Fire-Sale Acquisitions and Intra-Industry Contagion

Seungjoon Oh*

Peking University HSBC Business School

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Abstract

This paper presents empirical evidence on the combined effects of target firm distress and industry-level illiquidity on acquisition outcomes and industry-specific contagion. When the target industry is in distress, I find that the fire-sale effects cause distressed targets to be sold to industry outsiders at discounts and acquirers to gain higher return by exploiting targets weakened bargaining power. These findings are stronger for targets with high industry asset-specificity in capital, labor and technology. I also find that target rivals earn negative abnormal stock return due to negative information from fire-sale acquisitions.

Keywords: Mergers and acquisition, Fire-sale, Contagion, Financial distress, Asset-specificity

JEL Classification: G30, G34, C70

1 Introduction

Efficient reallocation of production inputs enables the economy to increase aggregate productivity and facilitates recovery from industry- and economy-wide recession. However, frictions due to information asymmetry reduce asset liquidity, thereby distorting reallocation (Shleifer and Vishny (1992) and Eisfeldt and Rampini (2006)). The fire-sale is a central mechanism through which asset redeployment becomes more costly in response to negative economic shocks, and thus those shocks are amplified (Shleifer and Vishny (2011)).

A fire-sale is an urgent sale of assets in an illiquid market. Fire-sale acquisitions, although they account for a significant proportion of asset reallocation,[1] have received little academic attention relative to the widely documented existence of fire-sale discounts in real asset transactions. Acquisitions differ from asset markets in a number of important ways. For example, labor and patented R&D are considered to be transferred with the change in ownership in acquisitions. Acquisitions also have a unique advantage with respect to identifying the channel of a fire sale, buyer identity and return being readily observable in contrast to the limited availability of data in real asset transactions. The goal of this paper is therefore to examine fire-sale effects in distressed target acquisitions by identifying the detailed channel of the discount and the intra-industry contagion effects to which it gives rise.

The essential condition for a fire-sale is a seller's financial constraint. Firms that face a severe liquidity constraint may be forced to sell some or all of their assets to avoid bankruptcy. Thus, distressed acquisitions play an important role as a restructuring mechanism. In an imperfect world, however, negative economic shocks can cause asset prices to fall below their fair market values. Shleifer and Vishny (1992) propose a theory in which industry insiders with higher valuation on a distressed firm's assets are financially constrained and sidelined due to financial

[1] See Figure 1.

frictions, while an industry outsider with high liquidity and a lower valuation can acquire assets at a lower bid. This model implies that demand-side frictions in an illiquid market create additional costs in urgent asset sales.

Empirically, calculating the fair market value of distressed targets in an illiquid market and examining fire-sale discounts in acquisitions are challenging for two reasons. First, a target's offer price reflects both fire-sale effects and the decline of the economic worth of its assets. Second, it is important to consider the creation and division of synergies. To circumvent the first identification problem, I estimate the combined effects of target firm- and industry-level distress on acquirer abnormal returns and offer price after controlling for the determinants of the economic worth of assets. More importantly, I examine the interaction effects of fire-sale and industry-level asset-specificity with which fire-sale effects are expected to be stronger, while a pure decline in economic worth of assets is less associated. Then, I address the second problem by decomposing the offer price into synergy and the target's bargaining power and analyzing these elements separately to identify the source of the discount.

Focusing on acquisitions between public firms that occurred between 1980 and 2010, I identify fire-sale acquisitions where both target industries and the targets themselves were distressed at the announcement. I find that acquirers in fire-sale acquisitions earn higher cumulative announcement returns relative to other acquirers over the -1 to +1 day window after controlling for other factors. I further confirm this result using buy-and-hold abnormal returns (BHARs) during the two years following the acquisitions. This directly supports fire-sale discounts in acquisitions because acquirers' return should be unaffected by target firm- and industry-level distress if acquirers pay the fair market value of a target.

I then analyze the source of this discount by examining the interaction effect of a target firm- and industry-level distress, separately, on offer price, synergy, and target's bargaining power. I find that a distressed target in a distressed industry, or fire-sale target, is acquired at 14% discount compared to distressed targets in non-distressed industries. More specifically, the channel of fire-sale proposed by Shleifer and Vishny's model implies that fire-sales are inefficient and exhibit lower synergy. In testing this, I also consider whether target firm- and industry-level distress negatively affects a target's bargaining power, thereby inducing a fire-sale discount that results in greater gains to buyers. I find that while the target's bargaining power, measured as the difference in announcement returns between target and acquirer, is substantially weakened, synergy is insignificantly affected, by the interaction effect of firm- and industry-level distress. These results suggest that observable fire-sale discounts are caused largely by wealth transfer to acquirers.

Next, I investigate whether target firm- and industry-level distress affect a buyer's identity and whether they drive stronger fire-sale effects if acquirers are outside the industry. Consistent with the model predictions, the results show that industry-wide distress increases the likelihood of targets being sold to industry outsiders by 20 percentage points and the fire-sale effects on acquirer abnormal returns, offer price, and target's bargaining power are even stronger if targets are sold to acquirers outside an industry. Particularly, I also find a both economically and statistically significant decrease in total synergy gain conditional on industry outside acquirers, which implies a deadweight loss from inefficient fire-sales.

To further demonstrate that the findings are driven by the fire-sale channel, I examine the interaction effects of combined distress of target firm and industry and high asset-specificity in three dimensions —capital-specificity, labor union, and R&D intensity— in which the fire-sale effects are expected to be stronger. The Shleifer and Vishny model suggests that fire-sale effects are stronger if targets' assets are specialized to their industry and, thus, not easily redeployable to industry outsiders. I show that the fire-sale effects are particularly strong for targets with high industry-specific assets. Specific capital, strong labor unions, and high R&D intensity in target industries strengthen the fire-sale effects by driving up frictions in asset allocation across industries. These findings provide evidence that a significant fire-sale discount exists, in a manner that is consistent with the industry-equilibrium theory of Shleifer and Vishny. Multiple robustness checks also show that the results are not driven by stock market undervaluation or macroeconomic recession effects. Overall, using these multiple complementary approaches, this paper disentangles the fire-sale effects from declines in fundamental value and demonstrates the channel of the fire-sale effects in acquisitions.

Finally, I relate fire-sale acquisitions to target industry rivals' stock returns. The relevant literature highlights contagious effects that economic shocks can transmit through the fire-sale. Fire-sale acquisitions could have a negative information externality by providing lower reference prices to subsequent acquisitions coming to market, or have a negative "out-of-play effect[2]" by reducing potential for an acquisition partner among industry. I find that industry rivals of fire-sale targets experience economically and statistically significant negative abnormal stock returns. The stock price of industry rivals drops upon announcement of fire-sale acquisitions, on average, by 1-4% over the -1 to +1 day window after controlling for other factors. The effect of fire-sale acquisitions on rivals' returns is stronger in high R&D industries where are likely to have high information asymmetry. This evidence supports the view that fire-sale acquisitions contribute to an intra-industry contagion of economic shocks by conveying negative information.

This paper contributes to the literature in several important ways. By providing new evidence on fire-sales in the corporate control market, this paper expands on previous research on fire-sales.[3] Pulvino (1998) provides the first empirical evidence

[2]Banerjee and Eckard (1998), Fridolfsson and Stennek (2005), and Campbell et al. (2011)

[3]Shleifer and Vishny (1992), Pulvino (1998), Aguiar and Gopinath (2005), Coval and Stafford (2007), Officer (2007), Bharath and Shumway (2008), Eckbo and Thorburn (2008), Campbell et al. (2011), Ang and Mauck (2011), Kim (2012), Meier and Servaes (2014) and Shleifer and Vishny (2011). See Shleifer and Vishny (2011)

of fire-sale effects on real assets by studying prices of used airplanes, and Campbell et al. (2011) examine foreclosure discounts from forced home sales. Considerable research also documents the fire-sale of financial assets (e.g., Shleifer and Vishny (1997), Coval and Stafford (2007), and Rajan and Ramcharan (2013)). In contrast to asset sales in real asset or financial markets, buyers in acquisitions should consider such factors as labor continuation, technology transfer, successor liabilities, and control premium. I add to this literature by expanding the notion of resource reallocation beyond physical capital to general assets including labor and technology. These findings provide a better understanding of how frictions negatively influence efficient resource allocation during industry- and economy-wide distress.

This paper is closely related to previous studies that analyze how targets' financial constraints affect acquisition outcomes.[4] Evidence on fire-sale acquisitions is mixed, however, and confounded in the literature by the empirical challenge of calculating the fundamental value of a target. My examination of fire sales in acquisitions takes account of the combined effects of target and target industry-wide distress as well as cross-sectional differences in asset-specificity. Furthermore, my comprehensive analysis of buyer identity, return, synergy, and bargaining power provides clear evidence of fire-sale effects in acquisition markets, and identifies the channel of inefficient asset reallocation during downturns.

This paper also suggests implications of widespread concerns about industry contagion effects resulting from fire-sales. The existence of negative spillover effects in asset fire-sales has been acknowledged in many papers.[5] Although fire sales

for a survey of the research on fire-sale.

