing model. These results are reported in Section 4 of the Internet Appendix. A similar difference exists between the intercepts of the merger and the matched-control samples.

9 Conclusion

Takeover event studies usually assume that the parameters of the expected return model are stable and that M&As are unpredictable during the pre-offer period. Those studies document that mergers do not create value for acquirer shareholders, but that target shareholders gain a hefty bid premium. This finding has been somewhat puzzling, because it is contrary to the value-maximizing goal of acquirers' managers. This paper relaxes those assumptions to improve the measurement of merger gains and reconcile the acquirers' value-creation puzzle.

I introduce a new event study approach (the two-break model), which detects two break dates in each merging firm's pre-offer return-generating process. This model captures takeover anticipation signals by allowing the parameters to change, and then incorporates those parameters to estimate the merger gains.

Comparing the merger gains of the two-break model with those of the traditional market model, I find that the latter significantly underestimates gains. The two-break model resolves the puzzle by showing that mergers create substantial value for both target and acquirer shareholders. The primary source of downward bias is that the pre-offer alphas are significantly positive and contain anticipation signals about future M&As. Hence, investors anticipate potential mergers long before their public announcements, and can incorporate part of the deal's expected synergy into the pre-offer return series, mainly in the alphas.

Based on these results, future research could explore whether this new approach can provide novel insights into the stylized takeover facts. Although the two-break model may seem specific to mergers, it is a general approach, and researchers can seamlessly apply it to other types of (corporate) events.

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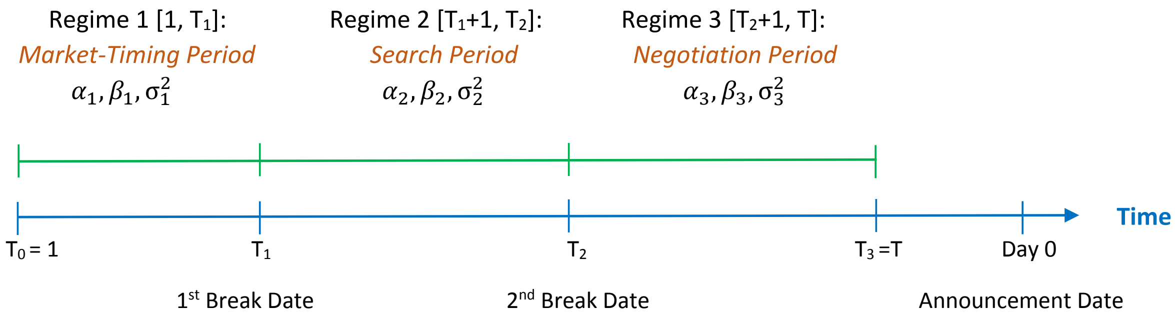
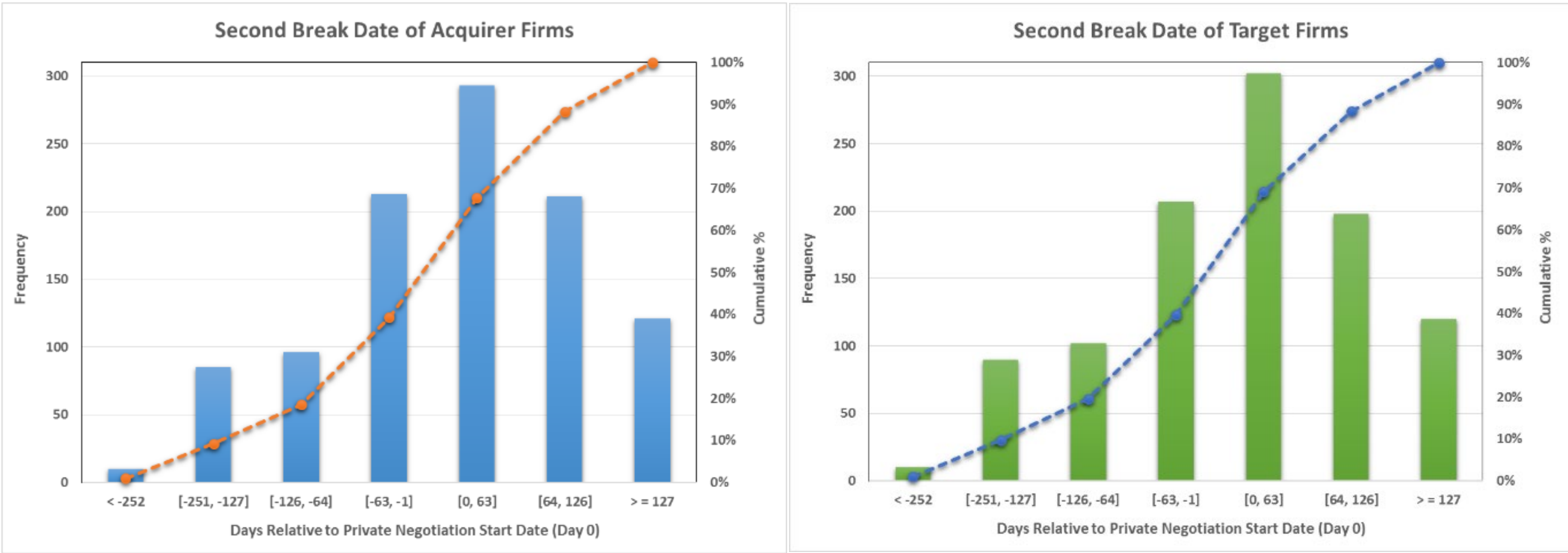
Figure 1: Timeline for the two-break model



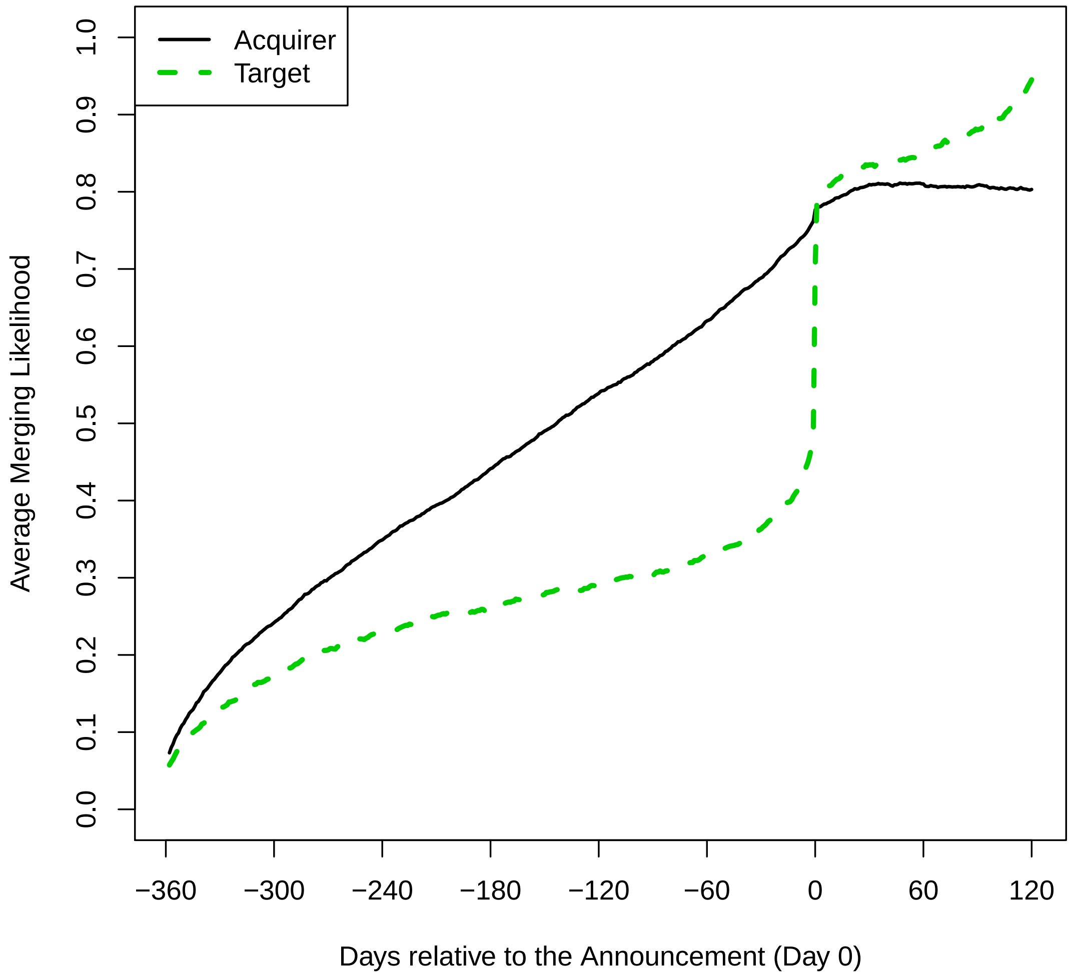
This figure illustrates the timeline for the two-break model (TBM). I assume there are two break dates (T_1 and T_2) in the CAPM of each return series. The pre-offer sample observation period for a firm begins on Day 1 and ends on Day T, and I divide it into three regimes based on the location of the two breaks. Regime 1 is called the *market-timing* period, and contains observations from the [1 to T_1] interval; Regime 2 (the *search* period) contains returns from the [T_1+1 to T_2] interval; Regime 3 (the *negotiation* period) contains returns from the [T_2 +1 to T] interval. The CAPM regression is estimated separately across each regime to measure the regime-wise parameters (alpha, beta, and the variance of the residuals).

Figure 2: Distribution of the second break dates relative to the start date of private negotiations



This figure illustrates the distribution of the second break dates of the acquirer and target firms relative to the start date of private negotiations (Day 0). The sample consists of 1,029 bids between public acquirers and public target firms with enough information on the private sale process from the SEC filings. The Qu and Perron (2007) test identifies the location of the second break dates in the CAPM of each of the target and acquirer firm's return series. I hand-collect the initiation date of negotiations from the firms' SEC filings after M&A transactions.

