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Davidson Heath, Mark Mitchell

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Market Returns and Interim Risk in Mergers

 Davidson Heath,^{a,*} Mark Mitchell^b
^a David Eccles School of Business, University of Utah, Salt Lake City, Utah 84112; ^b AQR Arbitrage, LLC, Booth School of Business, University of Chicago, Chicago, Illinois 60637

*Corresponding author

Contact: davidson.heath@eccles.utah.edu,  <https://orcid.org/0000-0001-6162-6566> (DH); mark.mitchell@chicagobooth.edu (MM)

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Abstract. A primary concern in mergers and acquisitions is the risk the deal may be cancelled before it is completed. We document that “interim risk” varies asymmetrically with the aggregate market return. Deals tend to be renegotiated when the market rises, but cancelled when the market crashes. These effects are conditional on the method of payment and the contracting stage of the deal, consistent with a mechanism of ex post renegotiation. Variation in interim risk over time alters the method of payment in mergers and the firms that are targeted and acquired.

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1. Introduction

A fundamental question in finance is how financial markets affect investment decisions. Mergers and acquisitions are among the largest and most consequential investments, altering firm boundaries and reshaping industries. It is well established that the stock market influences merger activity—both deal quantity¹ and deal quality.² A less-examined question is how the aggregate stock market affects the *outcome* of the merger process. A primary concern in mergers and acquisitions is the risk the deal may be cancelled before it is completed. From 1986 to 2018, one in eight announced deals were ultimately cancelled. Unsurprisingly, merger terminations escalated during the onset of the COVID-19 crisis as the market fell.³

This paper documents that interim risk—the risk that a merger or acquisition is cancelled after being announced—varies in an asymmetric fashion with the aggregate market return. A market crash, defined as the stock market falling 10% or more after the deal is announced, more than doubles the probability that the deal will be cancelled. This effect is present across large and small deals, horizontal and diversifying deals, hostile and friendly deals, and public and private acquirors. However, the effect does depend on both the method of payment and the contracting stage of the deal.

Why do these deals fail? Merger deals are complex, with many features that are difficult or impossible to contract on. Although the classic property rights theory of firm boundaries emphasizes ex ante distortions (Hart 1988), a more recent literature emphasizes ex post renegotiation that leads to inefficient outcomes (Hart and Moore 2008, Hart and Holmstrom 2010).

Our findings are consistent with a mechanism of ex post renegotiation. First, the theory predicts that a deal breaks down when market conditions move outside of a “self-enforcing” range. Consistent with this prediction, deal completion is unaffected by small drops in the market, but significantly impacted by larger market crashes. Second, the predicted effect on the deal outcome is asymmetric: When the surplus to be divided increases, the parties are able to agree on a revised price, but when the surplus to be divided decreases, the parties are unable to agree. We find that when the market rises, deals are revised; when the market crashes, deals are cancelled.

Third, the effect of the aggregate stock market on merger outcomes depends on the method of payment. In effect, a deal paid in cash is a fixed-price forward contract on the target firm, whereas a deal paid in stock is a floating-price forward contract, which specifies a ratio of acquiror shares per target share.⁴ Hence, a stock deal shares the risk of changing market conditions between the acquiror and target firm. For cash deals, however, the acquiror bears the risk of changing macroeconomic conditions. If the expected value to the acquiror falls below the bid price and the firms cannot agree to a revision, the acquiror may cancel the deal outright. We find that the effects of the aggregate stock market on merger revision and completion are present for deals to be paid in cash, and absent for deals to be paid in stock.⁵

Fourth, examining the scope for renegotiation, we find that the effect depends on the contracting stage of the deal, in particular the presence of a definitive agreement. The definitive agreement spells out the

merger plan in detail and almost always includes a material adverse change (MAC) clause that formally assigns major risks between the parties (Denis and Macias 2013). This finding suggests that as well as reducing the scope for renegotiation, the definitive agreement accomplishes the purpose of binding the acquiror firm to the deal.

Importantly, our findings cannot be explained by other forces such as adverse selection or mispricing (Shleifer and Vishny 2003). Our research design cleanly identifies the interim risk channel by exploiting the fact that aggregate market returns, in particular market crashes, are unpredictable (Welch and Goyal 2007). We also document that affected and unaffected deals are indistinguishable ex ante on their observable characteristics. Thus, treatment status—whether a given deal was affected by a market crash after its announcement—is unpredictable ex ante and quasi-randomly assigned.

Our proposed mechanism is that a market crash causes the acquiror to revise the expected deal value, which we term the revised-value channel. Alternatively, a market crash might cause financing for the deal (especially cash deals, which are more financing-dependent) to become unavailable or prohibitively expensive, which we term the lost-financing channel. The revised-value and lost-financing channels are not mutually exclusive. Going further into our results, we find support for the revised-value channel: The effects of market crashes on deal completion are stronger for deals in which there was more uncertainty about the target's value. By contrast, we do not find support for the lost-financing channel in our setting. First, the effect of market crashes on deal completion is not explained by contemporaneous changes in corporate credit spreads. Second, we find the effect is stronger for deals in which the acquiror firm was *less* financially constrained. In particular, the effect appears for deals in which the acquiror firm held enough cash and marketable securities to purchase the target out of pocket, where lost financing is highly unlikely. It is well documented both anecdotally and in academic studies (i.e., Cain et al. 2015) that deals do fail for lack of financing; our conclusion is that equity market crashes do not operate through this channel.

The difference in interim risk between methods of payment helps explain an otherwise puzzling fact. Cash deals pay a significantly higher premium than stock deals on average. Because a higher deal premium makes completion more likely, and in addition a cash bid is a costly signal by the acquiror (Hansen 1987, Fishman 1989, Gorbenko and Malenko 2017), cash deals should be completed at a higher rate. Yet from 1986 to 2018, cash deals had a slightly *lower* rate of completion than stock deals (87% versus 88% in our sample). Thus, cash deals must carry additional risks.

Two high-profile mergers that were announced in early 2020 provide an illustration. In February 2020 shortly before the COVID-19 pandemic emerged, Xerox Inc announced a majority-cash takeover of HP Inc, and Morgan Stanley announced its plan to acquire E-Trade Inc in an all-stock transaction. Less than a month later Xerox withdrew citing “[t]he current global health crisis and resulting macroeconomic and market turmoil” (<https://www.cnbc.com/2020/03/31/xerox-ends-its-hostile-takeover-bid-for-hp.html>, p. 1), while the Morgan Stanley/E-Trade merger was completed on schedule. In October 2020 the CEO of Morgan Stanley, James Gorman, commented “*I think it was fairly valued. It was an all-stock deal as you know. So as both stocks had moved and would have moved post crisis, I’m very comfortable with having done an all-stock deal*” (https://www.sec.gov/Archives/edgar/data/0001015780/000095010320006792/dp125480_425.htm, p. 1).

Finally, motivated by our findings on the risk that market crashes pose to deal completion, we examine how the ex ante level of risk affects deal terms. The VIX index measures expected future market volatility. We find that controlling for other macroeconomic factors—including the stock market's price/earnings level—a higher VIX predicts fewer deals to be paid in cash and a higher deal premium for cash acquisitions. Also, when the VIX is higher, the firms that are targeted and acquired in cash deals are smaller and have a lower market beta. These findings have implications for empirical studies of merger activity because they imply that variation in ex ante interim risk also affects the method of payment, the deal premium, and even which firms are targeted and ultimately acquired.

Bhagwat et al. (2016) and Bhagwat and Dam (2017) also examine the cancellation of pending merger deals. Their analysis defines the interim period as after the definitive agreement has been signed up to the deal's completion or termination. They find that termination or renegotiation is more likely when the target firm's stock rises, suggesting the target firm reneges on the initial deal when doing so favors its interests. They also find that a higher VIX predicts less merger activity. By contrast, we document that during the period between a deal's announcement and the signing of the definitive agreement, a stock market crash leads the acquiror to withdraw, from deals to be paid in cash. We show that a higher VIX predicts fewer cash deals and different terms for the deals that do occur. Thus, our mechanism of interim risk differs in timing, direction, and which counterparty reneges; our empirical findings are consistent with and complementary to those of Bhagwat et al. (2016).

The results in this paper and in Bhagwat et al. (2016) use stock returns to measure the forces that work against merger completion. The theory of contracts as reference points (Hart and Moore 2008)

suggests that interim risk comes from events that change the value of the transaction to the two parties, relative to the reference point of the initial agreement. Such events are likely, but not necessarily, linked to changes in market prices. When renegotiation is costly or inefficient, the theory predicts that minor events will not affect completion while major events will lead to termination—that is, contracts have a self-enforcing range. This is what we find in practice.

The merger literature, in particular models of the method of payment, has almost exclusively examined mergers through the lens of adverse selection.⁶ In these models, bidders choose between paying with securities versus cash based on the extent of asymmetric information about the acquirer and/or target firm, and the deal is always completed after agreement. Our results highlight that the interim risk of cancellation is also an important factor that affects merger outcomes and merger terms, including the method of payment. Our findings also contribute to the recent literature on incomplete contracting and strategic default. Default by buyers on fixed-price contracts has been analyzed in home mortgages (Guiso et al. 2013) and coffee markets (Blouin and Macchiavello 2019). We show that this mechanism also affects the largest and most complex market transactions, namely mergers and acquisitions of public firms.