[4]Officer (2007) shows that financially constrained unlisted private targets are acquired at lower multiples than public targets are. Eckbo and Thorburn (2008), on the other hand, examining the acquisition outcomes of automatic bankruptcy auctions in Sweden, find insignificant discounts for going-concern sales. Ang and Mauck (2011) investigate the acquisition outcomes of distressed firms in crises and suggest the weak evidence of fire-sale discounts in acquisitions. Concurrently developed working papers by Kim (2012) and Meier and Servaes (2014) highlight lower target premium and higher acquirer abnormal return in distressed target acquisitions, respectively.

[5]Kiyotaki and Moore (1997) propose a macroeconomic model in which shocks can turn into systemic risk through the lowering of collateral value. Campbell et al. (2011) show that foreclosures due to default or death

have been shown to be a central channel that amplifies economic shocks, little empirical evidence exists on the relation between fire-sale acquisitions and industry rivals' returns. If such a relation exists, it could be argued that fire-sale acquisition contributes to the contagion of economic shocks rather than the efficient reallocation of excess capacity. This paper shows that fire-sale acquisition has a negative contagious effect within an industry, even in corporate-level transactions.

The remainder of this paper is organized as follows. In Section 2, I develop hypotheses and discuss the related literature. In Section 3, I describe sample selection and variable construction, and present summary statistics. Effects of fire-sale on acquisition outcomes are examined in Section 4, which also reports the results of robustness checks. In Section 5, I investigate the impact of fire-sale acquisition on industry rivals. Section 6 concludes.

2 Hypothesis Development

The primary goal of this study is to address two questions: (1) whether firm- and industry-level distress cause firms to be sold at discounts due to a fire-sale effect, and (2) how fire-sale acquisitions affect a target's industry rivals. In this section, I discuss the prior literature related to these questions, and develop hypotheses that guide the empirical analysis.

2.1 Fire-Sale in Acquisitions

Distressed firms may face a severe liquidity constraint because they hold insufficient cash to meet debt obligations and have difficulties in raising capital. They can sell either some or all of their assets to generate cash needed to make debt payments, or attempt to renegotiate with creditors in order to restructure debt contracts. In

result in the lowering of other local house prices. Benmelech and Bergman (2011) also examine the spillover effects of the sale of a bankrupt aircraft company on its rivals' collateral value and increased external financing cost. See also Allen and Gale (2000), Oh (2012), and Hertzel and Officer (2012).

a perfect world, the resolution of firm distress is costless. An absence of friction in renegotiating debt contracts would prevent the premature liquidation of assets. Even in times of industry distress, targets can sell assets at fair market value.

In the real world, however, high financial distress costs may be incurred. Debt renegotiation often fails due to such frictions as information asymmetry between a debtor and its creditors, or holdout problems among creditors (Brown (1989), Gertner and Scharfstein (1991), and Asquith et al. (1994)). Distressed firms may be forced to sell their assets or control rights, or to go through a formal legal proceeding such as Chapter 11 bankruptcy. However, asset restructuring involves a liquidation cost that depends on market liquidity which, in turn, is determined by the credit constraints of peer firms and asset redeployability. Shleifer and Vishny (1992) propose theoretical implications of how financial constraints in an industry give rise to a price that drops below an asset's revised economic value, a condition known as a fire-sale.

Because the subjects of asset sales are fairly specialized within industries, the first-best buyers are usually industry insiders that have invested in knowledge of, and managed, similar assets. However, industry insiders are likely to be financially constrained at the same time, if a negative shock is industry-wide. Therefore, the first-best buyer with the highest valuation of a distressed firm's assets is often sidelined due to financial frictions and industry-wide debt overhang (Myers (1977), and Clayton and Ravid (2002)). As a result, demand in the secondary asset market drops further, so distressed targets in a distressed industry, or fire-sale targets, are likely to be acquired at discounts. Applying this industry-equilibrium theory of Shleifer and Vishny to distressed target acquisition, I also expect that distressed targets in a distressed industry are more likely to be sold to industry outsiders relative to comparable distressed targets in a non-distressed industry, and I expect fire-sale targets acquired by industry outsiders to experience further discount.

The Shleifer and Vishny model focuses on a demand-side channel that predicts inefficient sales to industry outsiders with high liquidity but lower synergy. I also consider whether fire-sale is attributed to greater distribution of total gains to buyers. Given that intense negotiations are required to set an acquisition's price, target firm- and industry-level distress may affect the sharing rule.[6] Target firm-level distress is expected to negatively affect a target's bargaining power by increasing cost of delay or discount rate relative to the acquirer's. In addition, the fact that more sellers with similar assets are competing in the secondary market during an industry downturn increases a target's impatience at the negotiation table.

The next hypothesis relates the fire-sale effect to cross-sectional differences in asset-specificity. The key underlying condition of asset illiquidity during an industry downturn is that assets are specialized, and can thus be fully utilized only by industry insiders with sufficient accumulated knowledge and investment to generate the highest value from them. Therefore, when assets are highly industry specific, the inefficient sale or wealth transfer incurred by demand-side constraints in a fire-sale becomes more severe because industry outsiders, who are unable to make the best use of them, have a lower reservation value on the assets. I consider a simple Cobb-Douglas production function: a firm uses three factors —capital, labor, and technology— to produce output. The hypotheses that follow are that the fire-sale effects in acquisition should be stronger in industries with high capital-specificity, strong labor unions, and high R&D intensity. These characteristics increase the friction in asset allocation across industries, and thus make the distressed targets less redeployable.

[6]The bargaining theory literature provides a rationale for this hypothesis (Nash (1950), Rubinstein (1982), Binmore et al. (1986), and Gul (1989)). A large body of literature suggests that two sources of impatience determine relative bargaining outcomes. The first is the relative cost of delay from discounting the future (Rubinstein (1982)) and the second, which views acquisition as a multiplayer bargaining game, is the desire to be the first to realize gains from a transaction (Gul (1989), and Rhodes-Kropf and Robinson (2008)).

2.2 Intra-Industry Contagion Effect

Having established the existence of fire-sale effects in acquisitions, I extend current research a step further by examining an industry-specific contagion effect from fire-sale acquisitions. The fire-sale effects can be contagious to a target's industry rivals.

Prior literature documents that acquisitions can affect a target's industry rivals by revealing new information about the value of industry assets.[7] Fire-sale prices can pull down the prices of subsequent acquisitions coming to market by providing a lower reference price (*negative information hypothesis*), as Campbell et al. (2011) proposed in housing markets. This negative information externality can be socially inefficient because it may cause firms selling assets in distressed industries to play a non-cooperative game. The possibility that updated information from other targets might further discount the option value to waiting may lead them to be inefficiently urgent to sell their assets ahead of others.[8]

The fire-sale acquisitions are also likely to have negative "out-of-play effects" for a target's industry rivals (Banerjee and Eckard (1998), and Fridolfsson and Stennek (2005)). Given that the number of capable buyers is limited during an industry downturn, announcements of acquisitions reduce the potential partners and the market's expectation that a rival will be acquired (Akdogu (2011), and Molnar (2007)).

Previous studies suggest that acquisitions, distinct from the *negative information hypothesis*, have implications for industry rivals in terms of changing product market dynamics. Eckbo (1983) proposes that acquirers gain competitive advantage from productivity improvements in operating, marketing, distribution, or purchasing ac-

[7] Eckbo (1983), Eckbo and Wier (1985), Song and Walkling (2000), Fee and Thomas (2004), and Shahrur (2005)

[8] Contestants compete by escaping first in this game, in contrast to the famous game theory model, *war of attrition*, in which contestants compete by persisting with accumulating costs over time.

tivities, and the resulting intense product market competition harms industry rivals (*intense competition hypothesis*). Recent studies by Fee and Thomas (2004) and Shahrur (2005) support this hypothesis based on evidence from horizontal mergers. This hypothesis predicts a negative stock return for industry rivals from diminished post-acquisition operating performance.

Alternatively, acquisitions can benefit industry rivals by increasing the likelihood of anticompetitive collusion (Stigler (1964), Eckbo (1983), Kim and Singal (1993) and Fee and Thomas (2004)). Stigler (1964) proposes that acquiring firms can use their increased market power to collude with rivals in order to reduce output to monopoly levels and raise prices at the expense of consumers. If anticompetitive acquisition is loosely governed by antitrust laws during industry downturns, monopolistic collusion is likely to motivate acquisitions (*market power hypothesis*). Under this hypothesis, I expect rival firms to have positive stock returns at the announcement of a fire-sale acquisition, and improved operating performance to follow.[9]

3 Data and Methodology

3.1 Sample Construction

The sample of mergers is from the Securities Data Company's (SDC) U.S. Mergers and Acquisitions Database. This paper employs all completed mergers between U.S. non-bankrupt public targets and U.S. public bidders during the period 1980-2010. I require acquiring firms to control less than 50% of the shares of target firms before the announcement, and the equity value of target firms to be greater than one million dollars. Both acquirers and targets must be public firms listed on the Center for Research in Security Prices (CRSP) and Compustat databases

[9] Other externalities from fire-sale acquisitions may exist in the agency and labor market channels. Substantial discounts in fire-sale acquisitions perhaps convey a warning to shareholders and managers of industry rivals that results in intensified monitoring and reduces agency costs in general. Moreover, distressed acquisitions that entail intense restructuring and worker layoffs will affect labor-related decisions of targets' rivals. These, however, are beyond the scope of this paper and remain for future research.

during the event window. I further eliminate firms in a financial industry (SIC: 6000 - 6999) and utilities (SIC: 4900 - 4999), using their primary SIC code.