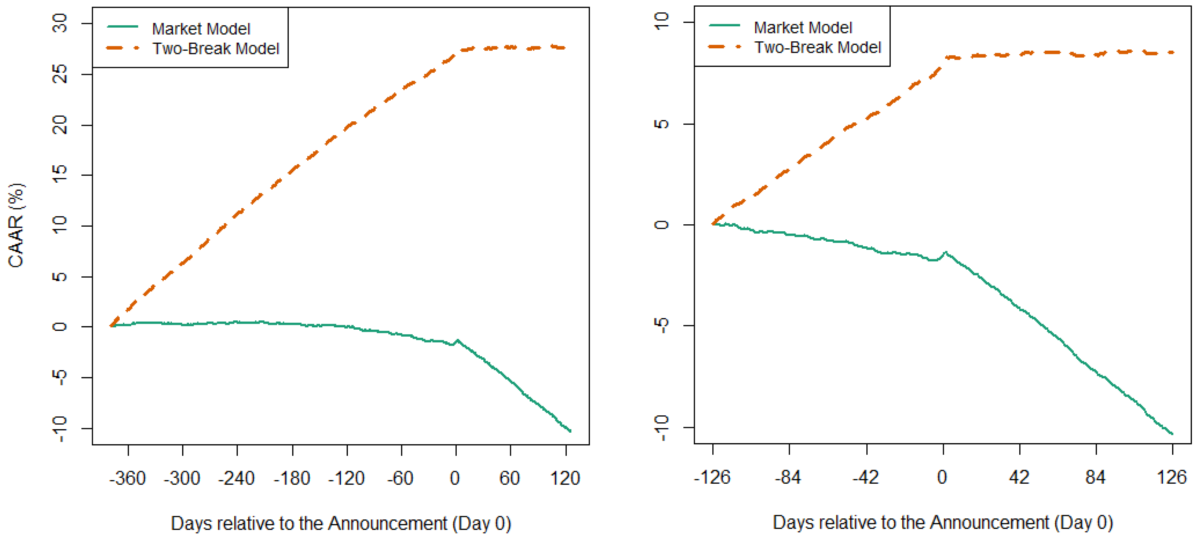
Figure 3: Time series of average merging likelihood



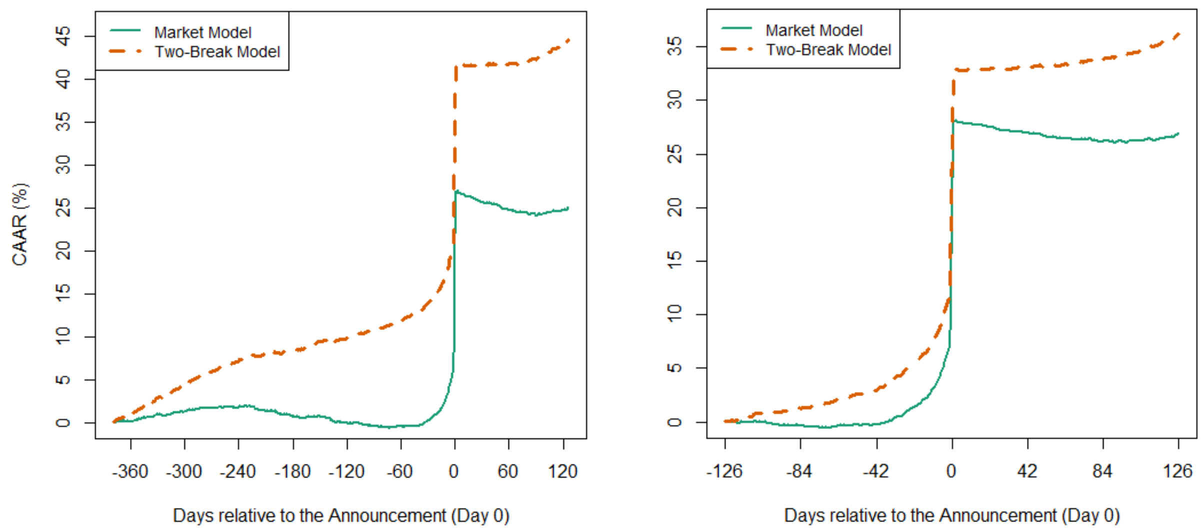
This figure illustrates the average merging likelihood for the acquirer and target firms around the bid announcement date (Day 0). The merging likelihood on each event day (X_d) for each firm is equal to $X_d = (P_d - P_F)/(P_C - P_F)$, where P_d is the stock price of a firm on day d. The fallback price (P_F) is its average stock price over a 21-day interval during the first month of the pre-offer period, beginning 379 trading days and ending 359 trading days prior to the public bid announcement date. The closing price (P_C) is the stock price on the deal consummation date or 126 trading days (roughly six months) after the announcement date, whichever comes first. I consider only mergers in which the closing price (P_C) was at least 10% higher than the fallback price (P_F). To ensure that this probability measure remains in the [0, 1] interval, $X_d = Min\{Max\left[(P_d - P_F)/(P_C - P_F), 0\right], 1\}$. Then, averaging X_d across all acquirer and target firms separately, I construct the two time series of the equal-weighted average merging likelihood. The price data of 5,802 acquirer firms and 1,993 target firms is used to create these two series.

Figure 4: Gains to the merging firms: Market model versus two-break model

Panel A: Acquirers' Gains

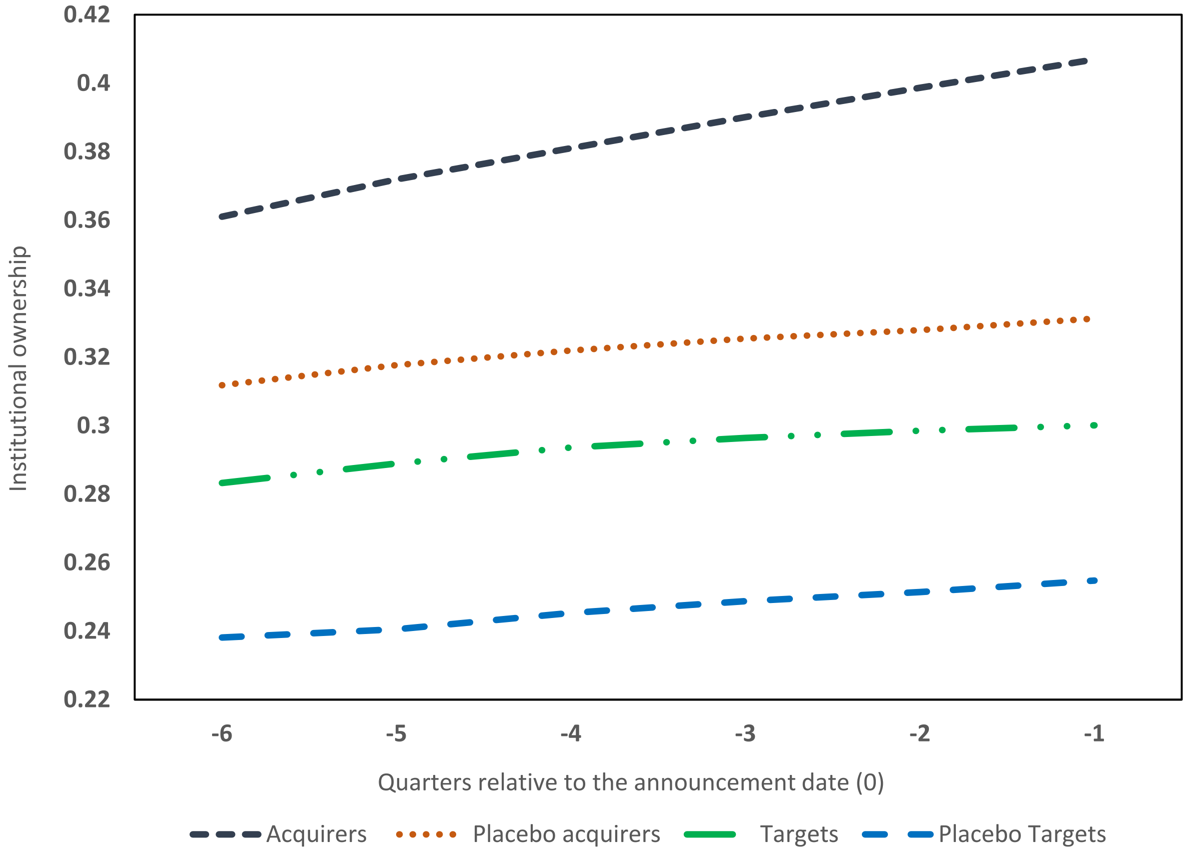


Panel B: Targets' Gains



This figure depicts the cumulative average abnormal returns (CAARs) to the acquirers (Panel A) and targets (Panel B) around the bid announcement date (Day 0) based on the market model and the two-break model. Using the CRSP value-weighted index, the market model estimates the abnormal return (AR) at day t using the parameters (alpha and beta) estimated from the benchmark estimation window, which contains returns from the (-379, -127) interval for each series. The Qu and Perron (2007) test estimates the parameters and AR of the two-break model. Section 2 provides further details on this model. During the event windows (-379, 126) and (-126, 126), the CAARs at day t are the sum of the daily average ARs over (-379, t) and (-126, t), respectively.