2. Hypothesis Development and Related Literature

In this section, we provide a basic framework that motivates our subsequent empirical analysis. The framework assumes that both merging parties attempt to maximize shareholder wealth, with no agency costs or transaction costs.

There are two firms, a (potential) acquirer and target. The target and acquirer each have an uncertain stand-alone value, and there are potential synergies if the two firms are combined. The acquirer bids for the target if the following condition holds:

$$E[\text{Target Value} + \text{Synergies}] > \text{Bid Price} \quad (1)$$

The target's shareholders have some reservation value for their shares, likely close to the target's stand-alone value plus a control premium. The equilibrium bid price will reflect the division of the expected surplus between the acquirer and the target.

Due to due diligence, regulatory, and other closing conditions, most mergers take at least a few months to complete. During this interim period, the expected target value and/or synergies could fall. If the expected value in (1) falls below the bid price so that the inequality no longer holds, the acquirer has an incentive to withdraw from the deal. This is the interim-risk mechanism that we investigate.

One could study this mechanism using the postannouncement returns of the target or its industry to proxy for changes in deal value, but one concern might be that these returns are contaminated by endogenous forces. For example, antitrust or other regulatory scrutiny results in a lower likelihood of deal completion, thus a reduction in the target's stock price and perhaps the target's peers as well. To address this concern we use an independent variable—the aggregate equity market return—which plausibly affects, but is unaffected by, changes in the expected deal value.⁷

Hypothesis 1. *Announced merger deals are more likely to be cancelled by the acquirer firm when the aggregate market falls.*

As long as the acquirer captures some of the initial expected surplus (i.e., there is some cushion between the expected value to the acquirer and the bid price), it also follows:

Hypothesis 2. *The interim risk effect is nonlinear: Deal cancellations are unaffected by small drops in the market, but are more likely when the market falls significantly.*

The form of payment also affects the division of interim risk. When the acquirer's stock is used as the form of payment, the deal is equivalent to a floating price forward contract. Thus, a market crash will simultaneously reduce the expected deal value and the effective bid price. By contrast, when cash is the main form of payment, the deal is equivalent to a fixed-price forward contract and the effective bid price does not adjust.

Hypothesis 3. *The interim risk mechanism is present for deals to be paid in cash, and is weaker or absent for deals to be paid in stock.*

The ability of the acquirer to withdraw from the deal, and the costs associated with doing so, will also vary with the stage that the merger has reached. In particular, the *definitive agreement* (DA) is a major event that affects the interim risk of cancellation (Quinn 2010).

To date the merger literature has not placed much emphasis on the presence, absence, or timing of the definitive agreement. The definitive agreement is a legally binding contract between the acquirer and target firm, which is in principle enforceable by either firm.⁸ In addition to spelling out the terms and conditions necessary for the merger to be completed, the definitive agreement explicitly allocates various interim risks to the acquirer or the target. The DA includes a material adverse change clause (MAC) that assigns various risks to the merging parties (Denis and Macias 2013). In particular, the MAC almost always assigns broad macroeconomic and market risks to the

acquirer. Given our focus on market crashes, the hypothesis is that once the definitive agreement is in place and serves as a legally binding contract, the acquirer is unable to terminate the merger.

Hypothesis 4. *The effect of market crashes on deal completion is weaker or absent after a definitive agreement is in place.*

A recent literature on the boundaries of the firm (Hart and Holmstrom 2010) emphasizes contracting frictions and in particular inefficient ex post renegotiation. When the expected value in (1) falls, the target shareholders' reservation value should fall as well. In principle, it should therefore be possible to renegotiate and revise the bid price downward. In other words, as long as the expected synergies are still positive, a revised deal could deliver gains to both parties and thus renegotiation could reduce or eliminate the interim risk of cancellation. Alternatively, the target's shareholders do not update their reservation value and are inefficiently unwilling to accept a lower price.⁹ The hypothesis of inefficient ex post renegotiation implies that:

Hypothesis 5. *Cash deals are revised when the market rises, but cancelled when the market crashes.*

2.1. Related Literature

The merger literature is voluminous and continues to grow rapidly. Below, we briefly summarize a subset of related papers. We omit most references to research published before 2000 as there are multiple survey articles that cover this earlier literature in detail.¹⁰

Primarily, this paper contributes to the literature that examines drivers of merger activity and the method of payment in mergers. Our results add to growing evidence that interim risk is a material factor in M&A transactions. Bates and Lemmon (2003), Gilson and Schwartz (2005), and Denis and Macias (2013) examine the costs and contractual features around cancelling merger deals. Bhagwat and Dam (2017) argue that there is a "seller's put" in M&A transactions, and Bhagwat et al. (2016) find that a deal is more likely to be cancelled or renegotiated when the target firm or its industry has a positive (market-adjusted) return postannouncement, consistent with the exercise of the seller's put. Our hypotheses, in contrast, focus on the acquirer's incentive to terminate when markets crash. Bhagwat et al. (2016) also show that higher expected volatility reduces overall merger activity—in particular acquisitions of public targets, consistent with their mechanism.

A small subset of the merger literature examines merger completion. Schwert (2000) documents that acquirer attitude (hostile versus friendly) is a key predictor of merger completion rates. Bates and Lemmon (2003) find that termination provisions in merger agreements

increase the likelihood of merger completion. Savor and Lu (2009) examine a sample of failed stock mergers to test the hypothesis that overvalued firms use equity to finance mergers. They note that market conditions are one of the reasons that managers cite as a reason for cancelled mergers, though they do not investigate this phenomenon per se. Becher et al. (2015) find that positive analyst coverage raises the likelihood of merger completion.

Studying the reactions of mergers to stock prices, Luo (2005) finds that the acquirer and target stock returns postannouncement yield information to the merging parties, and influence the likelihood of merger completion. Malmendier et al. (2016) find that targets of cash bids are revalued by +15% on average following deal failure, whereas targets of stock bids revert to their preoffer price. Merger activity has also been shown to relate to measures of uncertainty. Garfinkel and Hankins (2011) show that merger waves are partly driven by the uncertainty of cash flows at the firm level. Bonaime et al. (2018) show that higher uncertainty regarding taxes, government spending, monetary policy and regulation has a negative impact on merger activity. Studying the effects of the aggregate market on firms' decisions, Bernstein (2015) finds that during the dot-com era the likelihood of an initial public offering (IPO) being withdrawn was significantly higher if the NASDAQ crashed subsequent to the IPO announcement.

Mitchell and Pulvino (2001), Baker and Savaşoglu (2002), Hsieh and Walkling (2005), and Officer (2007) study the returns to merger arbitrage, which is essentially a bet on deal completion. In particular, Mitchell and Pulvino (2001) find that merger arbitrage returns are related to the stock market in a nonlinear fashion that resembles a short out of the money index put option. That is, merger arbitrage spreads widen during severely declining equity markets and are thus suggestive of subsequent merger failures and/or negative repricings. Our results are consistent with this finding, but we focus on the market's effect on deal outcomes.

In a study that focuses on the use of collars in stock mergers, Officer (2004) finds that acquirors are more likely to pay cash when they have a higher beta than the target firm. Officer (2004) finds further support for a contracting cost hypothesis, that market shocks during the interim period alter the allocation of merger value and result in ex post renegotiation. Our results directly provide confirmation for the idea that both the level and allocation of interim risk differs between cash and stock deals, and that interim risk affects deal terms.

Our results are also in line with a recent literature on strategic default and the property rights theory (Hart and Moore 2008, Hart and Holmstrom 2010, Blouin and Macchiavello 2019). Cain et al. (2015) provide evidence that private equity firms chose to strategically

default on previously agreed leveraged buyouts during the 2007–2008 financial crisis. We show that strategic default in mergers and acquisitions is a more general phenomenon, and extends beyond buyouts and beyond the 2008 market crash. The specific form of the effect we document—that smaller market drops have no effect, whereas larger market crashes have a large effect on deal completion—is also consistent with the prediction in this literature that contracts have a self-enforcing range, but break down when the market moves out of that range.

Securities laws require acquirors to announce a merger once a definitive agreement is in place, but the merging parties, combined or separately, can preannounce an intention to merge or a preliminary agreement to merge. Recent work in this area is by Aktas et al. (2018) who focus on the signaling effects of early announcements.

3. Data

Our sample consists of all transactions in the Thomson-Reuters SDC database from 1986 to 2018 that satisfy the following conditions:

- The deal form is “Acquisition,” “Merger,” “Acquisition of Majority Interest,” or “Acquisition of Remaining Interest”
- The deal’s final status is either “Completed” or “Withdrawn”
- The time between the announcement date and the completion or withdrawal date is at least 20 trading days
- The announcement date is not estimated by SDC
- The fraction of the target owned by the acquiror is less than 50% prior to the deal, and was or would have been more than 50% following the deal’s completion
- Data are nonmissing for the proposed method of payment, the initial and final price per share, and the target firm’s share price 4 weeks prior to the announcement date
- The target firm was publicly listed in the United States
- The value of the transaction is at least \$50 million in 2018 dollars (adjusted by the U.S. CPI)

These screens leave us with a sample of 7,341 deals from 1986 to 2018.