3.2 Identifying Fire-Sale Acquisitions

The Shleifer and Vishny model theoretically identifies firm distress combining with industry-wide distress as a set of necessary conditions for a fire-sale to occur. Following this model, acquisitions are defined as fire-sale acquisitions when both target industries and targets themselves are distressed at the announcement. The interaction variable of target firm- and industry-level distress is termed *Fire-Sale*. The variable constructions for firm- and industry-level distress are as follows.

3.2.1 Measures of Target Distress

To identify the distressed target mergers within the sample, I use two measures of firm distress widely employed in the literature. The first measure is based on the KMV-Merton model that provides a distance measure between expected asset value and the default threshold based on an option-pricing model (Merton (1974)). This model calculates default risk by considering equity as a call option on firm value and debt as a strike price. This measure is widely used in the literature (e.g., Committee (1999), Vassalou and Xing (2004), and Chava and Purnanandam (2010)), and its predictive power has been verified by many studies (e.g., Bharath and Shumway (2008), and Duffie et al. (2007)). Following Bharath and Shumway (2008), I construct expected default frequency (EDF) for each target from the distance to default. I call this continuous variable $Distress1_T$. The estimation process is detailed in Appendix A.

The second measure $Distress2_T$, following Pulvino (1998), defines a target as distressed if its leverage ratio is greater, and its current ratio (current assets/current liabilities) less, than the industry median. This measure implies that distressed targets face both short- and long-term financial constraints. I define a firm's industry as the set of firms with the same 3-digit SIC code.

3.2.2 Proxy for Industry Distress

The measure used in this paper for target industry distress should capture the degree of distress of a target's peer firms as a whole. I define an industry as distressed if its median firm's sales growth is negative in the year of acquisition. A firm's industry is defined as the set of firms with the same 3-digit SIC code. The target firms are excluded from the calculation of industry variables. This dummy variable is termed $Ind.Distress_T$.

Additionally, I construct, as a robusteness check, alternative measures of industry distress 1) if median sales growth is lower than -1% ($Ind.Distress2_T$), and 2) if median sales growth is negative for two consecutive years ($Ind.Distress3_T$). I report the main results of this paper based on the primary measure $Ind.Distress_T$. The results with alternative industry distress measures are reported in Appendix Table A.9. The results are qualitatively robust.[10]

3.3 Control Variables

In order to compare acquisition outcomes over different degrees of target firm- and industry-level distress, I control for other characteristics that may potentially drive the results. Control variables used in this study include target, acquirer, and deal and industry characteristics as well as year and industry fixed-effects. Firm- and industry-level proxies for future profitability and growth options are included to account for drops in the economic worth of assets. For the industry level, I add

[10] Following previous literature (e.g., Gilson et al. (1990); Opler and Titman (1994); Acharya et al. (2007); and Ang and Mauck (2011)), I also attempt to use as a measure of industry distress the negative industry median net income of all firms in an industry. Median net income appears to be a poor measure of industry distress, however, because of cross-industry variation in average net income levels. Negative net income for a substantial portion of high-tech industry firms in the public stock market does not necessarily mean that the high-tech industry is distressed.

median industry Q, defined as the ratio of market value of asset (estimated as book value of total asset - book value of equity + market value of equity) to book value of asset. For the firm level, I include target *profitability* (profit margin: the ratio of operating income before depreciation (*OIBDP*) divided by total sales) and target market-to-book ratio.

Other firm characteristics considered in the specification include *size*, defined as the natural log of market value of equity 4 weeks before the announcement, *leverage*, defined as the ratio of debt (current debt plus long-term debt) to book value of assets, and *tangibility*, defined as the PP&E scaled by total book value of assets. *Median industry leverage* is defined as the 3-digit SIC-level median leverage ratio. Major deal characteristics suggested in the previous literature are also considered. Deal specific controls include *same industry*, *all cash payment*, *all stock payment*, *tender offer*, *toehold*, *competing*, *poison pill*, and *termination fee*. All variables are defined further in Table 1.

3.4 Summary Statistics

Table 2 presents summary statistics of key variables used in this study. Panel A of Table 2 identifies targets' pre-merger characteristics. The mean and median of $Distress1_T$, firm default risk EDF, is 0.112 and 0.001 with standard deviation of 0.228. This variable shows high positive skewness. Of 1615 acquisitions in the sample, 982 targets have lower than 1% EDF at the announcement of acquisition. Panel B presents the acquirers' characteristics. It shows that the acquirers, on average, have lower default risk than targets while having larger size, higher Q, and higher profitability.

Panel C of Table 2 reports the major deal characteristics of the acquisition sample. The mean (median) premium based on targets' four weeks before the announcement is 50% (38%). The relative size between target and acquirer is, on average, 0.84. Tender offers account for 25% of total acquisitions, and acquirers hold, on average, 3% of a target's shares before acquisition. Acquirers are less likely to use cash for payment, in the distressed target acquisition sample. Lastly, 54% of acquisitions occur in the same industry. Panel D presents the major acquisition outcomes of the sample. The mean and median of acquirer return CAR_A is -1% and -0.7%, respectively. The positive mean of $CAR_{Combined}$ indicates that acquisitions create value on average. However, target bargaining measure $Bargain_T$ shows that targets capture the lions share of acquisition gains. Panel E reports the summary statistics for matched target industry rivals.

4 Fire-Sale Effects on Acquisition Outcomes

I employ multiple empirical approaches to examine fire-sale effects from a target's firm- and industry-level distress and identify a channel for the effects. First, I estimate the combined effect of target firm- and industry-level distress on acquirers' abnormal returns. Under the null hypothesis, acquirers' return should be unaffected by target firm- and industry-level distress. I assess whether distressed targets in a distressed industry are sold at discounts by comparing acquirers' abnormal returns between fire-sale acquisitions and other acquisitions. Second, I estimate the fire-sale effects on offer price after controlling for industry-median Q, firm Q and the firm profitability measure. These firm- and industry-level growth option and profitability measures control for the decline in the economic worth of target assets by capturing future growth prospects of the assets. Then, I examine whether fire-sale affects synergy or target bargaining power by decomposing the offer price and analyzing each component separately. Fourth, I test whether target firm- and industry-level distress affect buyer's identity and whether they drive stronger fire-sale effects if acquirers are outside the industry. Finally, to demonstrate that the findings are driven by the fire-sale channel, I estimate cross-sectional regressions using industry asset-specificity in three dimensions: capital-specificity, labor union, and R&D intensity. This empirical design enables me to disentangle the fire-sale effects from the decline in economic worth and identify the channel of the fire-sale effects.

4.1 Acquirer Return in Fire-Sale Acquisitions

The first test relates the fire-sale effect to acquirers' return. To provide support for the proposed fire-sale channel in which firm- and industry-wide distress combine to force the sale of a target at a discount, I compare acquirers' abnormal return between fire-sale targets and distressed targets in a non-distressed industry. Following Shleifer and Vishny (1992), I define fire-sale acquisitions as when both target industry and target are distressed at the time of the deal announcement. The interaction term of target distress ($Distress_T$) and target industry distress ($Ind.Distress_T$) is termed *Fire-Sale*.

As shown in Figure 2, I begin by plotting the evolution of the cumulative abnormal returns of acquirers from 20 days before to 200 days after announcement of the acquisition. Abnormal returns are calculated as the acquirer's return minus a value-weighted market index. The figure shows that cumulative abnormal returns of acquirers in fire-sale acquisitions lie well above other acquisitions throughout the 200 days following the acquisition announcements. The graph implies that acquirers of distressed targets in distressed industries earn higher abnormal returns compared to other acquirers, which suggests that targets in distressed industries are sold at a discount.

Because this figure does not control for other variables that might be driving the differences in acquirer returns, I also examine the fire-sale effects on acquirers' short-term and long-term returns using a regression analysis. The short-term return is estimated as the acquirer's three-day cumulative abnormal return (CAR) at announcement of the acquisition, using the standard method of Bradley et al. (1988).[11] I also estimate acquirers' buy-and-hold abnormal returns (BHAR), which is a commonly used measure of long-term abnormal performance[12], of fire-sale acquisitions and those of other acquisitions. I use a two-year window for the long-term performance analysis to reduce potential noise from overlapping events that can influence performance.[13] I define BHAR as follows.

$$\text{BHAR}_{i,t} = \prod_{j=1}^{T_i}(1 + r_{i,t+j}) - \prod_{j=1}^{T_i}(1 + r_{\text{Matched firm}_{t+j}}) \tag{1}$$

where $r_{i,t}$ denotes the return to stock i over month t and T_i is the holding period for stock i (2 years or the time until delisting or the occurrence of a new acquisition, whichever comes first).[14]

I expect a strong positive coefficient on the interaction term of target's firm- and industry-level distress for the following specification:

$$CAR^A_{ijdt} = \beta_1(\underbrace{Ind.D_{it} \times Distress_{it}}_{\text{Fire-Sale}}) + \beta_2 Ind.D_{it} + \beta_3 Distress_{it} + \gamma' X_{ijd} + \alpha_t + \alpha_i + \varepsilon_{ijdt} \tag{2}$$

$$BHAR^A_{ijdt} = \beta_1(\underbrace{Ind.D_{it} \times Distress_{it}}_{\text{Fire-Sale}}) + \beta_2 Ind.D_{it} + \beta_3 Distress_{it} + \gamma' X_{ijd} + \alpha_t + \alpha_i + \varepsilon_{ijdt} \tag{3}$$

where CAR^A_{ijdt} is the acquirer's three-day cumulative abnormal return (CAR) at announcement of acquisitions, estimated using a market model. $BHAR^A_{ijdt}$ is an acquirer buy-and-hold return during two years following acquisition announcement less a buy-and-hold return of the matched firm, $Distress_{it}$ and $Ind.D_{it}$ are the target firm and industry distress measures, respectively, of target i in year t , and

[11] I use the Fama-French three-factor model with 240 daily returns covering (-300, -60) to estimate parameters for each acquirer.