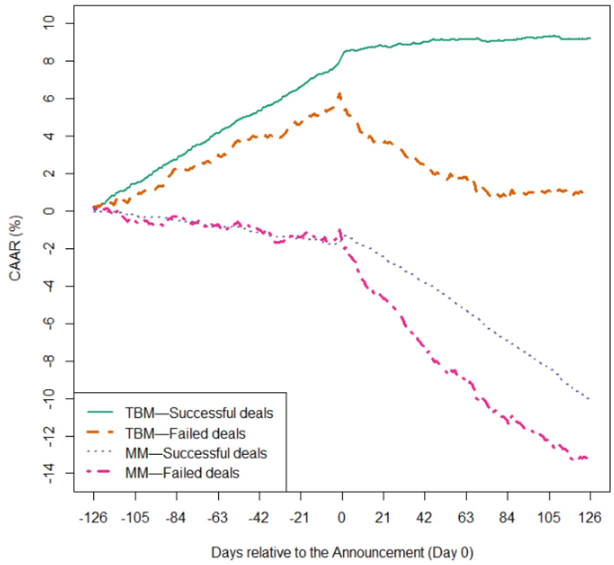
Figure 5: Institutional investor ownership of merging and placebo stocks



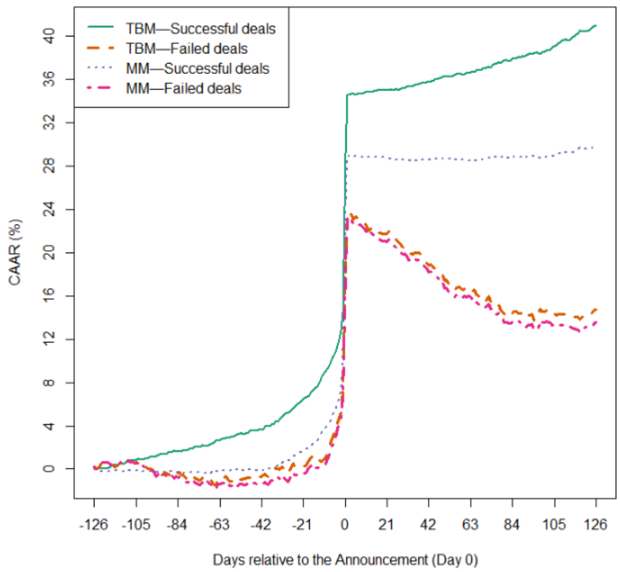
This figure plots the average quarterly institutional investor ownership of stocks of the acquirer, target, and industry-size-matched (placebo) firms beginning six quarters and ending one quarter before the public bid announcement date. Quarterly stock holdings data are from the Thomson Financial CDA/Spectrum database of the Securities and Exchange Commission (SEC) 13F filings. Institutional ownership (IO) in the stock of firm i at quarter t is the total number of shares held by all institutional investors, divided by the total number of outstanding shares at that quarter. Averaging IO across all the merging and placebo firms separately, I construct the time series of the equal-weighted average quarterly IO.

Figure 6: Gains to the merging firms in successful and failed deals

Panel A: Acquirers' Gains



Panel B: Targets' Gains



This figure plots the cumulative average abnormal returns (CAARs) to the acquirers (Panel A) and targets (Panel B) around the bid announcement date (Day 0) for successful and failed deals. CAARs over the (-126, 126) interval are estimated separately based on the market model (MM) and the two-break model (TBM). See the caption of Figure 4 for more details. The successful sample contains 10,057 acquirers and 2,464 target firms, whiles the failed sample consists of 941 acquirers and 469 target firms.

Table 1: Distribution of break dates

	N	Mean	S.D.	P25	P50	P75
Acquirer						
1st break date	10,998	-247.0	58.9	-299	-257	-203
2nd break date	10,998	-134.6	58.7	-180	-125	-82
Target						
1st break date	2,933	-244.2	59.5	-298	-254	-198
2nd break date	2,933	-128.8	58.2	-172	-116	-77

This table presents the descriptive statistics of the first and second break dates relative to the announcement date (Day 0). The Qu and Perron (2007) test identifies the location of those dates in the CAPM of each target's and acquirer's stock returns. The sample observation period of each return series starts at Day -379 and ends at Day -2 relative to the public bid announcement date (Day 0).

Table 2: Parameters of the two-break model for acquirer firms

	Acquirers			Random Matches			Industry-size Matches			Mean Difference	
	Mean	(2-1)	(3-2)	Mean	(2-1)	(3-2)	Mean	(2-1)	(3-2)	Acq-RND	Acq-Ind
Alpha											
MM	7.65***			4.24***			5.76***			3.41***	1.89***
1st regime	8.30***			4.79***			6.87***			3.51***	1.43***
2nd regime	7.88***	-0.42		4.29***	-0.5		5.51***	-1.36***		3.59***	2.37***
3rd regime	6.05***		-1.83***	2.18***		-2.11***	4.13***		-1.38***	3.87***	1.92***
Beta											
MM	0.88			0.62			0.78			0.26***	0.10***
1st regime	0.87			0.62			0.77			0.25***	0.10***
2nd regime	0.88	0.01		0.61	0.00		0.78	0.01		0.27***	0.10***
3rd regime	0.91		0.03***	0.61		0.00	0.77		-0.01	0.29***	0.14***
Volatility											
MM	0.026			0.025			0.028			0.0015***	-0.0015***
1st regime	0.026			0.025			0.027			0.0002	-0.0012***
2nd regime	0.026	0.00		0.026	0.0007***		0.027	0.0005***		-0.0005*	-0.0017***
3rd regime	0.025		-0.0011***	0.026		-0.0006***	0.027		-0.0009***	-0.0011***	-0.0020***

This table summarizes the mean of parameters based on the two-break model for the acquirers and their randomly matched and industry-size-matched control firms. The Qu and Perron (2007) test identifies the locations of the first and second break dates in the CAPM of each firm's return series. The pre-offer period starts at Day -379 and ends at Day -2 (Day 0 is the announcement). It is split into three regimes based on the two breaks' locations. The first regime (the *market-timing* period) begins at Day -379 and ends at the first break date. The second regime (the *search* period) begins from the day after the first break date and ends at the second break date. The third regime (the *negotiation* period) begins from the day after the second break date and ends at Day -2. The test estimates the parameters (daily alpha, beta, and volatility of residuals) across the three regimes. The sample consists of 10,988 acquirers. I report the daily alphas based on basis points. The matched-pairs t-test examines the difference between the cross-sectional averages of the post- and pre-break parameters, and of the main and placebo samples. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels for a two-tailed test, respectively.

Table 3: Parameters of the two-break model for target firms

	Targets			Random Matches			Industry-size Matches			Mean Difference	
	Mean	(2-1)	(3-2)	Mean	(2-1)	(3-2)	Mean	(2-1)	(3-2)	Trg-RND	Trg-Ind
Alpha											
MM	3.94***			4.46***			5.91***			-0.52	-1.97***
1st regime	5.72***			4.96***			7.17***			0.76	-1.45*
2nd regime	1.64**	-4.09***		4.06***	-0.90		6.76***	-0.41		-2.42**	-5.12***
3rd regime	11.24***		9.6***	2.11***		-1.95**	3.30***		-3.46***	9.13***	7.94***
Beta											
MM	0.68			0.62			0.64			0.07***	0.04***
1st regime	0.67			0.60			0.63			0.07***	0.04***
2nd regime	0.68	0.01		0.62	0.02		0.62	-0.01		0.06***	0.06***
3rd regime	0.67		-0.01	0.61		-0.01	0.65		0.03*	0.06***	0.02
Volatility											
MM	0.031			0.0251			0.030			0.0057***	0.0005
1st regime	0.030			0.0259			0.030			0.0042***	0.0003
2nd regime	0.030	0.0001		0.0266	0.0007*		0.030	0.0002		0.0036***	0.0002
3rd regime	0.032		0.0014***	0.0261		-0.0005	0.029		-0.0006	0.0055***	0.0022***

This table summarizes the mean of parameters based on the two-break model for the targets and their randomly matched and industry-size-matched control firms. The Qu and Perron (2007) test identifies the locations of the first and second break dates in the CAPM of each firm's return series. The pre-offer period begins at Day -379 and ends at Day -2 (Day 0 is the announcement). It is split into three regimes based on the two breaks' locations. The first regime (the *market-timing* period) starts at Day -379 and ends at the first break date. The second regime (the *search* period) starts from the day after the first break date and ends at the second break date. The third regime (the *negotiation* period) starts from the day after the second break date and ends at Day -2. The test estimates the parameters (daily alpha, beta, and volatility of residuals) across the three regimes. The sample consists of 2,933 public targets. I report the daily alphas based on basis points. The matched-pairs t-test examines the difference between the cross-sectional averages of the post- and pre-break parameters, and of the main and placebo samples. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels for a two-tailed test, respectively.

Table 4: Correspondence of break dates to the initiation date of negotiations

Panel A: Break and initiation dates

	N	Mean	S.D.	P25	P50	P75
Initiation date of negotiations	1,029	-119.0	81.7	-156	-96	-57
Acquirer						
1st break date	1,029	-246.8	58.5	-297	-259	-201
2nd break date	1,029	-133.3	57.8	-177	-122	-81
Target						
1st break date	1,029	-244.0	59.4	-297	-252	-197
2nd break date	1,029	-130.9	58.1	-173	-121	-79

Panel B: Daily Alphas

			Mean Difference		
	N	mean	(2-1)	(3-2)	(Nego. - Pre-Nego.)
Acquirer Firms					
1st regime	1,029	5.83***			
2nd regime	1,029	4.87***	-0.96		
3rd regime	1,029	4.95***		0.08	
Pre-negotiation period	1,029	5.59***			
Negotiation period	1,029	4.94***			-0.64
Target Firms					
1st regime	1,029	3.98***			
2nd regime	1,029	1.66	-2.32		
3rd regime	1,029	10.68***		9.02***	
Pre-negotiation period	1,029	2.33***			
Negotiation period	1,029	15.42***			13.09***

Panel A summarizes the descriptive statistics of the first and second break dates and the initiation dates of private negotiations. The sample consists of 1,029 bids between public acquirers and public target firms with enough information on the SEC filings' private sale process. The initiation date of negotiations is hand-collected from the firms' SEC filings. The caption of Table 2 explains how the sample observation period for each return series is split into three regimes based on the location of the two break dates. The pre-offer period is also divided into two periods based on each deal's initiation date: the pre-negotiation and the negotiation periods. Panel B presents the daily average alphas across those periods in basis points. The matched-pairs t-test examines the difference between the cross-sectional daily average alphas across periods. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels for a two-tailed test, respectively.