Stock returns are from the CRSP daily security file. We obtain daily levels of the VIX, our measure of expected market volatility, over the period from 1990 to 2018 from Bloomberg. We obtain the market’s cyclically adjusted price/earnings ratio (CAPE) from Robert Shiller’s website.

Table 1 displays summary statistics for our sample of 7,341 merger transactions. The average deal premium over the target’s share price 1 month prior to announcement (43%), the average completion rate

Table 1. Summary Statistics

	A. All deals					
	Mean	SD	P10	Median	P90	
Deal value (\$M 2018)	2,425	8,202	85	463	4,908	
Deal premium	1.43	0.40	1.05	1.35	1.88	
Deal length	97	67	33	81	176	
Is hostile	0.03	0.17	0.00	0.00	0.00	
Pct cash	0.57	0.45	0.00	0.77	1.00	
Pct stock	0.37	0.45	0.00	0.00	1.00	
Completed	0.87	0.33	0.00	1.00	1.00	
B. Split by method of payment						
	Majority stock			Majority cash		
	Mean	Median	SD	Mean	Median	SD
Deal value (\$M 2018)	3,227	471	11,015	1,843	427	5,680
Deal premium	1.39	1.32	0.41	1.45	1.37	0.38
Is hostile	0.02	0.00	0.12	0.04	0.00	0.20
Pct cash	0.05	0.00	0.12	0.94	1.00	0.13
Pct stock	0.92	1.00	0.14	0.02	0.00	0.31
Completed	0.88	1.00	0.32	0.87	1.00	0.34
C. Split by DA status at announcement						
	DA in place			No DA in place		
	Mean	Median	SD	Mean	Median	SD
Deal value (\$M 2018)	2,421	485	8,131	2,437	403	8,383
Deal premium	1.41	1.34	0.39	1.46	1.39	0.42
Is hostile	0.00	0.00	0.03	0.10	0.00	0.30
Tender offer	0.22	0.00	0.41	0.44	0.00	0.50
Is buyout	0.13	0.00	0.34	0.24	0.00	0.42
Pct cash	0.54	0.62	0.45	0.66	1.00	0.43
Pct stock	0.41	0.00	0.46	0.26	0.00	0.41
Completed	0.93	1.00	0.25	0.72	1.00	0.45
Acquiror size (\$M 2018)	23,042	3,421	87,313	24,544	2,030	334,744
Public acquiror	0.71	1.00	0.45	0.56	1.00	0.50

Notes. The table shows summary statistics for the sample of deals in the paper. The sample consists of mergers and acquisitions of publicly listed firms in the Thomson-Reuters SDC database announced from 1986 to 2018 with a deal value of at least \$50M in 2018 dollars and a deal length (time from announcement to either completion or withdrawal) of at least 20 trading days, as well as other requirements that deal data be available.

(87%) and the average fractions paid in cash (57%) and stock (37%) are typical of the empirical merger literature. Given our focus on the method of payment and the contracting stage of the deal, we note that the deal completion rate is 87% for majority-cash deals versus 88% for majority-stock deals, and 93% for deals announced with a definitive agreement (DA) in place versus 72% for deals without a DA in place.

4. Results

4.1. Market Crashes and Merger Cancellations

For each merger in the sample, we define the postannouncement market return as the value-weighted return to all U.S. common stocks in CRSP over the 20 trading days after the deal was announced (i.e.,

Table 2. Market Returns and Interim Risk

	(1) Completed	(2) Completed	(3) Completed	(4) Completed	(5) Completed
<i>MarketReturn</i>	0.15 (0.25)				
<i>MarketDown</i>		0.02 (0.03)			
<i>MarketDown10%</i>			-0.16*** (0.05)	-0.03 (0.09)	-0.22*** (0.06)
Payment Model	All Logit	All Logit	All Logit	Stock Logit	Cash Logit
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	7,341	7,341	7,341	2,731	4,207

Notes. The table shows estimates of the dependence of completion of mergers and acquisitions on ex post market returns. The dependent variable in each case is an indicator variable for whether each deal was completed after being announced. The independent variable is the CRSP value-weighted U.S. market return over the 20 trading days following the announcement date (*MarketReturn*); an indicator variable for whether the market return was negative (*MarketDown*); and an indicator variable for whether the market return was -10% or lower (*MarketDown10%*). The sample consists of M&A deals announced from 1986–2018. Stock deals are deals to be paid at least 50% in the acquirer firm's stock (Column 4) and cash deals are deals to be paid at least 50% in cash (Column 5). The table shows logit marginal effects. Standard errors (in parentheses) are robust and clustered by target firm industry.

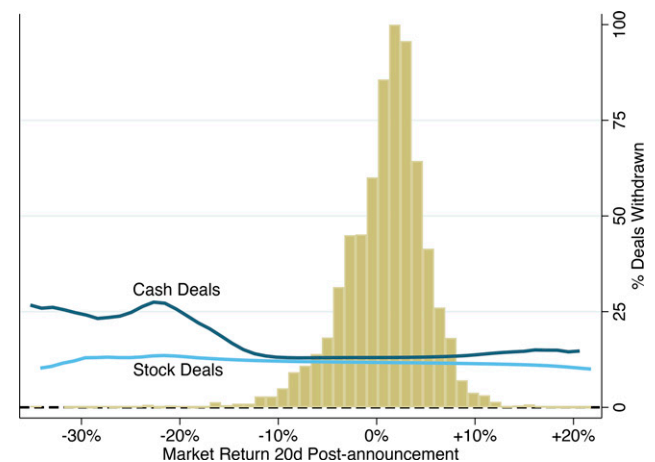
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

trading days +1 to +20, where day 0 is the announcement date). In further tests (shown in the online appendix) we find that using the CRSP value-weighted market return, excluding all firms in the target and acquirer firms' two-digit SIC industries, the results are nearly identical. We define a market crash as a market return of -10% or lower over the 20-day period after the merger announcement date. A 10% decline achieves the balance of having a material market downturn over a short time period, and also a sufficient number of observations so that the empirical tests have adequate statistical power.

Table 2 displays estimates from logit regressions in which the dependent variable equals 1 if a given deal was eventually completed and 0 otherwise. The key independent variable is the CRSP value-weighted U.S. market return over the 20 trading days following the announcement date. When we regress deal completion on the market return itself (Column 1), the coefficient is positive but small, implying that a market return of -10% leads to a 1.5-percentage point (pp) lower likelihood of deal completion. Using an indicator variable that equals 1 if the postannouncement market return is negative (Column 2), the effect on deal completion is instead slightly positive. Neither relation is statistically significant at conventional levels.

By contrast, when we use an indicator variable for a market crash of at least -10% (Column 3), we observe a large and statistically significant decrease in the likelihood of deal completion. The marginal effect of -16 percentage points more than doubles the 12.8% base rate of deal cancellation. This result, compared with Columns 1 and 2, highlights the nonlinearity of the relationship between the market return and merger completion in support of our Hypothesis 2.¹¹

Table 2 Columns 4 and 5 split the sample into deals to be paid 50% or more in the acquiring firm's stock versus deals to be paid 50% or more in cash.¹² Consistent with Hypothesis 3, market crashes have no effect on deal completion for deals to be paid in stock, and all of the effect appears for deals to be paid in cash. The magnitude of the effect is economically large: A postannouncement market crash increases the likelihood that a cash deal is cancelled by 22 percentage points relative to the 13.4% base rate of cancellation for cash deals.

Figure 1. (Color online) Market Returns and Deal Cancellations

Notes. The figure shows local polynomial regressions of deal cancellation rates against the CRSP value weighted stock market return over the 20 trading days postannouncement. The histogram shows the distribution of postannouncement market returns. The sample consists of M&A deals announced from 1986–2018 with a transaction value of at least \$50M in 2018 dollars.

Figure 1 plots local polynomial estimates of merger cancellations against postannouncement market returns as well as a histogram showing the distribution of postannouncement market returns. For market returns that are positive and of any magnitude, or negative but smaller than -10% , the slope is horizontal for both cash and stock deals at their average cancellation rate around 13% . When the market return is below -10% , however, 29% of cash bids are cancelled compared with 16% of stock deals.

Is the effect of market crashes on deal completion driven by just a few outliers such as the 1987, 2001 or 2008 market crashes? In fact, market crashes of 10% or more are not confined to those historical episodes. Figure 2 shows the daily level of the CRSP value-weighted U.S. stock market index over the sample period from January 1986 to December 2018. Periods of 20 trading days when the market fell by 10% or more are highlighted in blue. There were 175 such periods in the sample, only 88 (50%) of which occurred in 1987, 2001, or 2008. In the online appendix we examine if our results are solely driven by the downturns of 1987, 2001, and 2008. Omitting those three years, the effect of a postannouncement market crash on deal completion is slightly *stronger*. Thus, our results are not solely driven by a few historical episodes, but are pervasive throughout the sample. The online appendix further documents that the effect is robust to different estimators and control variables, in particular controlling for firm and industry stock returns.