[12] Barber and Lyon (1997), Kothari and Warner (1997), and Lyon et al. (1999).

[13] I estimate these results based on the 3- and 5-year window following the announcement date and find robust results.

[14] Matched firms are selected based on the following procedures. 1) Select all CRSP-listed companies at the end of the year prior to the year of the acquisition and companies not in the sample of acquisitions for a period of three years prior to the announcement date. 2) Select the subset of firms with total book asset values within ±30% of the total book asset values of the acquiring firm. 3) Rank the subset based on market-to-book ratio. 4) Choose the firm with the closest market-to-book ratio. 5) Matched firms are included for the full two-year holding period or until they are delisted, whichever occurs first.

X_{ijd} represents control variables for target i, acquirer j, and deal characteristics d. Year fixed effects (α_t) and industry fixed effects (α_i) are also included. Control variables are as follows.

$$X_{ijd} = \begin{cases} \text{Target \& Acquirer: Size, M/B, Leverage, Profitability, Tangibility} \\ \text{Deal: Same industry, Cash/Stock deal, Tender offer, Toehold, Competing, Term. Fee} \\ \text{Target Industry: Med. industry Q, Med. industry Leverage} \end{cases}$$

The variable of interest is *Fire-Sale*, the interaction between target firm- and industry-level distress. *Fire-Sale*$_1$ is the interaction between the continuous measure of target distress based on the distance-to-default model, $Distress1_T$ and $Ind.Distress_T$. *Fire-Sale*$_2$ is the interaction between the dummy measure, $Distress2_T$ and $Ind.Distress_T$. I expect all of these interaction effects to be positive.

Columns (1) and (2) in Table 3 present the results of examining the fire-sale effects on acquirers' cumulative abnormal returns at announcement (-1, +1). It shows that acquirers earn economically and statistically higher returns in fire-sale acquisitions. The economic magnitude of this effect is 2.5 percentage points based on the coefficient of *Fire-Sale*$_1$ and a one standard deviation increase in $Distress1_T$[15], and 5 percentage points based on the coefficient of *Fire-Sale*$_2$. The coefficients are statistically significant at the 1% level. I also find positive coefficients on the fire-sale effect in Models (3) and (4). In Model (3), the coefficient implies that acquirer buy-and-hold abnormal returns are 23.5 percentage points higher in distressed industries with a one standard deviation increase in $Distress1_T$. This directly supports fire-sale discount in acquisitions because acquirers' return should be unaffected by target firm- and industry-level distress if they pay the fair market value of a target.[16]

[15] The standard deviation of $Distress1_T$ is 0.228 in Table 2. The economic magnitude can be calculated by 0.11*0.228 = 2.5%

[16] I report, as a robustness check, coefficient estimates from quantile regressions (25th, median, and 75th) on acquirer abnormal returns in Appendix Table A.1. While the coefficients vary across quantiles, the results show that the relationship between acquirer returns and fire-sale is robust at different points in the conditional

4.2 Fire-Sale Discount: *Inefficient Sales or Wealth Transfer?*

The previous results show that acquirers earn higher returns from fire-sale acquisitions. To provide evidence of a specific source for these higher returns, I estimate the combined effect of firm- and industry-level distress on offer price after controlling for firm- and industry-level investment opportunity measures. Then, I decompose offer price into synergy and target's bargaining power, and quantify the fire-sale effects on the components of division of gains separately.

$$P_{ij} = V_i + \underbrace{S_{ij} * \omega_{ij}^T}_{\text{Division of Gains}}$$

where

$P_{ij} =$ total proceeds(offer price) for target i from acquirer j's bid

$V_i =$ stand-alone value of target i

$S_{ij} =$ synergy from acquisition between target i and acquirer j

$\omega_{ij}^T =$ target i's bargaining power over acquirer j

4.2.1 Fire-Sale Discount on Offer Price

To examine the effect of a fire-sale on the offer price a target receives, I employ three different measures of offer price for target shareholders from the SDC database. The first measure $Ln(Price1)$ is the log of total enterprise value ($RANKVAL$). I use the log transformation for these variables to adjust skewed size distribution. The second measure $Ln(Price2)$ is the log of total transaction value ($TRANSACT$). Transaction value represents the equity value of the target company (i.e., offer price per share * shares outstanding plus cost to acquire convertibles) plus any assumed liabilities that are publicly disclosed.[17] The third measure, $Premium$, is offer price

distribution of acquirer returns.

[17]The correlation between $Ln(Price1)$ and $Ln(Price2)$ is 0.98.

per share divided by target stock price four weeks prior to announcement.[18]

The hypothesis on price discounts in fire-sale acquisitions predicts a strong negative coefficient on the interaction term of target's firm- and industry-level distress for the following specification:

$$Price_{ijdt} = \beta_1 \underbrace{(Ind.D_{it} \times Distress_{it})}_{Fire\text{-}Sale} + \beta_2 Ind.D_{it} + \beta_3 Distress_{it} + \gamma^{'} X_{ijd} + \alpha_t + \alpha_i + \varepsilon_{ijdt} \quad (4)$$

where $Distress_{it}$ and $Ind.D_{it}$ are the target firm and industry distress measures, respectively, of target i in year t, and X_{ijd} represents control variables for target i, acquirer j, and deal characteristics d. Year fixed effects (α_t) and target industry fixed effects (α_i) are also included. Standard errors are heteroskedasty-consistent and clustered at year-industry.

In Panel A of Table 4, Columns (1), (3) and (5) show that the coefficients on $Fire\text{-}Sale_1$ are negative and statistically significant to all measures of offer price. These results indicate that distressed targets in a distressed industry are acquired at a discount relative to distressed targets in a non-distressed industry. The economic magnitude can be interpreted as 14% discount relative to distressed targets in non-distressed industries for an increase of one standard-deviation of the default risk, $Distress1_T$.[19] As shown in Columns (2), (4), and (6) of Table 4 Panel A, the results are robust to use of the dummy variable of firm distress, $Distress2_T$ and its interaction term $Fire\text{-}Sale_2$.

In the presence of firm- and industry-level profitability, this significant interaction term in Table 4 provides support for the fire-sale effect on price discounts.

[18] Although *Premium* is widely used in literature to compare the offer price, this measure is affected by the reference stock price in the denominator, which is particularly confounded by target firm- and industry- distress. Therefore, I focus on the enterprise value in this paper.

[19] The standard deviation of $Distress1_T$ is 0.228 in Table 2. The economic significant can be calculated by Exp((-0.88+0.23)*0.228)-1 = -14%)

4.2.2 Synergy and Bargaining Power in Fire-Sale Acquisitions

Measuring the division of total gains on the basis of the abnormal stock return at the announcement date enables me to identify the source of fire-sale discount in the previous results. Synergy is measured based on Bradley et al. (1988). I use combined CAR: market equity value weighted average of target's CAR and acquirer's CAR over the -1 to +1-day window. I employ a bargaining outcome measure that uses the difference in abnormal dollar returns between target and acquirer following Ahern (2011).[20] Basically, the bargaining outcome is the percentage of a firm's abnormal gain over total abnormal synergistic gain. One problem with using abnormal return to measure bargaining outcome is that it can be negative for the acquirer. A player with a negative expected bargaining outcome will not participate in the game.[21] I avoid this problem by using the difference in dollar gains between target and acquirer as a proxy for the target's bargaining outcome. Following Ahern (2011), I normalize this measure by dividing by the sum of the acquirer's and target's market values four weeks prior to the announcement. The measure of the acquirer's relative bargaining power is,

$$NDCAR_T = \frac{DCAR_{Target} - DCAR_{Acq}}{MV_{Target} + MV_{Acq}}$$

where DCAR: Dollar Cumulative Abnormal Return at the announcement (-1, +1).

I construct, as a robustness check, an alternative measure that calculates the ratio of the target's abnormal dollar return to the combined abnormal dollar return of acquirer and target, and winsorize this ratio by 0 and 1. This measure is more intuitive, but potentially downward biased if negative abnormal returns are frequent

[20] Offer premium, which is used by most bargaining-related papers (e.g., Officer (2003), and Subramanian (2003)) does not necessarily capture a target's relative bargaining outcome because it does not consider the acquirer's share of gains.