Table 5: Conditional beta dynamics of merging firms

	$\beta_{acq,1} > \beta_{trg,1}$	$\beta_{acq,1} < \beta_{trg,1}$
Acquirer firms		
$\bar{\beta}_1$	1.06	0.66
$\bar{\beta}_2$	0.92	0.89
$\bar{\beta}_3$	0.98	0.86
$(\bar{\beta}_2 - \bar{\beta}_1)$	-0.14***	0.23***
$(\bar{\beta}_3 - \bar{\beta}_2)$	0.06***	-0.03
$(\bar{\beta}_3 - \bar{\beta}_1)$	-0.08***	0.20***
Target firms		
$\bar{\beta}_1$	0.40	1.19
$\bar{\beta}_2$	0.63	0.78
$\bar{\beta}_3$	0.58	0.83
$(\bar{\beta}_2 - \bar{\beta}_1)$	0.23***	-0.41***
$(\bar{\beta}_3 - \bar{\beta}_2)$	-0.05**	0.05*
$(\bar{\beta}_3 - \bar{\beta}_1)$	0.18***	-0.36***
N	1,917	1,016

This table summarizes the average beta for the merging firms over the three regimes, i.e., $\bar{\beta}_1$, $\bar{\beta}_2$, and $\bar{\beta}_3$. The sample consists of 2,933 bids between public acquirers and public target firms. It is split into two groups based on whether the acquirer beta in the first regime is larger ($\beta_{acq,1} > \beta_{trg,1}$) or smaller ($\beta_{acq,1} < \beta_{trg,1}$) than that of the target firm. The Qu and Perron (2007) test identifies the first and the second break dates in the CAPM of each firm's return series. The sample observation period for each return series starts at Day -379 and ends at Day -2 (where Day 0 is the announcement date). It is split into three regimes based on the location of the two breaks. The first regime (the *market-timing* period) starts at Day -379 and ends at the first break date. The second regime (the *search* period) starts from the day after the first break date and ends at the second break date. The third regime (the *negotiation* period) starts from the day after the second break date and ends at Day -2. The test estimates the beta across the three regimes. The matched-pairs t-test examines the difference between the average betas across regimes, e.g., $(\bar{\beta}_2 - \bar{\beta}_1)$. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels for a two-tailed test, respectively.

Table 6: Merger gains of acquirer and target shareholders: Market model vs. two-break model

	Acquirers				Targets			
	CAAR		Diff. (MM - TBM)		CAAR		Diff. (MM - TBM)	
Event Window	MM	TBM	CAAR	AAR (bps)	MM	TBM	CAAR	AAR (bps)
(-379, 126)	-10.34%	27.71%	-38.05%	-7.52	26.56%	43.37%	-16.81%	-3.32
(-379, -127)	0.00%	19.16%	-19.16%	-7.57	0.00%	8.89%	-8.89%	-3.52
(-126, 126)	-10.34%	8.55%	-18.89%	-7.46	26.56%	34.47%	-7.91%	-3.13
(-126, -2)	-1.67%	7.73%	-9.40%	-7.52	6.89%	11.59%	-4.70%	-3.76
(-63, -2)	-0.94%	3.70%	-4.64%	-7.36	7.26%	9.54%	-2.28%	-3.63
(-42, -2)	-0.53%	2.53%	-3.06%	-7.46	7.14%	8.61%	-1.47%	-3.60
(-20, -2)	-0.18%	1.25%	-1.43%	-7.52	5.50%	6.13%	-0.63%	-3.31
(-10, 10)	-0.35%	1.12%	-1.47%	-7.03	24.72%	25.32%	-0.60%	-2.85
(-5, 5)	0.17%	0.94%	-0.77%	-7.02	23.23%	23.51%	-0.28%	-2.55
(-1, 1)	0.30%	0.50%	-0.20%	-6.85	21.04%	21.12%	-0.08%	-2.55
(-1, 20)	-0.90%	0.64%	-1.54%	-7.00	20.55%	21.22%	-0.67%	-3.05
(-1, 42)	-2.44%	0.73%	-3.17%	-7.21	19.98%	21.36%	-1.38%	-3.13
(-1, 63)	-3.95%	0.78%	-4.73%	-7.28	19.61%	21.61%	-2.00%	-3.07
(-1, 126)	-8.67%	0.82%	-9.49%	-7.41	19.67%	22.88%	-3.21%	-2.51

This table summarizes the cumulative average abnormal returns (CAARs) to the acquirers and targets over various event windows around the bid announcement date (Day 0) based on the market model (MM) and the two-break model (TBM). Using the CRSP value-weighted index, the market model estimates the abnormal return (AR) at day t using the parameters (alpha and beta) that are estimated from the benchmark estimation window, i.e., the (-379, -127) interval. The Qu and Perron (2007) test estimates the parameters and AR of the two-break model. Section 2 provides further details on this model. The CAARs over event window (t_1, t_2) are computed by summing the daily average abnormal returns (AARs) in that window. I report the difference between the MM's and the TBM's daily average abnormal returns in basis points in column AAR (bps), which is the difference in their CAARs divided by the length of the related event window and then multiplied by 10,000. The matched-pairs t-test examines the difference between the CAARs of the two models over each event window. All are significant at the 1% level (unreported).

Table 7: Relative firm-specific stock return variation across the three regimes

	Mean	S.D.	P25	P50	P75	Mean Difference (2-1)	(3-2)	(Main - Placebo)
Acquirers								
1st regime	2.32	1.40	1.24	2.24	3.43			-0.30***
2nd regime	2.18	1.42	1.09	2.13	3.31	-0.14***		-0.30***
3rd regime	2.19	1.40	1.13	2.07	3.25		0.01	-0.37***
Placebo acquirers								
1st regime	2.62	1.40	1.57	2.64	3.79			
2nd regime	2.48	1.43	1.42	2.52	3.68	-0.14***		
3rd regime	2.56	1.41	1.48	2.54	3.73		0.08***	
Target								
1st regime	3.02	1.30	2.06	3.11	4.05			-0.02
2nd regime	2.87	1.29	1.91	2.98	3.91	-0.15***		-0.03
3rd regime	3.01	1.25	2.09	3.14	3.99		0.14***	0.02
Placebo target								
1st regime	3.04	1.34	2.14	3.19	4.07			
2nd regime	2.90	1.33	1.99	3.02	3.96	-0.14***		
3rd regime	2.99	1.35	2.01	3.10	4.06		0.09***	

This table summarizes the descriptive statistics about the relative firm-specific stock return variation of the acquirer, target, and industry-size-matched (placebo) firms across three regimes. The sample consists of 10,998 acquirer and placebo-acquirer firms and 2,933 target and placebo-target firms. $\psi_{i,j}$ denotes relative firm-specific stock return variation of firm i during regime $j(=1,2,3)$ and equals to $ln(\sigma^2_{\epsilon,i,j}) - ln(\sigma^2_{m,i,j})$, where $\sigma^2_{\epsilon,i,j}$ and $\sigma^2_{m,i,j}$ are firm-specific return variation and systematic return variation for stock i during regime j, receptively. The Qu and Perron (2007) test identifies the first and second break dates in the CAPM of each firm's return series. The sample observation period for each return series starts at Day -379 and ends at Day -2 (where Day 0 is the announcement date). It is split into three regimes based on the location of the two breaks. The first regime (the *market-timing* period) starts at Day -379 and ends at the first break date. The second regime (the *search* period) starts from the day after the first break date and ends at the second break date. The third regime (the *negotiation* period) starts from the day after the second break date and ends at Day -2. The test estimates the two variances across the three regimes. The matched-pairs t-test examines the difference between the average ψ across regimes. The two-sample t-test examines the difference between the average ψ of the merging firms and the placebo firms in each regime. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels for a two-tailed test, respectively.

Table 8: Regression of mark-up returns on run-up returns for target firms

Sample	Full	Successful	Failed	Tenders	Mergers	Cash	Equity
Market Model							
(-126, -2)	0.172***	0.132***	0.347***	-0.020	0.204***	0.006	0.263***
	(8.192)	(6.378)	(5.757)	(-0.473)	(8.740)	(0.163)	(7.382)
(-42, -2)	0.164***	0.133***	0.277**	-0.055	0.184***	-0.049	0.294***
	(4.359)	(3.567)	(2.373)	(-0.774)	(4.214)	(-0.799)	(4.943)
Two-Break Model							
(-126, -2)	-0.066***	-0.103***	0.034	-0.258***	-0.023	-0.245***	0.007
	(-2.923)	(-4.731)	(0.469)	(-6.977)	(-0.890)	(-6.399)	(0.211)
(-42, -2)	-0.103***	-0.135***	-0.059	-0.287***	-0.080*	-0.325***	0.006
	(-2.713)	(-3.503)	(-0.548)	(-4.109)	(-1.803)	(-4.525)	(0.103)
N	2,933	2,464	469	533	2,400	877	1,115

Sample	Within-wave	Off-wave	Pre-1998	Post-1998	Large acquirers	Small acquirers
Market Model						
(-126, -2)	0.187***	0.162***	0.209***	0.134***	0.198***	0.139***
	(4.838)	(6.648)	(6.917)	(4.782)	(6.804)	(4.665)
(-42, -2)	0.264***	0.121***	0.191***	0.154***	0.194***	0.125**
	(3.792)	(2.741)	(3.543)	(3.040)	(3.570)	(2.399)
Two-Break Model						
(-126, -2)	-0.063	-0.066**	-0.016	-0.107***	-0.072**	-0.059*
	(-1.493)	(-2.541)	(-0.476)	(-3.614)	(-2.310)	(-1.825)
(-42, -2)	-0.070	-0.115**	-0.066	-0.119**	-0.103**	-0.111**
	(-1.024)	(-2.482)	(-1.199)	(-2.309)	(-1.964)	(-1.980)
N	1,007	1,926	1,597	1,336	1,667	1,266

This table reports the coefficient estimates from regressing the mark-up returns on the run-up returns for the public target sample and various subsamples. The full target sample consists of 2,933 bids. The dependent variable is the mark-up CAARs from one day before the bid announcement date (Day -1) through delisting or 126 trading days after the bid, whichever comes first. The independent variable is the run-up CAARs over either the (-126, -2) or (-42, -2) intervals. The market model and the two-break model separately measure those CAARs, and are explained in more detail in Section 2. Section 3 of the Internet Appendix describes how each subsample is constructed. t-statistics are reported in parentheses and are based on Huber-White robust standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels for a two-tailed test, respectively.