Thus, a major difference between the two main methods of payment (stock versus cash) in mergers

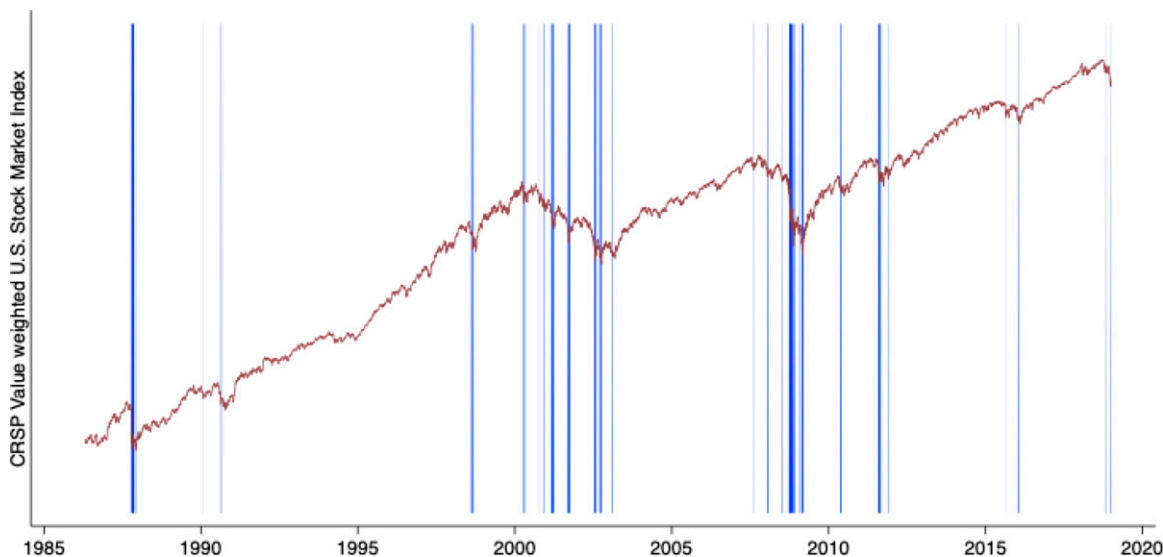
and acquisitions is in their interim risk of cancellation, and this difference in interim risk is revealed when the aggregate stock market falls significantly. These findings are consistent with Mitchell and Pulvino (2001). That paper documents nonlinearity in the returns to merger arbitrage, which is essentially a bet on deal completion.¹³ We elaborate on these findings further in the next sections, including how stock bids share interim risk and how the presence of a definitive agreement reduces it.

4.2. Varying the Horizon and Breakpoint

Table 3 explores how the effect of market crashes on deal completion depends on the postannouncement time horizon and the breakpoint used to define a market crash, which are 20 trading days and -10% in our baseline specification. We restrict the analysis in Table 3 to cash deals, because we did not observe significant effects for stock deals. Our first tests (Columns 1–3) change the breakpoint used to define a market crash to -5% or -15% . For the smaller breakpoint of 5% the coefficient estimate is again economically meaningful (-10 percentage points) and statistically significant. Because there are very few occurrences of a market crash of 15% over 20 market days, this relationship is weaker.

We next change the length of the postannouncement time horizon to (i) 40 trading days after the announcement date and (ii) to deal finalization, in which the market return is computed from the day after the announcement until the resolution of the deal in either completion or cancellation. We also vary the breakpoint to -5% , -10% , and -15% , respectively.

Figure 2. (Color online) Market Crashes over Time



Notes. The figure shows the level of the CRSP value-weighted stock market index, daily over the sample period from 1986–2018. Periods of 20 trading days over which the index fell by 10% or more are indicated by vertical bars.

Table 3. Varying Horizons and Breakpoints

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Dependent variable = Completed								
<i>MarketDown5%</i>	-0.10** (0.05)			-0.05 (0.05)			-0.02 (0.06)		
<i>MarketDown10%</i>		-0.22*** (0.06)			-0.09 (0.05)			-0.06 (0.06)	
<i>MarketDown15%</i>			-0.06 (0.12)			-0.04 (0.08)			-0.08 (0.07)
Days Postannouncement	20	20	20	40	40	40	To Final	To Final	To Final
Payment	Cash	Cash	Cash	Cash	Cash	Cash	Cash	Cash	Cash
Model	Logit	Logit	Logit	Logit	Logit	Logit	Logit	Logit	Logit
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,207	4,207	4,207	4,207	4,207	4,207	4,207	4,207	4,207

Notes. The table presents additional tests of the dependence of completion of cash merger deals on ex post market returns. The dependent variable in each case is an indicator variable for whether each deal was completed after being announced. The independent variable is an indicator variable for whether the CRSP value-weighted U.S. stock market return was lower than -5%, -10%, or -15% over the 20 (Columns 1–3) or 40 (Columns 4–6) trading days following the deal announcement or over all trading days until the deal's resolution (Columns 7–9). The sample consists of M&A deals announced from 1986–2018 that were to be paid at least 50% in cash. The table displays logit marginal effects. Standard errors (in parentheses) are robust and clustered by target firm industry.
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

In all specifications, the sign on the coefficient is negative, but is smaller in magnitude and not statistically significant.

These results suggest that the interim risk of deal cancellation for cash deals is concentrated in the first month after the deal is announced. We note that a definitive agreement is usually signed within one to two months of the initial announcement.¹⁴ As we explore in the next section, the presence of a definitive agreement acts to negate the interim risk of market crashes.

4.3. Different Types of Cash Deals

Next, we explore how the effect of market crashes varies across cash deals of different types. This analysis addresses two questions: First, is the method of payment just a proxy for another deal characteristic that correlates with the likelihood of paying in cash—for example, whether the acquirer firm is a private or publicly listed firm? Second, is the effect limited to certain types of cash deals such as private equity buy-outs (Cain et al. 2015), or is it pervasive across different types of cash deals?

Table 1 Panel B compares majority-cash to majority-stock deals in our sample to provide a sense of how the method of payment covaries with other deal characteristics. Majority-cash deals are smaller on average, pay a higher premium, are slightly more likely to be hostile bids and are slightly less likely to be completed than majority-stock deals.

First, Table 4 Panel A Columns 1–2 split the full sample on the basis of whether the deal had a definitive agreement (DA) in place at announcement. This split tests our Hypothesis 4. We see that the effect of market crashes on deal completion is present for cash

deals without a DA, but entirely absent for cash deals with a DA in place. This finding suggests that the DA negates the interim risk of cancellation due to market crashes by legally assigning the risk to one party, generally the acquirer. Columns 1 and 2 also show that with or without a DA in place, stock deals' completion is unaffected by market crashes. With these findings in mind, in our subsequent sample splits we examine the subset of merger deals that are affected by market crashes, namely, deals that (1) were to be paid 50% or more in cash and (2) did not have a DA in place at announcement.

Legally, a merger deal must be announced within a few days after the DA is signed; in practice, quite a few deals are announced prior to the DA being signed (Aktas et al. 2018). In our sample, 28% of all deals were announced prior to the DA, and in those cases the average gap between the announcement and the DA was 70 calendar days. Announcing the deal pre-DA was more common in hostile bids and tender offers, but the majority (53%) were friendly deals that were not tender offers.

Table 1 Panel B compares deals that had a DA in place at announcement to deals that did not. The two groups are similar in terms of deal size, target size (not shown) and acquirer size. Deals announced pre-DA pay a higher premium, are significantly more likely to be paid in cash, to be launched by a private acquirer, to be a hostile bid, a buyout, or a tender offer, and are significantly less likely to be ultimately completed. Although both types of deal are represented in both groups in all cases, a concern is that the absence of a DA at announcement may be proxying for one or more of these characteristics. We examine this possibility next.

Table 4. Effects Across Different Types of Cash Deals

Panel A								
	(1)	(2)	(3)	(4)	(5)	(6)		
	Dependent variable = Completed							
<i>MarketDown10%</i>	-0.02	-0.38***	-0.39**	-0.33***	-0.44***	-0.34***		
× MajorityCash	(0.05)	(0.08)	(0.17)	(0.09)	(0.17)	(0.09)		
<i>MarketDown10%</i>	-0.05	-0.02						
× MajorityStock	(0.05)	(0.15)						
Payment	All	All	Cash	Cash	Cash	Cash		
DA in place	Yes	No	No	No	No	No		
Acquiror			Public	Private				
Attitude					Hostile	Friendly		
Model	Logit	Logit	Logit	Logit	Logit	Logit		
Observations	5,300	2,041	588	781	162	1,207		
Panel B								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable = Completed							
<i>MarketDown10%</i>	-0.32***	-0.45***	-0.33***	-0.42***	-0.40***	-0.35***	-0.48***	-0.24**
	(0.11)	(0.11)	(0.11)	(0.12)	(0.15)	(0.10)	(0.12)	(0.11)
Payment	Cash	Cash	Cash	Cash	Cash	Cash	Cash	Cash
DA in place	No	No	No	No	No	No	No	No
Deal size	Large	Small						
Horizontal merger			Yes	No				
Buyout deal					Yes	No		
Tender offer							Yes	No
Model	Logit	Logit	Logit	Logit	Logit	Logit	Logit	Logit
Observations	676	693	578	791	423	946	784	585

Notes. The table examines how the effect of market crashes on deal completions varies across different types of cash deals. Panel A splits the sample based on whether the deal had a definitive agreement (DA) in place at announcement (Columns 1–2), the acquiror firm’s listed status (Columns 3–4), and the deal’s attitude (Columns 5–6). Panel B splits majority-cash deals (that were to be paid at least 50% in cash), without a DA in place, based on the deal’s size (Columns 1–2), whether the acquiror and target are in the same two-digit SIC industry (Columns 3–4), and whether the acquiror is a holding company or an operating firm (Columns 5–6). The table shows logit marginal effects. Standard errors (in parentheses) are robust and clustered by target firm industry.