[21] Many studies explain the negative acquirer return based on such drivers of mergers as the hubris hypothesis, the market-driven misvaluation hypothesis, swarm behavior, and the market mania hypothesis (Roll (1986), Malmendier and Tate (2005) , Malmendier and Tate (2008), Shleifer and Vishny (2003)).

for acquirers.

$$Bargain_T = \begin{cases} \dfrac{DCAR_{Target}}{DCAR_{Target} + DCAR_{Acq}} & \text{if} \quad DCAR_{Target} > 0, DCAR_{Acq} > 0 \\ 0 & \text{if} \quad DCAR_{Target} < 0, DCAR_{Acq} > 0 \\ 1 & \text{if} \quad DCAR_{Target} > 0, DCAR_{Acq} < 0 \end{cases}$$

where DCAR: Dollar Cumulative Abnormal Return at the announcement (-1, +1).

I then estimate the effect of firm- and industry-level distress on each component using the following specifications.

$$S_{ijdt} = \beta_1 (\underbrace{Ind.D_{it} \times Distress_{it}}_{Fire\text{-}Sale}) + \beta_2 Ind.D_{it} + \beta_3 Distress_{it} + \gamma' X_{ijd} + \alpha_t + \alpha_i + \varepsilon_{ijdt} \tag{5}$$

$$\omega^T_{ijdt} = \beta_1 (\underbrace{Ind.D_{it} \times Distress_{it}}_{Fire\text{-}Sale}) + \beta_2 Ind.D_{it} + \beta_3 Distress_{it} + \gamma' X_{ijd} + \alpha_t + \alpha_i + \varepsilon_{ijdt} \tag{6}$$

where S_{ijdt} denotes the measure for synergy and ω^T_{ijdt} denotes target's bargaining power. $Distress_{it}$ and $Ind.D_{it}$ are the target firm and industry distress measures, respectively, and X_{ijd} represents control variables for target i, acquirer j, and deal characteristics d. Year fixed effects (α_t) and target industry fixed effects (α_i) are also included. Standard errors are heteroskedasty-consistent and clustered at year-industry.

The hypothesis of the synergy channel predicts lower synergy in fire-sale acquisitions and lower corresponding gain for targets. In Panel B in Table 4, however, Columns (1)-(2) show that the measure of synergy has an insignificant relation with the interaction effects of target firm- and industry-level distress. One interpretation of this result is that fire-sale acquisitions with severe inefficiency are avoided by a conservative ex-ante debt structure or by alternative resolution of distress (Morellec (2001), and Campello and Giambona (2013)). Alternatively, this result is consistent with current research by Almeida et al. (2011) and Erel et al. (2014), that highlights the importance of financial synergy.

The results in Models (3)-(6) in Table 4 Panel B, on the other hand, show that target firm- and industry-level distress has a negative and significant impact on a target's bargaining outcome. Models (3) and (4) present coefficient estimates on $NDCAR(\omega_T)$. The coefficient of the interaction effect is economically large and statistically significant, and the effect is robust to both measures of target distress. This result implies that distressed targets in a distressed industry receive a substantially lower portion of total gains relative to other targets in the sample. The economic magnitudes are $40 million further transfer to acquirer for a one standard deviation increase in a target's default probability in a distressed industry or 5% * $1.8 billion = $90 million further transfer to acquirer based on $\textit{Fire-Sale}_2$. Consistent with this result, the regression estimates in Models (5) and (6) indicate that targets have 10-20 percentage points lower bargaining share of total synergy gain in fire-sale acquisitions.

In sum, these results provide support for the bargaining channel of the fire-sale effects, which states that distressed targets in a distressed industry are acquired at discounts due to targets' weakened bargaining power.

4.3 Acquirer Identity in Fire-Sale Acquisitions

4.3.1 Effects of Industry-wide Distress on Acquirer Identity

Thus far, the results suggest that financial constraints of targets and their peer firms drive a price discount. To provide further evidence of fire-sale effects, I explore the effects of target firm- and industry-level distress on acquirers' identity, whether they are inside or outside the target's industry. The null hypothesis is that acquirer identity is unaffected by target firm- and industry-level distress. Alternatively, the main hypothesis of this paper is that targets are likely to sell to industry outsiders when their peer firms are financially constrained. To test this hypothesis, I compare the probability of being acquired by industry outsiders over target firm- and industry-level distress using the following probit model to estimate probability.

$$Prob.(Outsider_{ijdt}) = \beta_1(\underbrace{Ind.D_{it} \times Distress_{it}}_{Fire\text{-}Sale}) + \beta_2 Ind.D_{it} + \beta_3 Distress_{it} + \gamma' X_{ijd} + \alpha_t + \alpha_i + \varepsilon_{ijdt} \quad (7)$$

where $Outsider_{ijdt}$ is the dummy equals 1 if acquirer j has a different 3-digit SIC code from target i.[22] $Distress_{it}$ and $Ind.D_{it}$ are the firm and industry distress measures, respectively, of target i in year t, and X_{ijd} represents control variables for target i, acquirer j, and deal characteristics d. Year fixed effects and industry fixed effects are also included.

Table 5 presents estimates of the probability that targets are sold to industry outsiders. Acquirer and deal characteristics are excluded in Models (1) and (3) to control for potential endogeneity.[23] I find large and significant coefficients for the industry distress measure in all Models (1)-(4). The coefficient on industry distress captures the difference in probability of being acquired by industry outsiders. The result, evaluated at the means of independent variables, indicates that targets in a distressed industry are more likely to sell to outside buyers by 20 percentage points compared with targets in a non-distressed industry. The stand-alone variable of target distress and the interaction term of target firm- and industry-level distress have insignificant coefficients. The results imply that when the target industry is distressed, peer firms in the same industry are not capable of buying the target.

4.3.2 Fire-Sale Acquisitions with Outsider

I next examine the triple-interaction effect of target firm distress, industry distress, and outside acquirer dummy. The hypothesis suggests that the effects on fire-sale targets should be stronger if the targets are sold to acquirers outside a target's industry.

[22] I have verified that the results are robust to the use of alternative definition using 2-digit SIC code. The results are reported in Table A.2 in Appendix.

[23] Acquirer and deal characteristics are determined simultaneously with acquirer identity.

Table 6 presents the estimates from regressions that explain the main acquisition outcomes using the interaction variable of fire-sale and acquirer's industry identity.[24] I find that the interaction effects of target firm- and industry-level distress on acquirer returns, offer price, and target's bargaining power are stronger when acquirers are from different industries. The triple-interaction effects are economically large and statistically significant. The results in Table 6 indicate that, if the acquirer is an industry outsider, a one standard deviation increase in the target's default probability during industry distress increases the acquirers' return by 4.6 percentage points, and decreases the offer price by 47.7% and the target's bargaining power by 5.7%. Crucially, I also find that the coefficient of triple interaction term on synergy becomes negative (economic magnitude = -3.2%) and statistically significant, which indicates that a deadweight cost incurred from inefficient fire-sales conditional on industry outside acquirers.

It is also important to note that the interaction term of target firm- and industry-level distress, $\textit{Fire Sale}_1$ becomes insignificant in Models (1)-(3) when the triple interaction effect with industry outsider is included. This suggests that the results in the previous section is largely driven by fire-sale acquisitions with industry outsiders. This result supports the fire-sale channel suggested by the Shleifer and Vishny model.

4.4 Fire-Sale Effects with Specialized Assets

When assets are highly industry specific, inefficiency from demand-side constraints becomes more severe as industry outsiders are not able to utilize the assets to their best-use. The resulting prediction is that distressed targets in an industry with high asset specificity may be sold at a deeper discount in an illiquid market. I test this prediction with three main input factors —capital, labor, and technology—

[24] In this analysis, I report the results with $\textit{Fire-Sale}_1$ due to the small sample size with $\textit{Fire-Sale}_2$.

of production function.

4.4.1 Fire-Sale Effects and Capital-Specificity

I measure industry capital-specificity based on industry's machinery and equipment (*ppenme*) scaled by the book value of total assets (*at*) obtained from Compustat (Acharya et al. (2007) and Almeida et al. (2011)). As this value has been absent from Compustat since 1997, I construct a time-invariant measure of industry-level capital-specificity by taking median value across firms and years within the 3-digit SIC code from 1980-1996.[25]

I separate the total sample into high and low capital-specificity industries based on the sample median industry capital-specificity, and conduct a subsample analysis. Table 7 presents estimates of target firm- and industry-level distress on the main dependent variables over industry capital-specificity. I compare the interaction effect of target firm distress and industry distress on acquisition outcomes in each column between Panels A and B. The dependent variables are acquirer's abnormal return (CAR_A), offer price ($Ln(Price1)$), target's bargaining power ($NDCAR(\omega^T)$) and synergy ($CAR_{Combined}$).

I find that the fire-sale effects on acquirer's abnormal return, offer price, and target's bargaining power tend to be stronger when industry-level capital-specificity is high. For Column (1) and (3), the coefficients in Panel A show economically larger and statistically more significant than the regression results in Panel B. For Column (2), the interaction effect is economically and statistically significance only targets with high capital-specificity. These patterns are more significant in the result based on a dummy variable $Distress2_T$ in Table A.3 in Appendix.

These results indicate that the main results in the previous section are driven

[25] Alternatively, I consider to measure industry capital-specificity based on industry's property, plant, and equipment (PP&E) scaled by the book value of total assets. This measure, however, proxies for overall tangibility of the industry instead of industry capital-specificity because property, including real estate, is highly redeployable.

by asset illiquidity consistent with the proposed hypothesis and thus provide strong evidence for the fire-sale channel.