Table 9: Regression of acquirer merger gains on target merger gains

	Regression Model				
	(1)	(2)	(3)	(4)	(5)
	Acq. CAAR(-42, -2)	Acq. CAAR(-42, 1)	Acq. CAAR(-42, 1)	Acq. CAAR(-42, 42)	Acq. CAAR(-42, 42)
Trg. CAAR(-42, -2)	0.131***	0.137***		0.131***	
	(7.604)	(7.398)		(5.259)	
Trg. CAAR(-42, 1)			0.099***		0.099***
			(7.532)		(5.823)
Intercept	0.005	-0.006	-0.025***	-0.006	-0.026***
	(0.985)	(-1.026)	(-3.656)	(-0.737)	(-2.650)
Control variables	Yes	Yes	Yes	Yes	Yes
Adjusted-R2	0.045	0.037	0.034	0.019	0.019
N	2,933	2,933	2,933	2,933	2,933

This table reports the coefficient estimates from regressing the acquirers' gains on the targets' gains for the public target sample. The two-break model (see caption of Table 2 for further details) measures the merger gains. Acquirers' CAAR, the dependent variable, is estimated over three intervals: (-42, -2), (-42, 1), and (-42, 42). The independent variable, Targets' CAAR, is measured over (-42, -2) and (-42, 1) intervals. The (-42, -2) interval captures the run-up in returns, while the (-42, 1), and (-42, 42) intervals measure total gains. The sample consists of 2,933 bids over the 1980-2017 period. All regressions include the following control variables: ratio of the transaction value to the market value of the acquirer firm's assets (relative size), acquirer's ownership in the target firm at the time of bid announcement (toehold size), whether a deal is announced in 1999 or 2000 (1999 to 2000 indicator), whether the deal is paid in all cash (cash) or equity (equity), whether the deal is a tender offer (tender offer), whether the target firm resists an unsolicited offer (hostile), whether the target firm has a defensive tactic (such as poison pills, lock-ups, greenmail, white knights, etc.) in place at the time of deal announcement (target defense), whether the acquirer and the target have the same primary three-digit SIC code (same industry), and whether the deal is announced within a merger wave (M&A wave indicator). t-statistics are reported in parentheses and are based on Huber-White robust standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels for a two-tailed test, respectively.

Internet Appendix for

"The Real Merger Gains: Correcting for Partial Anticipation"

M. Vahid Irani

This Internet Appendix provides further details on the time series measure of merging likelihood, the cross-sectional predictive power of alpha, the subsample analysis, and the robustness checks discussed in the paper.

1 Time series measure of merging likelihood

Following Brown and Raymond (1986) and Samuelson and Rosenthal (1986), the merging likelihood on event day (X_d) for each firm is: $X_d = (P_d - P_F)/(P_C - P_F)$, where P_d is the stock price of a firm on day d.[1] The fallback price (P_F) is its average stock price over a 21-day interval during the first month of the pre-offer period, beginning 379 trading days before and ending 359 trading days before the public bid announcement date (Day 0). The closing price (P_C) is the stock price on the deal consummation date, or 126 trading days (roughly six months) post-announcement date, whichever comes first.

The distribution of this probability measure can suffer from outliers when either the numerator or the denominator takes values that are negative or close to zero (see Schwert, 1996, for further details). To correct this issue, I make two adjustments, as follows. First, Samuelson and Rosenthal (1986) suggest only considering deals for which there is a wide range of price movements (i.e., $P_C - P_F$). Therefore, I include only mergers in which the closing price (P_C) is at least 10% higher than the fallback price (P_F). This adjustment is the "censoring" approach discussed in Schwert (1996). Second, I ensure that this probability measure remains in the [0, 1] interval, so that

[1] Schwert (1996) uses a similar approach to calculate the run-up index, in which the ex-ante probability for each target firm equals the run-up over the total premium. I do not use his measure here because it does not vary over time for each firm.

$X_d = Min \{Max [(P_d - P_F)/(P_C - P_F), 0], 1\}$. This adjustment is consistent with the "truncation" approach suggested by Schwert (1996). Then, averaging X_d across all acquirer and target firms separately, I form two time series of the equal-weighted average merging likelihood for merging firms. I use price data of 5,802 acquirer firms and 1,993 target firms.

Note that the fallback price (P_F) above differs from that used by Brown and Raymond (1986), in that their estimate is the stock price four weeks before the announcement date. Eaton et al. (2019) find that the private merger negotiations usually begin about six months ahead of the public announcement. This recent evidence suggests that, in contrast to Brown and Raymond's (1986) implicit assumption, the ex-ante merging likelihood is not zero one month before the announcement date. The early anticipation contaminates their fallback price. Therefore, I estimate this price from the first month in the pre-offer period, during which the ex-ante merging likelihood is arguably low because firms have not yet begun searching for potential business partners.

2 Cross-sectional predictive power of alpha

The takeover literature finds that several firm- and market-level characteristics explain the likelihood that a firm will engage in takeover activity (see, for example, Cremers, Nair, and John, 2009; Bhagwat, Dam, and Harford, 2016). If the alpha contains information about the ex-ante merging likelihood, which is orthogonal to those established predictors, it should provide additional explanatory power in the cross-sectional M&A predictions.

Internet Appendix Table 2 presents the results of estimating the linear regressions to determine which variables can predict future acquirers (columns (1)-(3)) and targets (columns (4)-(6)). I mainly follow Cremers et al. (2009) and Bhagwat et al. (2016) to identify the relevant variables in Models (1) and (4), which serve as the baseline regressions. All independent variables are lagged by one year. I include industry fixed effects to control for omitted time-invariant industry characteristics that could drive both M&A activity and firm characteristics. As in Bhagwat et al. (2016), instead of incorporating year fixed effects, I explicitly use time series variables (such as the market return and

Internet Appendix Table 2

market return volatility) to capture any marketwide shocks at an annual level. Given the dependent variable's binary nature, we could use probit, logit, or linear probability models. However, following Chamberlain (1980), I employ the linear probability model in order to avoid the biases inherent when using probit or logit with industry fixed effects. I cluster standard errors at the firm and year level to correct for potential serial and cross-sectional correlations in the error term.

My results are generally consistent with previous findings. I find that the intensity of an industry's acquisition activity (*Prior M&A ind.*) in both baseline models has more explanatory power than relative valuation measures (M/B ratio) in explaining future M&A activity. This result supports the neoclassical (Q) theory of mergers (Harford, 2005), and not the notion that market valuation drives mergers.

The baseline models employ two risk measures: systematic risk, measured as the beta of the market model (MM), and idiosyncratic risk, the volatility of residuals from the market model (*IVOL*). Although firms with more exposure to systematic risk are less likely to acquire another firm, a firm's beta does not explain the likelihood of being an acquisition target. However, firms with more IVOL are more likely to engage in business combinations as buyers or sellers, possibly to benefit from diversifying their idiosyncratic risk. This cross-sectional result is consistent with a time series finding from the two-break model (TBM), i.e., a decrease in acquirer firms' average *IVOL* during the *negotiation* period.

Firms with higher prior stock returns (*Stock return*) are more likely to offer a takeover bid. However, the lower a firm's returns, the more likely it is to become an acquisition target. This performance measure is based on raw returns, although firms may have different risk profiles. To manage this issue, I replace the raw performance measure with a risk-adjusted measure (i.e., *Alpha*) in Models (2) and (5). The alpha is statistically significant in both, implying that relatively overperforming firms are more likely to be buyers, while underperformers are more likely to be targets. I conduct a horse race between the raw and risk-adjusted stock returns in Models (3) and (6). The alpha survives, while the raw return loses its explanatory power. This finding indicates that alpha is a better predictor of future M&A activity than raw returns. Overall, bounding this cross-sectional evidence with the trending time series merging likelihood in the pre-offer period, I conclude that alpha contains signals about potential M&A deals. Hence, it should be included as part of the abnormal returns.

3 Subsample analysis

Next, I investigate several key questions. First, does the unpredictability bias vary with a characteristic of the merging firms or with the sample period? Second, can the market anticipate the main deal terms, such as outcome, payment form, or target managers' attitude? I test whether the CAARs of the TBM and MM differ among various subsamples.

Internet Appendix Table 3 summarizes the results across three event windows — (-379, 126), (-126, -2), and (-1, 126). These windows represent the twenty-four-month sample period, the six-month run-up period, and the six-month mark-up period, respectively. The total premium is the sum of the run-up and mark-up CAARs (e.g., Schwert, 1996; Eaton et al., 2019).

Internet Appendix Table 3

3.1 Successful vs. failed offers

The results in Internet Appendix Table 3 (Panel A) show that the MM CAARs in the run-up period interval are similar between successful and failed offers for both target and acquirer firms. This suggests the market cannot differentiate between successful and failed offers in the run-up period. However, the TBM finds the opposite. The run-up CAARs to merging firms in successful offers exceed those in failed ones by 1.84% and 7.52%. Moreover, the MM underestimates more of the CAARs to successful merging firms than the TBM (e.g., 38.96% (= 28.89% - (-10.07%) over the (-379, 126) period). The underestimation for the failed acquirers equals 28.29% (= 15.13% - (-13.16%)). The reason for this bias is that all three of the regime-wise alphas for the merging firms are larger for the successful than for the failed offers. Overall, the TBM finds that the market indeed anticipates the outcome of a potential offer.

3.2 Tender vs. merger offers

Previous studies report that target shareholders gain higher bid premiums in tender offers than in mergers (see, e.g., Schwert, 1996; Offenberg and Pirinsky, 2015). Consistent with this view, Internet Appendix Table 3 (Panel B) shows that, for example, target CAARs (-379, 126) for tender offers are 45.93%, while they are 22.26% for mergers. In contrast, the TBM reports that the difference between these two CAARs (1.48%) is statistically insignificant. Similarly, the MM finds that acquirers underperform significantly in merger deals, but the TBM finds the opposite. Their market model CAARs (-379, 126) are 4.03% more in the tender offers, while their TBM CAARs are 9.78% more in merger offers.

So, how to explain the above bias? Target managers usually perceive tender offers to be more hostile than mergers. This is because acquirers often approach target shareholders directly, without negotiating with the target's top executives. Friendly private negotiations, on the other hand, are more likely to occur in mergers, which in turn can increase the likelihood of information leakage and the early anticipation of potential M&As. Confirming this view, I find that the regime-wise alphas in merger offers are significantly larger than those in tender offers for both merging firms (unreported). Hence, the MM underestimates more CAARs in mergers because it fails to account for stronger anticipation signals in such deals.