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

The rest of Table 4 Panel A splits the subsample of majority-cash deals without a DA in place, on the basis of whether the acquiror was a publicly traded or private firm (Columns 3–4) and whether the deal was a hostile or friendly bid (Columns 5–6). We see that the effect is present, significant, and of a similar magnitude in all cases. These results show that interim risk does not depend on the acquiror firm’s public-private status or the deal’s attitude. Also, the method of payment is not a proxy for private acquirors or hostile offers.

Table 4 Panel B splits the subsample of majority-cash deals without a DA in place on the basis of whether the deal was above or below median size in its year (Columns 1–2), whether the acquiror and target were in the same two-digit SIC industry (Columns 3–4), whether the deal was a financial buyout or an operating merger (Columns 5–6), and whether the deal was a tender offer or not (Columns 7–8). We see that the treatment effect is present and significant in all cases.

Thus, the effect of market crashes on deal completion is pervasive across different types of cash deals

without a DA in place. In the online appendix we present the corresponding sample splits within the other three subsamples (majority-stock with no DA in place; majority-stock with a DA in place; majority-cash with a DA in place). Within those subsamples, we find *no* significant treatment effect across all the sample splits.¹⁵

These findings suggest that, as hypothesized, it is the fixed-price nature of cash deals that produces their higher interim risk exposure. Due to their floating-price nature, stock deals appear to be immune to market crashes whether a definitive agreement is in place.¹⁶

4.4. Other Deal Outcomes

4.4.1. Reason for Deal Cancellation. In this section, we examine the effects of postannouncement market returns on measures of deal outcomes apart from completion. First, we examine the stated reason for the deal’s cancellation. For each cancelled deal we read through the detailed synopsis of the deal’s history in SDC. We code two outcomes: (i) the acquiror withdrew their offer (93% of cases) or (ii) the target

Table 5. Other Deal Outcomes

Panel A: Reason for deal cancellation				
	(1) AcqWithdraw	(2) TgtWithdraw	(3) CompetingBid	
<i>MarketDown10%</i>	0.22*** (0.08)	0.07 (0.19)	0.05 (0.12)	
Payment	Cash	Cash	Cash	
DA in place	No	No	No	
Model	Logit	Logit	Logit	
Year FE	Yes	Yes	Yes	
Observations	1,369	748	1,369	
Panel B: Revisions to deal price				
	(1) RevisedDown	(2) RevisedDown	(3) RevisedUp	(4) RevisedUp
MarketReturn × MajorityCash	-0.09** (0.04)	-0.09** (0.04)	0.29*** (0.10)	0.32*** (0.08)
MarketReturn × MajorityStock	0.06 (0.08)	0.11 (0.11)	-0.08 (0.09)	0.14 (0.12)
Payment	All	All	All	All
DA in place	All	All	All	All
Deal-level controls	No	Yes	No	Yes
Model	Logit	Logit	Logit	Logit
Year FE	Yes	Yes	Yes	Yes
Observations	6,600	5,067	7,341	5,406

Notes. The table presents estimates of the relation between postannouncement stock market returns and measures of deal outcomes apart from completion. Panel A examines the party responsible for a deal's cancellation. *AcqWithdraw*, *TgtWithdraw*, and *CompetingBid* are indicator variables that equal 1 if the stated reason for the deal's cancellation is, respectively, the acquiror's withdrawal, target's rejection, or the acceptance of a competing bid. Panel B examines revisions to deal prices. *RevisedDown* and *RevisedUp* are indicator variables that equal 1 if the deal's price was revised downward or upward, respectively, from the initial bid price. Deal-level controls are the variables *DAinPlace*, *logInitPremium*, *logValue*, *IsHostile*, and *CompetingBid*. Standard errors (in parentheses) are robust and clustered by target firm industry.

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

rejected the offer (5% of cases). These outcomes are not mutually exclusive or mutually exhaustive. In some cases the acquiror and target mutually terminated the agreement (both outcomes coded as 1), and in other cases a third party such as a regulator blocked the deal (both outcomes coded as 0).

Table 5 Panel A examines which party's actions are behind cancellation after a market crash. Column 1 shows that a postannouncement market crash is associated with a 22-percentage point increase in the likelihood that the acquiror withdraws their offer; this relationship is strongly statistically significant. By contrast, the relationship between market crashes and rejection by the target firm is weaker and is not statistically significant at conventional levels. Column 3 shows that another influential factor—the presence of a competing bid—is also not significantly associated with a postannouncement market crash.

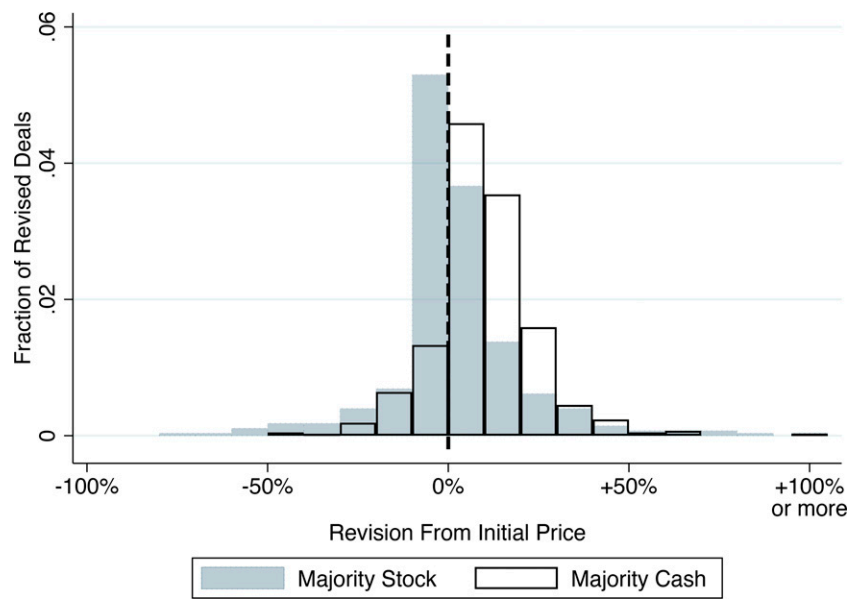
Thus, the evidence as to which party is responsible for deal cancellation is consistent with our main hypothesis. A market crash postannouncement leads to a revision downward of expected deal value. For deals to be paid in cash, the reduction in expected value is entirely borne by the acquiror firm. If the deal

does not have a definitive agreement in place, the acquiror firm has both the incentive and the leeway to terminate the deal.

4.4.2. Revisions to Deal Price. Our results so far on interim risk are consistent with the theoretical literature on ex post renegotiation (Hart 2009, Blouin and Macchiavello 2019). That theory also makes specific predictions as to when deals are likely to be revised, which we examine next. The theory predicts that deals break down and are cancelled when the expected total surplus falls, because the parties are unable to agree on a revised version of the deal. By contrast, when the expected deal value rises, the parties are able to agree on a revised version of the deal.

Overall, cash deals are more likely than stock deals to be revised during the interim period. Thirteen percent of the cash deals in our sample had a final price that differed from the initial price at announcement, compared with 8% of stock deals. Figure 3 plots the distribution of changes from the initial price to the final deal price, separately for cash and stock deals. We see a striking asymmetry: The higher rate of revisions for cash deals is *entirely* driven by upward revisions to the

Figure 3. (Color online) Market Returns and Deal Revisions



Notes. The figure shows separate histograms for deals paid in stock versus cash of the extent to which the final deal price was revised. The sample consists of M&A transactions announced from 1986–2018 with a transaction value of at least \$50M in 2018 dollars, for which the final deal price differed from the initial price at announcement.

price. Two percent of cash deals and 3% of stock deals were revised downward during the interim period; by contrast, 11% of cash deals and 5% of stock deals were revised upward.

How do postannouncement market returns explain revisions to the deal price? Table 5 Panel B presents estimates of this relationship for both cash and stock deals. We see that a 10% lower market return postannouncement (decreased deal value) makes a cash deal 0.9 percentage points more likely to be revised downward (Column 1). This is a sizeable effect relative to the 2% base rate. On the other hand, a 10% higher market return postannouncement (increased deal value) makes a cash deal 2.9 percentage points more likely to be revised upward (Column 3). In both cases, there is no significant relation for stock deals. Thus, the market’s effect on upward revisions to cash deals is more than three times larger than its effect on downward revisions. This asymmetric effect of the market return on revisions to the deal price, conditional on the method of payment, also holds controlling for other deal characteristics that predict deal revisions (Columns 2 and 4).