4.4.2 Fire-Sale Effects and Target Labor Union

I further investigate the impact of target labor unions on the fire-sale effects. Labor unions play a significant role in protecting workers' rights through collective bargaining. Strong labor unions could increase restructuring costs by influencing layoff costs or severance payments and blocking restructurings and plant closings (McLaughlin and Fraser (1984)). Especially high costs may be incurred during industry downturns, when acquirers may need to restructure firms intensively. Therefore, industries with strong labor unions may thus experience less demand in acquisition markets during industry downturns. A strong labor union could also influence a distressed firm to sell all of its assets with a guarantee of labor continuation, thereby reducing the acquisition price and transferring wealth from the distressed target's shareholders to its workers. This hypothesis predicts that if a target industry has a strong labor union, then the fire-sale effects should be stronger because strong labor union increases restructuring costs and thus makes the distressed target less redeloyable.

Alternatively, a strong labor union can resist acquisitions, in particular, hostile takeovers, by refusing to tender workers' shares or voting against acquisitions (Pagano and Volpin (2005), and Kim and Ouimet (2014)). This will lower the probability of receiving a takeover bid, but increase the offer price. It is also possible for strong labor unions to make concessions to and create more synergy gain for acquirers by giving up their rents. This competing hypothesis predicts that the fire-sale effects are likely to be mitigated in industries with strong labor unions.

Therefore, it is empirical question to examine whether strong labor unions in target industries promote the fire-sale effects or not. I perform a subsample analysis using regressions with the same specifications as in main regressions, but dividing the total sample into strong labor union industries and weak labor union industries.

I employ a labor unionization measure that records the percentage of unionized workers in each 3-digit SIC industry from 1980-2010. The Union Membership and Coverage Database constructed by Barry Hirsch and David Macpherson compiles industry-level unionization data from the Current Population Survey (CPS) of the Bureau of Labor Statistics.[26] The database provides two unionization measures, (1) the percentage of labor union membership, and (2) the percentage of workers covered by a collective bargaining agreement.[27] CPS classifies industries based on firms' primary Census Industry Classification (CIC) codes. In the present study, I match each CIC industry to a 3-digit SIC industry by comparing the industry specification. Table 2 reports the descriptive statistics for the first labor union variable. I create a dummy variable for strong labor union industry that equals one if the labor union measure is above the median value of total sample.

The results in Table 8 show that the fire-sale effects combined with strong labor unions result in further increases in returns for acquirers, a deeper discount in offer prices, and weaker bargaining outcomes for targets. Comparing each column between Panels A and B, I find that the coefficients on fire-sale variable are economically larger and statistically more significant when the target industry has a strong labor union. These results suggest that strong labor unions promote the fire-sale effects by generating further demand-side frictions.

4.4.3 Fire-Sale Effects and R&D Intensity

I next explore how asset-specificity in technology (intangible assets) affects fire-sale effects in distressed target acquisitions in a distressed industry. Technology-

[26] At www.unionstat.com, Hirsch and Macpherson (2002)

[27] I mainly employ the first measure. The correlation between two unionization measures is 0.99. The results are robust with the second measure.

intensive industries play particularly important roles in acquisition markets. Previous literature documents that productive opportunity is a main motivation of acquisitions (e.g., Higgins and Rodriguez (2006), and Levine (2011)). However, there is little evidence on how variation in an industry's technology intensity affects acquisition outcomes across different industry-specific financial conditions.

Aboody and Lev (2000) suggests that R&D may increase firm- and industry-level information asymmetry for the following three reasons. First, contrary to capital or labor, R&D is more likely to be specific to a firm and its industry, so, across industries, firms have difficulty in sharing knowledge on their technologies and undergoing R&Ds. Second, relatively less organized markets for technology assets lead outsiders not to infer the precise value of the assets from market prices. Third, the current accounting rule does not require to report value and productivity changes of R&D after being expensed. Building on this argument, I develop a hypothesis that technology- or knowledge-based assets are likely to be less redeployable to industry outsiders, particularly during an illiquid market, therefore, strengthening fire-sale effects in acquisitions. Higher information asymmetry embedded in technology-intensive industry drives more frictions in asset allocation across industries because industry outsiders have more difficulty in valuing and operating the assets.

I examine this hypothesis by estimating the combined effect of target firm- and industry-level distress on acquisition outcomes with different R&D intensities. I measure R&D intensity based on research and development expenses divided by total sales. This variable is set to zero if total assets are reported for a firm in the same year but no record is reported for R&D expenses. I separate the total sample into high and low R&D industry subsamples. An observation is considered to be high (low) R&D industry if it belongs to an industry with below (above) the sample median industry R&D intensity. Subsample analysis with separate estimation enables coefficients of the control variables and fixed effects to vary across high and low R&D regimes.

In Table 9, results for the subsamples are reported in Panels A and B. Each panel presents the fire-sale effects on acquirer's abnormal returns (CAR_A), offer price ($Ln(Price1)$), target's bargaining power ($NDCAR(\omega^T)$) and synergy ($CAR_{combined}$). Comparing each column between the two Panels A and B of Table 9, I find that the fire-sale effects on acquirer's abnormal return, offer price, and target's bargaining power are economically large and statistically significant only in high R&D industries. In Panel A, these coefficients are sharper than those for the full sample. Control variables also show coefficients generally consistent with the regression results with full sample. In contrast, in Panel B, they reveal no relation when R&D intensity is low. This is robust in both target firm distress measures. These results further support the hypothesis that price discounts in distressed target acquisitions in a distressed industry are driven by the fire-sale channel rather than the decline in economic worth of target assets.

4.5 Alternative Explanations

4.5.1 Stock Market Undervaluation in Fire-Sale Acquisitions

A potential concern with the previous results is that the fire-sale discount and related acquisition outcomes could be driven by stock market undervaluation. Many studies in the M&A literature show that stock market misvaluation drives acquisition activity and outcomes (Shleifer and Vishny (2003), Rhodes-Kropf and Viswanathan (2004), and Rhodes-Kropf et al. (2005)). If either firm- or industry-level distress causes systematic undervaluation of targets, it would be possible for informed acquirers to purchase undervalued targets at prices below their fundamental values.

As a robustness check, I re-estimate the fire-sale effects in the main regressions using the same explanatory variables and including measures for target firm- and industry-level undervaluation. Following Rhodes-Kropf et al. (2005), I measure target undervaluation by decomposing the market-to-book ratio of firms with the same 3-digit SIC code into three components: firm-specific error; industry-wide, short-run error; and long-run growth option. Details of this estimation are provided in Appendix B. Table A.6 in Appendix presents the descriptive statistics for the robustness checks. Panel A shows that the book-to-value ratio is lower for distressed than for non-distressed targets. Moreover, distressed targets are undervalued, on average, by 2% at the firm level.[28] Sector errors are -6% in all samples.

The regression results in Appendix Table A.7 show that target misvaluation (Target Misval.) has significant effects on all dependent variables except target's bargaining power. Models (1) and (2) show that the target undervaluation results in higher returns for acquirers, and Models (3) and (4) indicate that a negatively misvalued target receives a significantly lower offer price. In Models (7) and (8), I also find that the negative misvaluation of a target can increase combined abnormal returns in acquisitions, which implies that target undervaluation is a source of additional synergy gain. The target industry misvaluation measures are insignificant in all specifications. The results support that fire-sale targets are priced below their fundamental values and it influences acquisition outcomes significantly. However, the fire-sale variable, the interaction of target firm- and industry-level distress, remains significant and consistent with the main results, even in the presence of the target misvaluation measure. The results thus show that the fire-sale channel is essential to explaining the outcomes of distressed target acquisition.

4.5.2 Fire-Sale Acquisitions in Recession

While the present study measures industry-specific distress and estimates the fire-sale effects on acquisition outcomes, Ang and Mauck (2011) investigated the

[28] A negative number of misvaluation implies that targets are undervalued.

effect of economy-wide recession on acquisitions and argued that recession drives a higher offer premium for distressed targets because acquirers assume the targets to be largely depressed during recession. In this section, I control for the recession dummy variable and examine the effect of target firm- and industry-level distress on key variables. Recessions are defined in terms of recessionary months identified by NBER, as in Ang and Mauck (2011).

Table A.8 in Appendix presents coefficient estimates from an OLS regression that uses the same explanatory variables as in the paper's main regressions, but includes the recession dummy variable. The results in Table A.8 show that the recession dummy has a negative effect on acquirer's return. Target bargaining power is also positively related with the recession dummy. In all specifications, however, coefficients on the main explanatory variable, the interaction effect of target distress and target industry distress, are robust and consistent with the main regressions in the previous sections. This result provides evidence that industry-specific rather than economy-wide distress accounts for the fire-sale effects in distressed target acquisitions.

5 Intra-Industry Contagion of Fire-Sales

In this section, I examine the contagion effects of fire-sale acquisitions on target rivals in the same industry by exploring rivals' operating performance and abnormal stock returns following the announcement of a target's fire-sale acquisition. The *negative information hypothesis* predicts negative stock returns, but makes no particular prediction with respect to post-acquisition operating performance. However, the *intense competition hypothesis* predicts negative stock returns following negative operating performance whereas *market power hypothesis* implies positive stock returns following positive operating performance in the post-acquisition period. This mutually exclusive set of competing hypotheses enables me to identify a valid hypothesis by investigating post-acquisition stock returns and comparing operating performance, of rivals in the pre- and post-acquisition period.