3.3 Cash vs. equity exchange offers

The takeover literature investigates why acquirers' managers tend to choose cash over equity to finance takeover transactions. The asymmetric information hypothesis (see Betton, Eckbo, and Thorburn, 2008, and references therein) explains this choice. It predicts that acquirers will use equity when their stocks are overvalued, but cash when either their stocks or the target's stock are undervalued. Consistent with this hypothesis, Andrade, Mitchell, and Stafford (2001) and Schwert (1996) document that M&As that are financed (partly or entirely) with acquirers' stock generate lower CAARs than those financed with cash. The MM CAARs in Internet Appendix Table 3, Panel C, are in line with this finding. For example, the difference between the target CAARs (-379, 126) in the equity and cash deals based on the market model is -19.91%, which is statistically significant. This suggests that target shareholders receive markedly larger bid premiums in cash deals. However, the TBM estimates this difference is -3.46% and insignificant.

In general, the TBM measures significantly larger CAARs to both merging firms in equity deals. As per (unreported) results, the regime-wise alphas in such deals are significantly larger than those in cash deals. Interestingly, the TBM results show that acquirers outperform when they choose equity instead of cash. In summary, the MM's unpredictability assumption explains a significant portion of the prior finding that payment choice affects the wealth of merging shareholders.

3.4 Within vs. off-merger waves

In addition to regulatory changes and industrial and technological shocks, takeover waves coincide with rapid credit expansion and stock market booms (Harford, 2005). The cost of financing a takeover for acquirers is relatively cheaper within these M&A waves. Maksimovic, Phillips, and Yang (2013) find that within-wave mergers also create greater efficiency improvements. Hence, we can expect higher gains when the merging firms take advantage of the positive economic environment during waves to restructure their real assets. The clustering of M&As during economic expansions suggests that the market should also be more successful in anticipating potential M&As during waves. I test whether the MM's bias varies according to whether a deal is announced within or off a merger wave.[2]

Internet Appendix Table 3 (Panel D) shows that the MM CAARs (-379, 126) for acquirer firms are similar between within- and off-wave deals. Target firms realize 5.66% more gains in off-wave deals. In contrast, the TBM CAARs indicate that the merging firms gain substantially more when they announce takeover transactions during a wave (particularly acquirers). For example, acquirer CAARs in the (-379, 126) interval are 17.01% higher for within-wave M&As than off-wave ones; the difference is 4.13% for target

[2] I follow Maksimovic et al. (2013, page 2183) to identify an M&A wave at the industry level (three-digit SIC code).

firms. I also note that the majority of MM bias comes from a severe underestimation of CAARs for within-wave deals. The bias in run-up CAARs for the acquirer and target firms for such deals is 12.33% (= 11.86% - (-0.47%)) and 6.40% (= 12.56% - 6.16%), compared to 7.88% (= 5.59% - (-2.29%)) and 3.76% (= 11.03% - 7.27%) for off-wave deals. Consistent with this, the unreported regime-wise alphas of merging firms are higher for within-wave deals. All the results here confirm that the market receives strong signals for deals announced within a merger wave, and the TBM incorporates those signals when estimating the merger returns.

3.5 Acquisition of private vs. public targets

Chang (1998) finds that acquirer returns are higher when target firms are private, especially for equity exchanges. He attributes this to monitoring activities by target shareholders, which alleviate information asymmetries. Fuller, Netter, and Stegemoller (2002) report similar results for private and subsidiary target firms. In addition to the increased monitoring benefits, they argue that unlisted firms' illiquidity can explain these higher acquirer gains. Moreover, Bhagwat et al. (2016) suggest that these gains result from a lower risk of renegotiation or termination in such deals.

But the MM CAARs in Internet Appendix Table 3 (Panel E) reject the above finding. They show that acquirers lose significantly less value in public than in private acquisitions. The TBM shows that acquirers realize positive returns in both deal types, and substantially higher returns when they buy private targets. For example, the difference between acquirer CAARs in public and private acquisitions is -16.58% over the (-379, 126) period; it is 4.01% based on the MM. The regime-wise alphas are significantly larger for private acquisitions (unreported). I find similar results when I replace private targets with subsidiaries of public or private firms (unreported). By adjusting for the ex-ante merging likelihood, the TBM verifies the findings of previous papers.

3.6 Pre- vs. post-1998 acquisitions

Aktas, de Bodt, and Roll (2010) report a lack of competing public bidders, fewer hostile offers, and few public offer price revisions in the post-1990 takeover market. These patterns suggest higher returns to acquirer shareholders and lower returns to target shareholders in the post-1990 period. However, Netter, Stegemoller, and Wintoki (2011) document a significant decline in acquirers' abnormal returns from 1992 to 2008, and no difference in targets' returns. I split the sample period into two halves (before and after 1998) to test whether the TBM can shed light on these conflicting results.

Consistent with the lack of competition, Internet Appendix Table 3 (Panel F) shows that acquirers perform better in the post-1998 period based on MM CAARs, by 2.09% to 5.72% depending on the event window. The TBM CAARs show that acquirers' gains are similar across both subperiods when measured over the (-379, 126) and (-126, -2) intervals, but mark-up CAARs are 2.33% higher in the post-1998 period. As with the acquirer case, the MM generates higher CAARs to post-1998 period targets, but the TBM only confirms higher target CAARs in the mark-up window. Notably, the MM shows no difference in target firms' run-up CAARs, while the TBM indicates a significantly lower run-up in their share prices post-1998. In summary, the MM finds higher returns for merging firms in the post-1998 period, but the TBM finds this is not the case except for post-offer CAARs.

3.7 Large vs. small acquirers

Moeller, Schlingemann, and Stulz (2004) show that small acquirers gain more than large acquirers in takeover transactions. This result is robust to the choice of payment method and target firm's public status. I investigate whether this finding is tied to the unpredictability assumption. I consider an acquirer to be large (small) if it is in the top (below top) quintile of U.S. public firms' market capitalizations in the announcement year.

Internet Appendix Table 3 (Panel G) shows that the MM finds a disparity in the run-up period, where small acquirer CAARs (-126, -2) exceed those of large acquirers by 2.30%. However, this model estimates that small acquirers underperform significantly in the mark-up (-1, 126) period by 1.67%, which is inconsistent with Moeller et al.'s (2004) findings. The TBM implies this is a biased inference, because small acquirers outperform large ones in both the run-up and mark-up periods (6.17% and 2.37%, respectively). The evidence in Moeller et al. (2004) is based on a short event window around the announcement day, the (-1, 1) interval, which I can also replicate (unreported). The TBM results here extend their evidence to longer event windows, and so provide additional support for the disparity in the gains of small and large acquirers.

In summary, assuming M&As are unpredictable can actually cause the MM to bias the acquisition gains in various subsamples. The TBM reports larger CAARs in deals with a higher perceived merging likelihood, such as successful deals, merger offers, and within-wave deals. This evidence supports the model's ability to adjust for the dynamic of ex-ante merging likelihood by incorporating a higher alpha in the measurement of CAARs.

4 Robustness checks: Calendar-time portfolio returns

Next, I examine whether the above-documented pre-offer alphas are robust to the use of the calendar-time portfolio approach. The event-time alphas and CAARs may suffer from three issues. First, previous literature shows M&As are clustered in specific periods and in certain industries (see, e.g., Harford, 2005). Such clusters can cause the pre-offer returns of merging firms to overlap in longer event windows (such as the twelve- and eighteen-month pre-offer windows I use here). This creates cross-sectional dependence in those returns, and may misspecify the test statistics (see, e.g., Lyon, Barber, and Tsai, 1999). Second, Kothari and Warner (1997) document that the CAARs are biased upward regardless of the asset pricing model used to generate the expected security returns, and they increase monotonically with the size of the event window. Fama (1998) and Lyon et al. (1999) argue that using a calendar-time portfolio approach can eliminate the cross-correlation problem, yielding more robust test statistics. This approach also mitigates the bias in the CAARs over longer event windows. Third, I have thus far employed the MM and the CAPM to estimate the alphas and CAARs. However, we know from the empirical asset pricing literature (see, for example, Fama and French, 1996; Fama, 1998) that these two models are not strong enough to predict the abnormal returns. In other words, the alphas may be a product of some missing asset pricing factors (the "bad-model" problem). To address this issue, I use several recently developed asset pricing models to estimate the alphas: the Fama-French (1992) three-factor model, the Fama-French three-factor and the momentum factor model (Carhart, 1997), the Fama-French (2016) five-factor model, and Hou-Xue-Zhang (2015) Q-factors.

For each calendar day, I use the return on each stock involved in a takeover attempt over the past eighteen months. I construct this portfolio using the entire return series from the pre-offer period, from Day -379 to Day -2. Then, I take the average returns across stocks to obtain the daily equal-weighted portfolio returns ($R_{p,t}$), and I reconstruct the portfolio each day. As an alternative approach, I form another daily portfolio return series using the twelve months' of pre-offer returns from Day -379 to Day -127. The returns in this portfolio come from the benchmark estimation window, and not from the run-up period, so its alphas are somewhat comparable to the MM's average intercept. For the sake of space, I formulate below only one of the time series regressions (the Fama-French (1992) three-factor as the model of expected returns) to estimate the daily intercept, a_p. The regression uses portfolio excess return ($R_{p,t} - R_{f,t}$) as the dependent variable.

$$R_{p,t} - R_{f,t} = a_p + b[R_{m,t} - R_{f,t}] + sSMB_t + hHML_t + e_t, \tag{IA.1}$$

where $R_{m,t}$ is the return on the value-weighted CRSP index on day t; $R_{f,t}$ is the one-month Treasury bill rate on day t; SMB_t is the return on small firms minus the return on large firms on day t; and HML_t is the return on high book-to-market stocks minus the return on low book-to-market stocks on day t. Internet Appendix Table 4 presents the daily intercepts from regressing the portfolio returns of merging firms on the asset pricing factors. Similarly, I estimate the intercept for two different placebo portfolios: the randomly selected match (RND), and the industry-size match (Ind). I also measure the spread from a portfolio long in the stock of merging firms and a portfolio short in the stocks of placebo firms. I use Huber-White robust standard errors.