The asymmetric relation between the aggregate market return and upward revisions to cash deals is consistent with our Hypothesis 5. The theory predicts that renegotiation between the initial buyer and seller is feasible when the expected surplus to be divided increases, but breaks down when it decreases. Stock deals are seldom explicitly revised in response to market returns, because the offer can automatically adjust via the acquiror’s stock price. By contrast, because

they are exposed to changes in market conditions, cash deals are revised when the market rises, but cancelled when the market crashes.

4.5. Tests for Ex Ante Selection

A key advantage of our research design for studying interim risk is that both theory and evidence suggest that treatment status—experiencing a market crash—is as good as randomly assigned. This feature is important because many other factors, some of which may be unobservable, have been proposed to affect merger activity and the method of payment. For example, if a firm or industry’s stock is overpriced, this can make firms more likely to launch acquisitions and to pay for those acquisitions in stock (Shleifer and Vishny 2003). However, as long as these other firm or industry-level factors are uncorrelated with treatment status, then our estimates will recover the true treatment effects. Put differently, the key requirement for a clean test of the interim risk channel is that treatment status should be uncorrelated with a deal’s ex ante characteristics and environment.

First, a large asset-pricing literature suggests that market returns are unpredictable, especially over the short horizon of 20 trading days that we examine. Welch and Goyal (2007) examine a broad list of candidate predictive variables for the monthly market return and find low R^2 and poor predictive performance. Second, we empirically test for differences between treated and control firms—that is, we look for evidence of ex ante selection effects that could bias our comparison of treated and control deals.

Table 6. Tests for Ex Ante Selection

Panel A: All deals						
	(1) PctCash	(2) MajorityCash	(3) logPremium	(4) logSize	(5) log(M/B) ^{Acq}	(6) log(M/B) ^{Tgt}
<i>MktDown</i> 10%	0.01 (0.04)	0.03 (0.04)	-0.00 (0.02)	0.03 (0.15)	-0.01 (0.07)	0.01 (0.05)
Payment	All	All	All	All	All	All
DA in place	All	All	All	All	All	All
Model	OLS	OLS	OLS	OLS	OLS	OLS
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,341	7,341	7,341	7,341	4,373	6,541
Panel B: Cash deals						
	(1) logPremium	(2) logSize	(3) log(M/B) ^{Acq}	(4) log(M/B) ^{Tgt}		
<i>MktDown</i> 10%	-0.03 (0.03)	0.13 (0.18)	-0.07 (0.07)	0.09 (0.06)		
Payment	Cash	Cash	Cash	Cash		
DA in place	All	All	All	All		
Model	OLS	OLS	OLS	OLS		
Year FE	Yes	Yes	Yes	Yes		
Observations	4,207	4,207	1,775	3,815		
Panel C: Deals with no DA in place						
	(1) logPremium	(2) logSize	(3) log(M/B) ^{Acq}	(4) log(M/B) ^{Tgt}		
<i>MktDown</i> 10%	-0.03 (0.04)	-0.00 (0.22)	-0.02 (0.12)	0.08 (0.08)		
Payment	All	All	All	All		
DA in place	No	No	No	No		
Model	OLS	OLS	OLS	OLS		
Year FE	Yes	Yes	Yes	Yes		
Observations	2,041	2,041	1,001	1,798		

Notes. The table compares the ex ante characteristics of treated vs. untreated deals (i.e., deals that experienced a post announcement market crash or not). In Panel A the sample consists of the full sample of M&A deals from 1986–2018; in Panel B the sample consists of deals that were to be paid at least 50% in cash; in Panel C the sample consists of deals that did not have a definitive agreement in place at announcement. Standard errors (in parentheses) are robust and clustered by target firm industry.

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

Table 6 Panel A compares treated and control deals across all deals in the sample. Because deal characteristics and merger activity change over time, we use regressions with year fixed effects. We see that treatment status is not significantly related to the method of payment, the deal size and premium, and the market-to-book ratios of both the acquirer and target firms. Thus, affected and unaffected deals were indistinguishable ex ante on these characteristics. Panel B shows the same comparisons within majority-cash deals only. Panel C shows the same comparisons within the set of deals that did not have a definitive agreement (DA) in place at announcement. Again, we see no significant differences between treated and control deals.

In all cases, the differences between treated and control deals are small both in absolute terms and relative to the variation in the sample. For example, within both cash deals (Panel B) and deals with no DA in

place (Panel C), the difference in the average premium paid between treated and control deals is -3%. By comparison, the mean premium paid across all cash deals is 34% and the sample standard deviation is 24%; for deals with no DA in place, the mean premium paid is 34% and the sample standard deviation is 27%. Thus, the differences between treated and control deals are insignificant both statistically and economically.

In further tests presented in the online appendix, we examine the possibility of selection bias due to variation in deals' pretreatment macroeconomic environment. We do so by controlling for the relevant macroeconomic variables and deal characteristics, deal-by-deal, and by matching treated and control deals on the basis of their pretreatment environment. The results are nearly identical to our baseline estimates, and we conclude that selection bias is not a first-order concern.

Table 7. Tests of the Revised-Value Channel

	(1) Completed	(2) Completed	(3) Completed	(4) Completed
<i>SmallTarget</i> × <i>MktDown</i> 10%	−0.36*** (0.08)			
<i>LargeTarget</i> × <i>MktDown</i> 10%	−0.19 (0.12)			
<i>YoungTarget</i> × <i>MktDown</i> 10%		−0.32*** (0.07)		
<i>OldTarget</i> × <i>MktDown</i> 10%		−0.12 (0.13)		
<i>HighTgtIdioVol</i> × <i>MktDown</i> 10%			−0.37*** (0.08)	
<i>LowTgtIdioVol</i> × <i>MktDown</i> 10%			−0.20* (0.12)	
<i>HighTgtBeta</i> × <i>MktDown</i> 10%				−0.24** (0.11)
<i>LowTgtBeta</i> × <i>MktDown</i> 10%				−0.28*** (0.11)
Payment	Cash	Cash	Cash	Cash
DA in place	No	No	No	No
Model	Logit	Logit	Logit	Logit
Year FE	Yes	Yes	Yes	Yes
Observations	1,369	1,235	1,369	1,140

Notes. The table examines the evidence for market returns affecting deal completion via revised expectations of the acquisition value. Columns 1–4 split the sample of deals on the median of the target firm’s size, age (time since first public filing), idiosyncratic volatility, and market beta. The sample consists of M&A deals announced from 1986–2018 that were to be paid at least 50% in cash. The table shows logit marginal effects. Standard errors (in parentheses) are robust and clustered by target firm industry.

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

A more subtle concern is selection into announcement status; that is, whether the deal is announced pre-definitive agreement (pre-DA) or not could lead to a sample selection bias because we do not *observe* treatment status for deals announced after the DA is signed. In the online appendix, we examine this possibility using Heckman correction models for selection into pre-DA status. Again, the results are nearly identical to our baseline estimates, and we conclude that bias due to sample selection is unlikely.

In sum, both theory and evidence suggest that other factors such as asymmetric information, mispricing, deal characteristics, or the macroeconomic environment cannot explain the patterns of deal cancellation and revision with the postannouncement market return that we observe. The effects we find are plausibly explained by interim risk and are not plausibly explained by alternative forces.

4.6. Economic Channels

Our results so far show that market crashes lead to the termination of cash mergers. Next we investigate the economic channel that explains the cancellation of these deals. We consider two nonexclusive channels: Revised value and lost financing.

4.6.1. Revised Value. First we examine our main hypothesized mechanism, which we term the revised-value channel, in which the expected value of the deal

falls when the market crashes. A market crash plausibly causes a change in the expected future operating value of the deal, that is, the stand-alone value of the target plus expected synergies.

To check the validity of this channel, we examine how the treatment effect of a market crash varies with measures of how strongly it should affect the expected deal value. From the acquirer firm’s perspective, the deal’s value is more subject to revision if the target firm has a more uncertain valuation, as measured by (i) a smaller book value of assets, (ii) a shorter track record of public filings to analyze, or (iii) a more volatile target stock price. Table 7 shows the results when we split the sample across the median of the target firm’s book value of assets (Column 1), the number of years since the target’s first public filing in Compustat (Column 2), and idiosyncratic stock volatility (Column 3). In all three cases, the effect of market crashes on deal completion is stronger for deals in which the target firm was more difficult to value. Finally, we hypothesize that market crashes should have a stronger effect on the value of a target firm with (iv) a higher market beta. Column 4 shows that the effect is significant for both high- and low-beta target firms. The coefficients are similar, but slightly larger for low-beta target firms. These last findings do not provide evidence in favor of the revised-value channel, but neither do they rule it out.