5.1 Abnormal Stock Returns of Industry Rivals

I first estimate the impact of fire-sale on industry rivals' stock returns at the announcement of a fire-sale acquisition. To minimize other confounded effects in the broad industry classification, I focus on target industry rivals in the same 4-digit SIC code. I compare abnormal stock returns for industry rivals that share similar characteristics with the target. Matched industry rivals are selected based on size and market-to-book ratio. Among the subset of same industry rivals that have total book asset values within ±30% of the total book asset values of the target firm, I choose a rival with the closest market-to-book ratio to that of the target. Figure 3 plots the equal-weighted average of short-term cumulative abnormal returns of matched target rivals from 10 days before to 50 days after the announcement of acquisitions. It shows that matched target rivals of fire-sale acquisitions experience negative short-term returns relative to other rivals.

I, then, turn to regression analysis and control for other factors that could be driving the differences including product market variables. Rival's cumulative abnormal return (CAR) at the announcement (-1, +1) of the acquisition of an industry target is estimated using the Fama-French three-factor model. I use 240 daily returns covering (-300, -60) to estimate parameters for each rival firm.[29] I estimate the fire-sale effects on target industry rivals using the following specifications.

$$R^T_{ijdkt} = \beta_1 \underbrace{(Ind.D_{it} \times Distress_{it})}_{Fire\text{-}Sale} + \beta_2 Ind.D_{it} + \beta_3 Distress_{it} + \gamma' X_{ijdk} + \alpha_t + \alpha_i + \varepsilon_{ijdkt} \qquad (8)$$

where R^T_{ijdkt} is the CAR for a matched industry rival of targets with same 4-digit SIC over the three-day period (-1, +1) surrounding the announcement of acquisition, X_{ijdk} represents control variables for target i, acquirer j, rival k, and

[29]The results are robust after excluding the cases of multiple acquisitions occurring during the estimation period.

deal characteristics *d*.

The coefficient estimates from the OLS regression in Table 10 show that the interaction effect of a target's firm- and industry-level distress negatively affects the stock returns of industry rivals. The coefficient is large and significant. The economic magnitude of the coefficient can be interpreted as 1-4 percentage points. These results support both the *negative information hypothesis* and *intense competition hypothesis*. Negative abnormal returns, however, do not allow me to determine whether the negative contagion effects are related to the negative information or acquiring firms' competitive advantage.

In the second matched sample test, I conduct subsample analysis with high and low industry-level R&D intensity. The previous section shows that high R&D intensity drives stronger fire-sale effects by creating greater information asymmetry between industry insiders and outsiders. If negative stock returns of target industry rivals are not driven by fire-sale effects, then there should be no difference between the stock market reactions of high and low R&D industries in this sub-sample. On the other hand, if high information asymmetry in high R&D industries reinforces negative information effects, then I should find greater impact for target industry rivals in high R&D industries. I show that the effects of a fire-sale acquisition on target industry rivals are stronger in high R&D industries. This evidence, therefore, supports the *negative information hypothesis*. Models (3)-(6) in Table 10 reports the subsample results. They reveal a significant relation when industry-level R&D intensity is high, but an insignificant relation when industry-level R&D intensity is low. The estimates in Models (3)-(4) show -1.4% rivals' abnormal return for a one standard deviation increase in $Distress1_T$, or -5.97% decrease by $Distress2_T$ when the target industry is distressed. These negative coefficients are economically larger and statistically more significant than those of the full matched rival sample.

5.2 Operating Performance of Industry Rivals

I next examine matched industry rivals' operating performance by comparing ROA and profitability margin (operating cash flow/total sales) pre and post acquisition. I estimate the impact of acquisitions on industry rivals' operating performance using the following specifications.

$$\text{ROA-Diff}^{T}_{ijdk} = \beta_1(\underbrace{Ind.D_{it} \times Distress_{it}}_{Fire\text{-}Sale}) + \beta_2 Ind.D_{it} + \beta_3 Distress_{it} + \gamma^{'} X_{ijdk} + \alpha_t + \alpha_i + \varepsilon_{ijdkt} \quad (9)$$

$$\text{Profit-Diff}^{T}_{ijdk} = \beta_1(\underbrace{Ind.D_{it} \times Distress_{it}}_{Fire\text{-}Sale}) + \beta_2 Ind.D_{it} + \beta_3 Distress_{it} + \gamma^{'} X_{ijdk} + \alpha_t + \alpha_i + \varepsilon_{ijdkt} \quad (10)$$

where ROA-Diff$^{T}_{ijkdt}$ is the difference of return on asset for industry rivals between the average post-acquisition period (+3, +1) year and the average pre-acquisition period (-3, -1) year, and X_{ijkd} represents control variables for target i, acquirer j, rival k, and deal characteristics d. The error terms are clustered by target, industry and year. Profit-Diff$^{T}_{ijkdt}$ is the difference in profitability margin (operating cash flow/total sales) for industry rivals between the average post-acquisition period (+3, +1) year and the average pre-acquisition period (-3, -1) year. The coefficient estimates from the OLS regression in Table 11 indicate that the interaction of a target's firm- and industry-level distress has an insignificant effect on the post-acquisition operating performance of industry rivals.

Taken together, industry rivals' negative abnormal stock returns unaccompanied by diminished operating performance at announcements of acquisitions support my hypothesis, which states that negative information from fire-sale acquisitions causes a negative contagion effect for industry rivals of fire-sale targets.

6 Conclusion

Do fire-sales exist in acquisitions? If they do, how do fire-sale acquisitions affect target industry competitors? This paper addresses these two important questions by inferring the effect of the frictions involved in fire-sale acquisitions from an examination of the combined impact of firm- and industry-level distress on acquisition outcomes.

The main finding in this paper is that a target's firm- and industry-level distress is a robust and economically important determinant of acquisition outcomes. In particular, the evidence suggests that distressed targets with financially constrained industry peers are sold at substantial discounts, as proposed by Shleifer and Vishny (1992). Acquirers gain higher announcement returns in fire-sale acquisitions and fire-sale targets are more likely to sell to outside acquirers. I demonstrate the fire-sale effects in acquisitions by showing that these findings are stronger when fire-sale targets are sold to industry outsiders or when targets' assets are highly industry-specific. The results are robust to stock market undervaluation and economic recession. I also find that fire-sale acquisitions negatively affect target industry rivals' stock returns by sending negative information without fundamental changes in product market competition.

Overall, this study shows that financial distress costs in an illiquid market are substantial, particularly, when the assets are less redeployable. It highlights implications for debt capacity and capital structure as well as the contagion channel through which economic shocks can transmit. The results suggest that information friction creates inefficiency in asset reallocation, which potentially slows recovery from recession. Direct government involvement through bailout being likely to create moral hazard problem, government policy should instead encourage intensive corporate filing and information sharing between banks as ways to improve selective screening and increase the efficiency of asset reallocation during downturns.

References

Aboody, D. and B. Lev (2000). Information asymmetry, R&D, and insider gains. *Journal of Finance 55*(6), 2747–2766. 29

Acharya, V. V., S. T. Bharath, and A. Srinivasan (2007). Does industry-wide distress affect defaulted firms? Evidence from creditor recoveries. *Journal of Financial Economics 85*(3), 787–821. 13, 26

Aguiar, M. and G. Gopinath (2005). Fire-sale foreign direct investment and liquidity crises. *Review of Economics and Statistics 87*(3), 439–452. 5

Ahern, K. (2011). Bargaining power and industry dependence in mergers. *Journal of Financial Economics*. 21, 45

Akdogu, E. (2011). Value-maximizing managers, value-increasing mergers, and overbidding. *Journal of Financial and Quantitative Analysis 46*(1), 83. 10

Allen, F. and D. Gale (2000). Financial contagion. *Journal of Political Economy 108*(1), 1–33. 7

Almeida, H., M. Campello, and D. Hackbarth (2011). Liquidity mergers. *Journal of Financial Economics 102*(3), 526–558. 22, 26

Ang, J. and N. Mauck (2011). Fire sale acquisitions: Myth vs. Reality. *Journal of Banking & Finance 35*(3), 532–543. 5, 6, 13, 31, 32

Asquith, P., R. Gertner, and D. Scharfstein (1994). Anatomy of financial distress: An examination of junk-bond issuers. *Quarterly Journal of Economics 109*(3), 625–658. 8

Banerjee, A. and E. W. Eckard (1998). Are mega-mergers anticompetitive? Evidence from the first great merger wave. *Rand Journal of Economics*, 803–827. 5, 10

Barber, B. M. and J. D. Lyon (1997). Detecting long-run abnormal stock returns: The empirical power and specification of test statistics. *Journal of Financial Economics 43*(3), 341–372. 17

Benmelech, E. and N. K. Bergman (2011). Bankruptcy and the collateral channel. *Journal of Finance 66*(2), 337–378. 7

Bharath, S. T. and T. Shumway (2008). Forecasting default with the merton distance to default model. *Review of Financial Studies 21*(3), 1339–1369. 5, 12, 58

Binmore, K., A. Rubinstein, and A. Wolinsky (1986). The nash bargaining solution in economic modelling. *RAND Journal of Economics*, 176–188. 9