Internet Appendix Table 4

Suppose the significant regime-wise alphas are a product of some missing asset pricing factors or a result of the M&A clustering M&A in certain industries and periods. In that case, the intercepts (a_p) should be insignificant. Internet Appendix Table 4 shows this is not the case, however. The intercepts are economically and statistically significant regardless of the employed asset pricing model. For example, using either twelve- or eighteen-month portfolio returns, the intercept ranges between 5.47 bps (1.15% per month) and 6.50 bps (1.37% per month) for acquirers. These numbers exceed the daily intercept for the placebo portfolios by 1.52 to 3.64 bps.

One concern could be that market overvaluations drive acquirer firms' significant alphas, and not the ex-ante anticipation for potential M&As. If this is true, then the intercept from the Q-factor model of Hou et al. (2015) and the Fama-French (2016) five-factor model should be negligible, as both models have an investment factor. However, the significance of both intercepts rules out the overvaluation theory. It indicates that investors receive anticipation signals and incorporate part of the expected synergy of potential deals into the acquirer return series during the pre-offer period.

As with the acquirer case, the targets' alphas are positive and significant. Their intercepts for twelve-month portfolio returns are between 2.01 and 2.69 bps, but are significantly smaller, by 2.10 to 2.33 bps, than those of their industry peers. These findings are consistent with earlier regime-wise alphas for target firms, confirming that targets are more likely to seek business partners when underperforming their peers. However, when they start to negotiate with potential acquirers, the market receives stronger anticipation signals. In turn, the negotiations lead to a run-up in their stock prices, which fills the underperformance gap with their peers. Consistently, I find no significant difference between the intercepts of eighteen-month portfolio returns of the targets and their matched portfolios.

In summary, the anticipation results (significant positive pre-offer alphas) in this paper are robust to using the calendar-time portfolio approach and the most recent asset pricing models.

Internet Appendix Table 1: Sample selection

Selection Criteria	Source	Number of Exclusions	Sample Size
All completed and withdrawn bids (FORMC = M, AM) between U.S. acquirers and targets during the 1/1980 to 12/2017 period	SDC		54,514
Deal value is greater than $1 million	SDC	24,238	30,276
Acquirer is a public firm at the time of the bid offer	CRSP	11,307	18,969
Deal value relative to the market value of equity of the acquirer is at least 1%	SDC & CRSP	3,321	15,648
Number of days between the announcement and completion dates is between 0 and 1,000 days	SDC	65	15,583
Share price of the acquirer firms in the pre-offer period is greater than $1	CRSP	813	14,770
No missing daily returns in the pre-offer period	CRSP	2,724	12,046
Firms have less than 120 daily zero returns	CRSP	1,048	10,998
Final Sample			68,708

This table describes the sample selection process. All bids are completed or withdrawn mergers between U.S. public acquirer firms and U.S. public, private, or subsidiary target firms between January 1980 and December 2017, and are retrieved from the mergers and acquisitions database of Securities Data Company (SDC) Platinum. Daily closing security prices come from the Center for Research in Security Prices (CRSP).

Internet Appendix Table 2: Cross-sectional prediction of future merger activity

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var.	Firm offers to acquire another firm			Firm is a target of an acquisition		
Alpha		0.0201***	0.0252**		-0.0130***	-0.0121***
		(4.688)	(2.488)		(-5.701)	(-2.782)
Stock return	0.0164***		-0.0053	-0.0114***		-0.0010
	(3.892)		(-0.537)	(-5.382)		(-0.245)
Beta	-0.0184***	-0.0151***	-0.0143***	-0.0007	-0.0028	-0.0026
	(-4.121)	(-3.211)	(-3.060)	(-0.280)	(-1.070)	(-0.985)
IVOL	0.6217***	0.4587***	0.4223**	0.3552***	0.4576***	0.4509***
	(4.106)	(2.938)	(2.609)	(5.308)	(6.485)	(6.270)
Market return	0.0388	0.0495	0.0532	0.0361	0.0285	0.0291
	(0.806)	(1.016)	(1.133)	(1.629)	(1.248)	(1.307)
Market VOL	-3.6540*	-3.5631*	-3.5404*	-1.2946	-1.3533	-1.3491
	(-1.955)	(-1.919)	(-1.924)	(-1.251)	(-1.294)	(-1.296)
Prior M&A ind.	0.0569***	0.0569***	0.0569***	0.0131***	0.0131***	0.0131***
	(9.109)	(9.140)	(9.142)	(3.683)	(3.691)	(3.689)
Market-to-Book	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
	(0.021)	(0.008)	(0.056)	(0.268)	(0.212)	(0.234)
Inst. Shares	0.1224***	0.1221***	0.1219***	0.0550***	0.0552***	0.0552***
	(15.737)	(15.688)	(15.762)	(11.594)	(11.629)	(11.587)
Amihud illiquidity	0.0001	0.0000	0.0000	-0.0005***	-0.0005***	-0.0005***
	(0.980)	(0.247)	(0.055)	(-11.626)	(-9.769)	(-9.714)
Ln (Size)	0.0389***	0.0383***	0.0382***	-0.0052***	-0.0048***	-0.0048***
	(15.937)	(15.503)	(15.426)	(-4.038)	(-3.757)	(-3.763)
Market Leverage	-0.0433***	-0.0417***	-0.0418***	0.0597***	0.0589***	0.0589***
	(-3.539)	(-3.457)	(-3.462)	(12.068)	(11.704)	(11.716)
Cash Holdings	-0.1257***	-0.1249***	-0.1247***	0.0064	0.0058	0.0059
	(-7.625)	(-7.615)	(-7.656)	(1.066)	(0.979)	(0.983)
Asset Tangibility	-0.1021***	-0.1019***	-0.1019***	0.0035	0.0034	0.0033
	(-9.476)	(-9.487)	(-9.493)	(0.592)	(0.572)	(0.572)
ROA	0.0094**	0.0069	0.0068	0.0019	0.0032	0.0032
	(2.074)	(1.532)	(1.499)	(0.504)	(0.851)	(0.847)
Constant	-0.2646***	-0.2573***	-0.2560***	0.0830***	0.0787***	0.0789***
	(-6.350)	(-6.142)	(-6.060)	(3.950)	(3.699)	(3.697)
Observations	189,181	189,181	189,181	189,181	189,181	189,181
Adj. R-squared	0.094	0.094	0.094	0.015	0.015	0.015

This table presents the coefficient estimates from linear probability models of future M&A activity on the firm- and market-level characteristics. The dependent variable equals 1 if a firm is a buyer (columns (1)-(3)) or a seller (columns (4)-(6)) in an acquisition attempt in the current calendar year, and 0 otherwise. M&A data come from SDC, and the sample period for takeover deals is 1980 to 2017. The sample includes 189,181 firm-year observations. All independent variables are lagged by one year. The Compustat database is used to construct accounting variables based on the fiscal year-end data before the merger announcement date. All other variables (unless explicitly stated) come from CRSP and are computed as of the end of December of the calendar year before the merger announcement date. *Stock return* (*Market return*) is calculated by compounding the daily returns of a firm (of the CRSP value-weighted index) over a calendar year. *Alpha* is the annualized intercept from the market model regression in which a firm's daily returns are regressed on the daily returns of the CRSP value-weighted index during a calendar year. *Beta* is the beta coefficient, and *IVOL* is the standard deviation of the residual, of the market model regression. *Market VOL* is the standard deviation of daily returns on the CRSP value-weighted index during a calendar year. Using the SDC data, *Prior M&A ind.* is an indicator that equals 1 if either the target's or the acquirer's three-digit SIC industry experienced at least one merger in the previous year. *Market-to-Book* is the ratio of market capitalization to the book value of equity of a firm. *Inst. Shares* is the total number of shares held by institutional investors (from the Thomson Financial CDA/Spectrum database of 13F filings) divided by the total number of outstanding shares as of the calendar quarter-end date before the merger announcement date. *Amihud illiquidity* is the ratio of the absolute daily return to daily dollar volume, multiplied by 1 million and averaged over a calendar year. *Ln(Size)* is the natural log of the market capitalization of a firm as of the end of December in a calendar year. *Market Leverage* is the ratio of book debt (item LT - item TXDITC - preferred stock) over the market value of total assets. *Cash Holdings* is the ratio of cash and short-term investments (item CHE) over the book value of total assets. *Asset Tangibility* is net property, plant, and equipment (item PPENT) scaled by the book value of total assets. *ROA* is the ratio of net income (item NI) over the book value of total assets. All specifications include industry (SIC 3-digit) fixed effects. *t*-statistics are in parentheses, and are based on standard errors clustered at the firm and year level. I winsorize all continuous variables at the 1% and 99% levels to mitigate the impact of outliers. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively, for a two-tailed test.