Table 8. Tests of the Lost-Financing Channel

	(1) Completed	(2) Completed	(3) Completed	(4) Completed	(5) Completed	(6) Completed
<i>MktDown</i> 10%	-0.36*** (0.08)					
Δ <i>CPRate</i>	0.04 (0.05)					
<i>Unconstrained</i> × <i>MktDown</i> 10%		-0.86*** (0.03)	-0.27 (0.25)	-0.80*** (0.03)	-0.71*** (0.04)	-0.75*** (0.03)
<i>Constrained</i> × <i>MktDown</i> 10%		-0.30 (0.19)	-0.52** (0.22)	0.01 (0.22)	-0.43 (0.27)	-0.28 (0.21)
Fin. constraint		AcqCash < TgtSize	Acq Tangibility	Acquiror KZ	Acquiror SA	Acquiror WW
Payment	Cash	Cash	Cash	Cash	Cash	Cash
DA in place	No	No	No	No	No	No
Model	Logit	OLS	OLS	OLS	OLS	OLS
Observations	1,369	513	508	431	358	515

Notes. The table examines the evidence for market returns affecting deal completion through the loss of deal financing. In Column 1, Δ *CPRate* is the change in the 3-month commercial paper rate over the 20 day postannouncement window for each deal. Columns 2–6 split the sample into deals with constrained vs. unconstrained acquirors on the basis of the acquiror’s cash compared with target firm size, asset tangibility, and the financial constraints measures of Kaplan-Zingales (KZ), Hadlock-Pierce (size-age, SA), and Whited-Wu (WW). The sample consists of M&A deals announced from 1986–2018 that were to be paid at least 50% in cash. The table shows logit marginal effects. Standard errors (in parentheses) are robust and clustered by target firm industry.

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

In sum, in three out of four sample splits the data provide support for the revised-value channel, in which a market crash leads to the acquiror firm withdrawing from the deal due to a reduction in the expected value of consummating the deal. This effect only appears in cash bids because for stock bids, the offer consideration (i.e., the price of the acquiror firm’s stock) changes at the same time as in a floating-rate purchase contract.

The model in Section 2 posits two components of deal value that are susceptible to market crashes—synergies and target firm value. In the online appendix we present additional tests on which component is likely to explain our findings. The results suggest that terminations following market crashes are not driven by changes to the target firm’s value (which, after all, is publicly observable and contractible), but instead by changes to the estimated synergies of the deal.

4.6.2. Lost Financing. The literature has established that financial constraints are a first-order factor in merger activity and the method of payment (Faccio and Masulis 2005, Erel et al. 2015, Gorbenko and Malenko 2017). A second channel that could explain our results, which we term the lost-financing channel, is that the financing for an announced deal becomes more expensive or unavailable when the market crashes. Cash deals are naturally more dependent on external financing than stock deals are, and Cain et al. (2015) document that during the financial crisis of 2008 lenders reduced their supply of credit to private equity firms.

We begin with tests that exploit variation among market crashes in contemporaneous changes to the cost of capital. Table 8 column 1 reruns our main estimate, adding as an explanatory variable the contemporaneous 20-day postannouncement change in the three-month commercial paper rate. The coefficient on market crashes is unchanged, and the coefficient on Δ *CPRate* is neither economically or statistically significant. Thus, equity market crashes do not appear to cause deal cancellations due to contemporaneous changes in corporate borrowing rates. This finding is less surprising when we consider the low correlation between the two variables. In our sample from 1980–2018, the correlation between the market-crash indicator and the contemporaneous Δ *CPRate* was slightly negative. On average, an equity market crash was accompanied by a *fall* of 10 basis points in the commercial paper rate.

Some acquiring firms have more cash and assets that can serve as collateral, reducing the need for outside capital. Next, we examine whether the effect of market crashes varies among deals based on measures of financial constraints at the firm level. These tests are within the subset of deals for which the necessary data for the acquiror firm is available in Compustat. Because the number of deals is therefore reduced, we are not able to fit logit estimates to the data. Instead we present linear probability model (OLS) estimates, which summarize the conditional expectations within the sets of different deals.

Table 8 Column 2 is a sharp test of the lost-financing channel. Here, “unconstrained” acquirors are firms whose premerger cash and marketable securities was larger than the target firm’s assets. We see that even

for deals in which the acquirer firm could pay for the acquisition out of pocket, a market crash made it 86% less likely that the deal would be completed—a larger effect than that for deals with constrained acquirors. This finding is inconsistent with lost financing as the explanation for our findings.¹⁷ Columns 3–6 similarly split the sample on the basis of the acquirer’s asset tangibility (Column 3); the acquirer’s Kaplan and Zingales (1997) financial constraints measure (Column 4); the acquirer’s Hadlock and Pierce (2010) size-age financial constraints measure (Column 5); and the acquirer’s Whited and Wu (2006) financial constraints measure (Column 6). For three of the four measures of financial constraints, the effect of market crashes on deal completion primarily or entirely appears in deals with *unconstrained* acquirors. The one exception is asset tangibility: the effect of market crashes on deal completion primarily appears in deals with low-tangibility acquirors. Although these findings are necessarily only suggestive due to the smaller sample size, overall they are inconsistent with the lost-financing channel.

A third test of the lost-financing channel is to examine the effect of market crashes on buyout deals, which explicitly rely on external capital, compared with operating mergers, which need not. Recall from Table 4 that the effect of market crashes is not localized to buyouts, but is strongly present in both buyouts and mergers between operating firms.

In sum, the evidence lends limited support to the lost-financing channel, in which market crashes affect deal completion via the cost or the availability of deal financing, as the primary explanation for our results. To emphasize, our results do not suggest that lost financing never causes a deal to be cancelled, but rather that lost financing is not the channel through which market crashes cause cancellations. This conclusion is plausible considering that our sample consists of mid- and large-size M&A deals that involved mostly established and profitable target firms, and that our results still hold when we exclude major financial downturns.

5. Interim Risk Affects the Merger Market

We have shown that ex post movements in the aggregate market—in particular, market crashes—cause cash deals to be cancelled, but not stock deals. Moreover, the signing of the definitive agreement appears to be the critical stage after which deal completion is no longer affected by market crashes. Next, we investigate how the time-varying risk of a market crash affects merger terms ex ante. Our work on this front extends the analysis of Bhagwat et al. (2016), who show that higher expected volatility as measured by the VIX results in reduced deal activity. We examine

how higher expected volatility impacts the method of payment as well as other deal terms, motivated by our model of interim risk.

If mergers failed for idiosyncratic, deal-specific reasons only, cash deals should be more likely to be completed, because a cash bid is a costly signal of high expected synergies (Rhodes-Kropf and Viswanathan 2004). Also, in our sample, cash deals offered a premium to the target’s premerger stock price that was 5.3% higher on average than stock deals ($t = 8.3$), and a higher premium predicts a higher likelihood of completion. Yet cash deals were completed slightly less frequently: 87% of cash deals were subsequently completed compared with 88% of stock deals.¹⁸ The contrast between average premiums and average completion rates for cash versus stock deals is striking and is plausibly driven at least in part by their differential exposure to interim risk. We next show that ex ante market uncertainty, as measured by the VIX index, affects the terms of merger deals in ways consistent with the interim risk channel.

We proxy for market uncertainty with the average level of the VIX index over the 20 trading days prior to the deal’s announcement. This measure is available starting in January 1990, which reduces the sample to 4,911 announced deals. The level of the stock market also covaries strongly with the VIX, and has been shown to predict merger activity and deal terms (e.g., Bhagwat et al. 2016, Bonaime et al. 2018). We control for this potential confound using the cyclically adjusted price/earnings ratio (CAPE) from Robert Shiller’s website. The VIX is a relevant measure of crash risk: Among deals announced when the VIX was below its sample median, 0.6% experienced a crash, whereas among deals announced when the VIX was above its sample median, 2.9% experienced a crash ($t = 7.4$). By contrast, the stock market’s price level (CAPE) at announcement does not significantly predict the risk that a deal experiences a market crash.

Table 9 displays regressions of the terms of merger deals on the ex ante VIX and CAPE. In Column 1, we see that the VIX predicts the method of payment in mergers: A higher VIX, corresponding to higher crash risk, is associated with fewer bids paid in cash and more bids paid in stock, suggesting that cash bids are less attractive when interim risk is higher. This effect is statistically and economically significant: Using the estimate in Column 1, moving the VIX from its historical low (0.10) to its historical high (0.65) lowers the fraction of deals to be paid in cash by 15 percentage points. Column 2 shows that a higher VIX predicts a higher likelihood that a deal is announced with a definitive agreement (DA) already in place.

In addition to the method of payment and definitive agreement, market uncertainty also affects the terms of the mergers that are announced and completed.

Table 9. Variation in Interim Risk Affects the Merger Market

	(1)	(2)	(3) Announced deals			(6) Completed deals			(8)
	MajorityCash	DAinPlace	logPremium	logSize	TargetBeta	logPremium	logSize	TargetBeta	
VIX	-0.27** (0.12)	0.18** (0.09)							
CAPE	-0.62*** (0.16)	0.35*** (0.08)							
MajorityCash × VIX			0.42*** (0.11)	-2.15*** (0.48)	-0.52** (0.21)	0.46*** (0.12)	-1.85*** (0.51)	-0.58*** (0.22)	
MajorityStock × VIX			0.17 (0.12)	-1.21** (0.51)	0.65*** (0.19)	0.21 (0.13)	-0.92 (0.58)	0.72*** (0.22)	
MajorityCash × CAPE			-0.45** (0.20)	-1.41 (0.93)	-0.47 (0.40)	-0.47** (0.21)	-1.91** (0.93)	-0.77* (0.41)	
MajorityStock × CAPE			-0.32 (0.21)	1.91** (0.92)	0.87* (0.46)	-0.31 (0.23)	1.59 (0.98)	0.63 (0.48)	
Model	Logit	Logit	OLS	OLS	OLS	OLS	OLS	OLS	
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Observations	6,456	6,456	6,456	6,456	5,633	5,678	5,678	4,987	

Notes. The table displays estimates of how ex ante market volatility affects the terms of merger deals that are announced and completed. VIX is the average level of the VIX index over the month prior to announcement. CAPE is the cyclically adjusted price-earnings ratio of the U.S. market as of the day prior to announcement. The sample consists of M&A deals announced from 1990–2018. Columns 1 and 2 show logit marginal effects. Standard errors (in parentheses) are robust and clustered by target firm industry.

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

Table 9 Columns 3–5 show that a higher level of interim risk predicts a higher premium paid, a smaller average target firm size, and a lower target firm beta—for cash deals only. By contrast, all these effects are smaller or of the opposite sign for stock deals.

If the effects of interim risk on deal terms were limited to marginal deals, then we would observe lesser effects on deals that are ultimately completed. Table 9 Columns 6–8 show that this is not the case: In fact, the effects on completed deals are similar or even larger, suggesting that the effects of interim risk on merger activity are pervasive.

These patterns are also evident in the broad cross-section of merger activity. In months when the VIX was below its sample median, 59% of announced deals were majority-cash and the average cash deal paid a premium of 35% to acquire a target with a market beta of 1.00. By contrast, in months when the VIX was above its sample median, 47% of deals were majority-cash and the average cash deal paid an premium of 44% to acquire a target with a market beta of 0.77. Thus, in months when interim risk was high ex ante, cash deals were less popular and cash acquirors paid a higher average premium to acquire targets with a lower average beta. These patterns are consistent with our results on the interim risk of merger cancellation and its dependence on the method of payment.

The results in Table 9 are based on variation in the level of the VIX prior to announcement, and so they are less cleanly identified than our prior results. That is, there are other ways in which high-VIX and low-

VIX environments differ from one another that could explain the results in this section. However, the results are consistent with our proposed mechanism of interim risk. First, the effects of the VIX are significant and consistent for cash deals only, and are smaller or opposite in sign for stock deals. Second, these results hold after controlling for the documented effects of the stock market's price level. Thus, we view these results as novel stylized facts that are, at a minimum, consistent with our proposed interim risk mechanism.¹⁹

Our results build on those of Bhagwat et al. (2016), who find that increases in the VIX predict lower levels of merger activity. A higher VIX forecasts a higher risk of a market crash, and we show that market crashes have significant effects on cash deals without a definitive agreement in place, consistent with our proposed mechanism. We show that firms appear to incorporate the ex ante level of interim risk in their choice of the method of payment, the terms of the deal, and even the types of firms that are targeted for acquisition.

6. Conclusion

This paper documents that interim risk—the risk of ex post cancellation—of large M&A deals varies asymmetrically with the aggregate stock market. Specifically, a market crash, defined as the market being down 10% or more from its level on the announcement day, increases the likelihood of a merger deal being cancelled. This effect is conditional on both the method of payment and the contracting stage of the

merger process. In summary, merger deals to be paid in cash are renegotiated upward but cancelled downward, while deals to be paid in stock are unaffected.

Importantly, the results cannot be explained by established factors in the merger literature such as ex ante information asymmetry or mispricing. The evidence suggests that a crash in the aggregate stock market lowers the forecasted value to be realized from the deal. In an efficient market, the acquirer's stock price incorporates changes in the expected acquisition value. Thus, a cash bid is effectively a fixed-price forward contract on the target firm, whereas a stock bid is a floating-price contract. Relative to a stock deal, a cash deal allocates the risk of ex post changes in deal value to the acquirer firm, but creates the risk that the acquirer will walk away when the market crashes.

The risk of cancellation disappears after the definitive agreement—the legal agreement that specifies the details of the merger and hardens it to renegotiation—is signed. This result suggests that frictions between the target and acquirer firm with regards to renegotiation, plus a downward revision to the expected deal value, are a lethal combination that causes merger agreements to fall through. These findings are in line with the recent theoretical literature on incomplete contracts and strategic default (Hart and Moore 2008, Hart and Holmstrom 2010).

Consistent with the interim risk mechanism, we find that the ex ante VIX index affects not only the level of deal activity, as shown by Bhagwat et al. (2016), but also the method of payment and other deal terms. When the VIX is higher, the frequency of deals to be paid in cash is lower, and the cash deals that are announced pay a higher premium, are smaller in size, and target firms with a lower market beta. These results hold after controlling for the documented effects of the stock market's level on deal activity, and suggest that interim risk affects the market for corporate control—both deal terms ex ante and deal outcomes ex post.

These results can be extended in several directions. First, our hypothesis is that acquirors incorporate a cushion into the offer price to account for interim risk, and specifically for mergers with a fixed (cash) price. Examining the determinants of that cushion could yield insights into the division of expected value in mergers between the acquirer and target firm. Also, there is nothing economically or legally special about the 10% threshold, although it is the common media definition of a market correction. In our setting, the precise treatment threshold is not tightly identified, and we obtain similar results with different thresholds. Where the true threshold lies, and whether it varies with deal characteristics or environment (e.g., is the threshold deeper for deals with a larger expected

surplus or higher costs of termination), is left to future research. Finally, market crashes as unpredictable events that are material to merger completion could be useful to causal inference.

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Endnotes

¹ Representative papers are Harford (2005), Rhodes-Kropf et al. (2005), and Bhagwat et al. (2016).

² See Bouwman et al. (2007).

³ See “More than \$100B of M&A deals terminated amid ‘new world order’ of COVID-19,” *S&P Global Market Intelligence*, June 25, 2020.

⁴ Eckbo et al. (2018) make this point in the context of optimal takeover bidding.

⁵ In principle, an acquirer and target could simply index a cash deal's price to the market return. Halonen-Akatwijuka and Hart (2013) examine why most contracts do not include features such as inflation adjustments in employment contracts. They argue that including such features makes negotiating other noncontractible features more difficult.

⁶ Representative papers include Hansen (1987), Fishman (1989), Eckbo and Langohr (1989), Shleifer and Vishny (2003), Boone et al. (2014), and Gorbenko and Malenko (2017). Other factors include taxes and agency costs.

⁷ As a check that reverse causality is ruled out, in the online appendix, we compute the market return after removing the target and acquirer firms' industries, and find the same results.

⁸ Upon signing a definitive agreement, the merging parties are required by Rule 10b-5 of the U.S. Securities Act to announce the merger publicly. In other cases, the parties are required to disclose that they are in negotiations to merge before the DA is signed.

⁹ Note that allowing the parties to renegotiate other features of the deal such as the method of payment does not change these predictions, because after the market crash has occurred, the reference point for negotiations has already been set (Hart 2009). In practice, it is rare for features other than the price per share to change during the interim period. We analyze revisions to the price in Section 4.4.

¹⁰ Representative survey articles include Andrade et al. (2001), Betton et al. (2008), and Mulherin et al. (2017).

¹¹ More than half (56%) of target firms whose acquisition was cancelled after a market crash were acquired within the next 5 years; however, only 3% of those subsequent acquisitions were by the original bidder. In other words, the original merger deal was almost never revived.

¹² The number of observations of 2,731 and 4,207 in Columns 4 and 5, respectively, do not add up to the number of observations of 7,341

in Columns 1–3. This difference is because a few deals include other considerations and are neither majority-cash nor majority-stock.

¹³ In their Table V, Mitchell and Pulvino (2001) estimate a probit model of the probability of deal failure where one of the independent variables reflects a severe market downturn. Defining deal failure as when an arbitrageur loses money on the position, they document that severe market downturns increase the probability of deal failure.

¹⁴ Among deals without a definitive agreement (DA) in place at announcement, the median time to signing the DA is 36 calendar days.

¹⁵ In unreported tests (available on request), we examined other features of stock deals such as equity collars (Officer 2004) and the necessity of a shareholder vote (Li et al. 2018), and find these features do not explain our conclusions.

¹⁶ In the online appendix, we present additional tests that support these conclusions: (i) we rerun our main estimates controlling for deal characteristics and macroeconomic conditions, and find similar results; (ii) we find suggestive evidence that the effect of market crashes within mixed-payment deals depends on the fraction paid in cash; (iii) we find suggestive evidence that market crashes have an effect on the completion of stock deals by acquirors with a low market beta.

¹⁷ We thank Jarrad Harford for suggesting this test.

¹⁸ This pattern is also true conditional on deal attitude: 88% of friendly cash deals are subsequently completed compared with 89% of friendly stock deals.

¹⁹ In the online appendix, we examine the implications of these facts for our main findings, specifically the possibility that the variation of merger activity and deal terms with the VIX and CAPE could lead to selection bias in treatment status or in sample composition. The results suggest that selection bias is not a major factor.

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