Internet Appendix Table 3: CAARs to the merging firms in various subsamples

Panel A: Successful vs. Failed offers

	CAARs of market model			CAARs of two-break model		
	Successful	Failed	(F - S)	Successful	Failed	(F - S)
Acquirer firms						
(-379, 126)	-10.07%	-13.16%	-3.09%	28.89%	15.13%	-13.76%***
(-126, -2)	-1.71%	-1.17%	0.54%	7.89%	6.05%	-1.84%*
(-1, 126)	-8.36%	-11.99%	-3.63%**	1.35%	-4.86%	-6.21%***
N	10,057	941				
Target firms						
(-379, 126)	28.97%	13.91%	-15.06%***	48.62%	15.78%	-32.84%***
(-126, -2)	7.29%	4.80%	-2.49%	12.79%	5.27%	-7.52%***
(-1, 126)	21.68%	9.12%	-12.56%***	25.37%	9.80%	-15.57%***
N	2,464	469				

Panel B: Tender vs. merger offers

	CAARs of market model			CAARs of two-break model		
	Tenders	Mergers	(M - T)	Tenders	Mergers	(M - T)
Acquirer firms						
(-379, 126)	-6.60%	-10.63%	-4.03%**	18.65%	28.43%	9.78%***
(-126, -2)	-3.12%	-1.55%	1.57%	3.38%	8.07%	4.69%***
(-1, 126)	-3.48%	-9.08%	-5.60%***	2.68%	0.67%	-2.01%*
N	810	10,188				
Target firms						
(-379, 126)	45.93%	22.26%	-23.67%***	44.58%	43.10%	-1.48%
(-126, -2)	13.48%	5.43%	-8.05%***	13.45%	11.18%	-2.27%
(-1, 126)	32.45%	16.84%	-15.61%***	32.11%	20.84%	-11.27%***
N	533	2,400				

Internet Appendix Table 3 - Continued

Panel C: Cash vs. equity exchange offers

	CAARs of market model			CAARs of two-break model		
	Cash	Equity	(E - C)	Cash	Equity	(E - C)
Acquirer firms						
(-379, 126)	-9.27%	-12.49%	-3.22%**	20.04%	35.13%	15.09%***
(-126, -2)	-4.15%	0.21%	4.36%***	3.16%	11.96%	8.80%***
(-1, 126)	-5.12%	-12.70%	-7.58%***	2.20%	-0.85%	-3.05%***
N	3,015	3,822				
Target firms						
(-379, 126)	39.01%	19.10%	-19.91%***	47.42%	43.96%	-3.46%
(-126, -2)	11.11%	4.26%	-6.85%***	13.53%	11.18%	-2.35%
(-1, 126)	27.90%	14.84%	-13.06%***	29.18%	19.85%	-9.33%***
N	877	1,115				

Panel D: Within vs. off-merger waves

	CAARs of market model			CAARs of two-break model		
	Within	Off	(O - W)	Within	Off	(O - W)
Acquirer firms						
(-379, 126)	-11.05%	-9.97%	1.08%	38.92%	21.91%	-17.01%***
(-126, -2)	-0.47%	-2.29%	-1.82%**	11.86%	5.59%	-6.27%***
(-1, 126)	-10.58%	-7.68%	2.90%***	1.94%	0.24%	-1.70%**
N	3,747	7,251				
Target firms						
(-379, 126)	22.85%	28.51%	5.66%**	46.08%	41.95%	-4.13%*
(-126, -2)	6.16%	7.27%	1.11%	12.65%	11.03%	-1.62%
(-1, 126)	16.68%	21.24%	4.56%***	21.52%	23.60%	2.07%*
N	1,007	1,926				

Panel E: Private vs. public targets

	CAARs of market model			CAARs of two-break model		
	Private	Public	(Pblc - Prv)	Private	Public	(Pblc - Prv)
Acquirer firms						
(-379, 126)	-12.64%	-8.63%	4.01%***	36.16%	19.58%	-16.58%***
(-126, -2)	-2.20%	-0.97%	1.23%	9.69%	6.07%	-3.62%***
(-1, 126)	-10.44%	-7.67%	2.77%***	1.80%	-0.62%	-2.42%***
N	4,785	4,083				

Internet Appendix Table 3 - Continued

Panel F: Pre- vs. post-1998 acquisitions

	CAARs of market model			CAARs of two-break model		
	Pre	Post	(Post - Pre)	Pre	Post	(Post - Pre)
Acquirer firms						
(-379, 126)	-12.96%	-7.24%	5.72%***	27.89%	27.49%	-0.40%
(-126, -2)	-2.57%	-0.60%	2.09%***	7.56%	7.93%	0.37%
(-1, 126)	-10.39%	-6.64%	3.75%***	-0.25%	2.08%	2.33%***
N	5,959	5,039				
Target firms						
(-379, 126)	20.74%	33.52%	12.78%***	44.88%	41.56%	-3.32%
(-126, -2)	6.09%	7.84%	1.75%	12.83%	10.11%	-2.72%**
(-1, 126)	14.65%	25.68%	11.03%***	19.70%	26.70%	7.00%***
N	1,597	1,336				

Panel G: Large vs. small acquirers

	CAARs of market model			CAARs of two-break model		
	Large	Small	(S - L)	Large	Small	(S - L)
Acquirer firms						
(-379, 126)	-10.72%	-10.08%	0.64%	17.75%	34.59%	16.84%***
(-126, -2)	-3.03%	-0.73%	2.30%***	4.08%	10.25%	6.17%***
(-1, 126)	-7.68%	-9.35%	-1.67%**	-0.58%	1.79%	2.37%***
N	4,492	6,506				
Target firms						
(-379, 126)	27.10%	25.85%	-1.25%	45.67%	40.33%	-5.34%**
(-126, -2)	6.79%	7.03%	0.24%	11.99%	11.06%	-0.93%
(-1, 126)	20.32%	18.83%	-1.49%	23.84%	21.63%	-2.21*
N	1,667	1,266				

This table summarizes the results of examining whether the cumulative average abnormal returns (CAARs) to the merging shareholders based on the market model (MM) and the two-break model (TBM) differ across various subsamples. Using the CRSP value-weighted index, the market model estimates the abnormal return (AR) at day t using the parameters (alpha and beta) that are estimated from the benchmark estimation window. This contains returns from the (-379, -127) interval for each series. The Qu and Perron (2007) test estimates the parameters and AR of the two-break model. Section 2 of the paper provides further detail on this model. CAARs over an event window (t_1, t_2) are computed by summing the daily average abnormal returns (AARs) in that window. The two-sample t-test examines the difference between average cumulative abnormal returns (CARs) across two subsamples over the event window (t_1, t_2). ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively, for a two-tailed test.

Internet Appendix Table 4: calendar-time portfolio alphas

	Twelve-month calendar-time portfolio					Eighteen-month calendar-time portfolio				
	MA	RND	Ind	(MA-RND)	(MA-Ind)	MA	RND	Ind	(MA-RND)	(MA-Ind)
Acquirers										
Ex. Ret.	9.46***	5.43***	7.63***	4.03***	1.83***	9.03***	5.01***	7.24***	4.02***	1.79***
	(8.49)	(6.08)	(7.21)	(8.43)	(4.68)	(8.14)	(5.65)	(6.91)	(8.73)	(5.01)
CAPM	6.47***	3.16***	4.88***	3.31***	1.58***	6.03***	2.74***	4.49***	3.29***	1.53***
	(13.90)	(6.91)	(9.61)	(8.03)	(4.13)	(13.49)	(6.18)	(9.20)	(8.46)	(4.41)
FF3	5.87***	2.55***	4.25***	3.33***	1.63***	5.47***	2.13***	3.87***	3.34***	1.61***
	(21.77)	(7.15)	(11.72)	(8.36)	(4.25)	(22.47)	(6.24)	(11.55)	(9.01)	(4.64)
Carhart	6.05***	2.79***	4.48***	3.26***	1.57***	5.62***	2.40***	4.10***	3.22***	1.52***
	(22.21)	(7.80)	(12.28)	(8.10)	(4.08)	(22.75)	(7.02)	(12.20)	(8.58)	(4.35)
FF5	6.23***	2.62***	4.49***	3.61***	1.74***	5.85***	2.21***	4.12***	3.64***	1.73***
	(24.04)	(7.54)	(12.57)	(9.05)	(4.53)	(24.98)	(6.63)	(12.55)	(9.76)	(4.96)
HXZ	6.50***	3.25***	4.93***	3.25***	1.57***	6.09***	2.87***	4.56***	3.22***	1.52***
	(23.23)	(9.47)	(13.96)	(8.01)	(4.07)	(23.87)	(8.79)	(14.12)	(8.43)	(4.34)
Targets										
Ex. Ret.	5.21***	5.89***	7.11***	-0.68	-1.92***	7.23***	5.43***	6.57***	1.80***	0.66
	(4.77)	(6.12)	(7.02)	(-1.00)	(-2.74)	(6.98)	(5.82)	(6.78)	(3.12)	(1.14)
CAPM	2.69***	3.60***	4.84***	-0.91	-2.14***	4.76***	3.14***	4.30***	1.62***	0.46
	(3.92)	(6.31)	(7.36)	(-1.32)	(-3.07)	(7.75)	(6.02)	(7.29)	(2.82)	(0.81)
FF3	2.01***	3.08***	4.35***	-1.07	-2.33***	4.08***	2.61***	3.78***	1.47***	0.3
	(3.63)	(6.13)	(7.63)	(-1.58)	(-3.35)	(8.74)	(5.87)	(7.70)	(2.62)	(0.52)
Carhart	2.39***	3.16***	4.49***	-0.77	-2.10***	4.44***	2.77***	3.96***	1.67***	0.48
	(4.29)	(6.25)	(7.84)	(-1.14)	(-3.01)	(9.46)	(6.18)	(8.02)	(2.96)	(0.83)
FF5	2.18***	3.14***	4.47***	-0.96	-2.29***	4.23***	2.67***	3.93***	1.56***	0.31
	(3.99)	(6.30)	(7.90)	(-1.42)	(-3.28)	(9.27)	(6.08)	(8.06)	(2.78)	(0.54)
HXZ	2.68***	3.64***	4.86***	-0.96	-2.18***	4.76***	3.22***	4.33***	1.54***	0.43
	(4.84)	(7.39)	(8.57)	(-1.42)	(-3.12)	(10.21)	(7.45)	(8.89)	(2.74)	(0.75)

This table reports the average daily excess return (Ex. Ret.) and daily intercepts (in basis points) from regressing the calendar-time portfolio returns of merging firms and their randomly matched (RND) and industry-size-matched (Ind) control firms on the CAPM, the Fama-French (1992) three-factor model, the Fama-French three-factor and momentum factor model (Carhart, 1997), the Fama-French (2016) five-factor model, and Hou-Xue-Zhang (2015) Q-factors. The (MA - RND) column shows the spread from a portfolio long in merging stocks and a portfolio short in the randomly matched stocks. The (MA - Ind) column shows the spread from a portfolio long in merging stocks and a portfolio short in the industry-size-matched stocks. I form a daily portfolio return series for each calendar day that uses the twelve months' of pre-offer returns, from Day -379 to Day -127. I then take the average returns across stocks to obtain the daily equal-weighted portfolio returns. I construct another daily portfolio return series that uses the eighteen months' of pre-offer returns, from Day -379 to Day -2. t-statistics are in parentheses and are based on Huber-White robust standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively, for a two-tailed test.

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