Bradley, M., A. Desai, and E. H. Kim (1988). Synergistic gains from corporate acquisitions and their division between the stockholders of target and acquiring firms. *Journal of Financial Economics 21*(1), 3–40. 17, 21

Brown, D. T. (1989). Claimholder incentive conflicts in reorganization: The role of bankruptcy law. *Review of Financial Studies 2*(1), 109–123. 8

Campbell, J. Y., S. Giglio, and P. Pathak (2011). Forced sales and house prices. *American Economic Review 101*(5), 2108–31. 5, 6, 10

Campello, M. and E. Giambona (2013). Real assets and capital structure. *Journal of Financial and Quantitative Analysis 48*(05), 1333–1370. 22

Chava, S. and A. Purnanandam (2010). Is default risk negatively related to stock returns? *Review of Financial Studies 23*(6), 2523–2559. 12

Clayton, M. J. and S. A. Ravid (2002). The effect of leverage on bidding behavior: Theory and evidence from the FCC auctions. *Review of Financial Studies 15*(3), 723–750. 8

Committee, B. (1999). Credit risk modelling: Current practices and applications. 12

Coval, J. and E. Stafford (2007). Asset fire sales (and purchases) in equity markets. *Journal of Financial Economics 86*(2), 479–512. 5, 6

Duffie, D., L. Saita, and K. Wang (2007). Multi-period corporate default prediction with stochastic covariates. *Journal of Financial Economics 83*(3), 635–665. 12

Eckbo, B. and S. K. Thorburn (2008). Automatic bankruptcy auctions and fire-sales. *Journal of Financial Economics 89*(3), 404–422. 5, 6

Eckbo, B. E. (1983). Horizontal mergers, collusion, and stockholder wealth. *Journal of Financial Economics 11*(1), 241–273. 10, 11

Eckbo, B. E. and P. Wier (1985). Antimerger policy under the hart-scott-rodino act: A reexamination of the market power hypothesis. *Journal of Law and Economics 28*(1), 119–149. 10

Eisfeldt, A. L. and A. A. Rampini (2006). Capital reallocation and liquidity. *Journal of Monetary Economics 53*(3), 369–399. 2

Erel, I., Y. Jang, and M. S. Weisbach (2014). Do acquisitions relieve target firms financial constraints? *Journal of Finance*. 22

Fee, C. E. and S. Thomas (2004). Sources of gains in horizontal mergers: Evidence from customer, supplier, and rival firms. *Journal of Financial Economics 74*(3), 423–460. 10, 11

Fridolfsson, S.-O. and J. Stennek (2005). Why mergers reduce profits and raise share prices–a theory of preemptive mergers. *Journal of the European Economic Association 3*(5), 1083–1104. 5, 10

Gertner, R. and D. Scharfstein (1991). A theory of workouts and the effects of reorganization law. *Journal of Finance 46*(4), 1189–1222. 8

Gilson, S. C., K. John, and L. H. Lang (1990). Troubled debt restructurings: An empirical study of private reorganization of firms in default. *Journal of Financial Economics 27*(2), 315–353. 13

Gul, F. (1989). Bargaining foundations of shapely value. *Econometrica*, 81–95. 9

Hertzel, M. G. and M. S. Officer (2012). Industry contagion in loan spreads. *Journal of Financial Economics 103*(3), 493–506. 7

Higgins, M. J. and D. Rodriguez (2006). The outsourcing of R&D through acquisitions in the pharmaceutical industry. *Journal of Financial Economics 80*(2), 351–383. 29

Hirsch, B. T. and D. A. Macpherson (2002). Union membership and coverage database from the current population survey: Note. *Indus. & Lab. Rel. Rev. 56*, 349. 28, 45

Kim, E. H. and P. Ouimet (2014). Employee stock ownership plans: Employee compensation and firm value. *Journal of Finance*. 27

Kim, E. H. and V. Singal (1993). Mergers and market power: Evidence from the airline industry. *American Economic Review*, 549–569. 11

Kim, J. H. (2012). Asset specificity and firm value: Evidence from mergers. In *Unpublished Working Paper*. 5, 6

Kiyotaki, N. and J. Moore (1997). Credit chains. *Journal of Political Economy 105*(21), 211–248. 6

Kothari, S. and J. B. Warner (1997). Measuring long-horizon security price performance. *Journal of Financial Economics 43*(3), 301–339. 17

Levine, O. (2011). Acquiring growth. *Unpublished Working Paper*. 29

Lyon, J. D., B. M. Barber, and C.-L. Tsai (1999). Improved methods for tests of long-run abnormal stock returns. *Journal of Finance 54*(1), 165–201. 17

Malmendier, U. and G. Tate (2005). Does overconfidence affect corporate investment? CEO overconfidence measures revisited. *European Financial Management 11*(5), 649–659. 21

Malmendier, U. and G. Tate (2008). Who makes acquisitions? CEO overconfidence and the market's reaction. *Journal of Financial Economics 89*(1), 20–43. 21

McLaughlin, D. B. and D. A. Fraser (1984). Collective bargaining: The next twenty years. *The ANNALS of the American Academy of Political and Social Science*, 33–39. 27

Meier, J.-M. A. and H. Servaes (2014). Distressed acquisitions. In *Unpublished Working Paper*. 5, 6

Merton, R. C. (1974). On the pricing of corporate debt: The risk structure of interest rates. *Journal of Finance 29*(2), 449–470. 12, 45, 58

Molnar, J. (2007). Pre-emptive horizontal mergers: Theory and evidence. *Bank of Finland Research Discussion Paper* (17). 10

Morellec, E. (2001). Asset liquidity, capital structure, and secured debt. *Journal of Financial Economics 61*(2), 173–206. 22

Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics 5*(2), 147–175. 8

Nash, J. F. (1950). The bargaining problem. *Econometrica*, 155–162. 9

Officer, M. S. (2003). Termination fees in mergers and acquisitions. *Journal of Financial Economics 69*(3), 431–467. 21

Officer, M. S. (2007). The price of corporate liquidity: Acquisition discounts for unlisted targets. *Journal of Financial Economics 83*(3), 571–598. 5, 6

Oh, F. D. (2012). Contagion of a liquidity crisis between two firms. *Journal of Financial Economics*. 7

Opler, T. C. and S. Titman (1994). Financial distress and corporate performance. *Journal of Finance 49*(3), 1015–1040. 13

Pagano, M. and P. F. Volpin (2005). Managers, workers, and corporate control. *Journal of Finance 60*(2), 841–868. 27

Pulvino, T. C. (1998). Do asset fire sales exist? An empirical investigation of commercial aircraft transactions. *Journal of Finance 53*(3), 939–978. 5, 12

Rajan, R. and R. Ramcharan (2013). Financing capacity and fire sales: Evidence from bank failures. *Unpublished Working Paper*. 6

Rhodes-Kropf, M. and D. Robinson (2008). The market for mergers and the boundaries of the firm. *Journal of Finance 63*(3), 1169–1211. 9

Rhodes-Kropf, M., D. T. Robinson, and S. Viswanathan (2005). Valuation waves and merger activity: The empirical evidence. *Journal of Financial Economics 77*(3), 561–603. 30, 31, 59

Rhodes-Kropf, M. and S. Viswanathan (2004). Market valuation and merger waves. *Journal of Finance 59*(6), 2685–2718. 30

Roll, R. (1986). The hubris hypothesis of corporate takeovers. *Journal of Business*, 197–216. 21

Rubinstein, A. (1982). Perfect equilibrium in a bargaining model. *Econometrica*, 97–109. 9

Shahrur, H. (2005). Industry structure and horizontal takeovers: Analysis of wealth effects on rivals, suppliers, and corporate customers. *Journal of Financial Economics 76*(1), 61–98. 10, 11

Shleifer, A. and R. W. Vishny (1992). Liquidation values and debt capacity: A market equilibrium approach. *Journal of Finance 47*(4), 1343–1366. 2, 5, 8, 16, 36

Shleifer, A. and R. W. Vishny (1997). The limits of arbitrage. *Journal of Finance 52*(1), 35–55. 6

Shleifer, A. and R. W. Vishny (2003). Stock market driven acquisitions. *Journal of Financial Economics 70*(3), 295–311. 21, 30

Shleifer, A. and R. W. Vishny (2011). Fire sales in finance and macroeconomics. *Journal of Economic Perspectives 25*(1), 29–48. 2, 5

Song, M. H. and R. A. Walkling (2000). Abnormal returns to rivals of acquisition targets: A test of theacquisition probability hypothesis'. *Journal of Financial Economics 55*(2), 143–171. 10

Stigler, G. J. (1964). A theory of oligopoly. *Journal of Political Economy 72*(1), 44–61. 11

Subramanian, G. (2003). Bargaining in the shadow of takeover defenses. *Yale Law Journal 113*(3), 621–686. 21

Vassalou, M. and Y. Xing (2004). Default risk in equity returns. *Journal of Finance 59*(2), 831–868. 12, 58

Figure 1: Components of Corporate Sector Asset Reallocation

This graph shows the components of corporate sector asset reallocation in billions of dollars between 1980 and 2010. The solid line denotes the total annual amount of asset reallocation: sum of acquisitions (Compustat: *acq*) and sales of property, plant and equipment (Compustat: *sppe*). The dotted line denotes total acquisitions of all firms in Compustat. The dashed line denotes sales of property, plant and equipment of all firms in Compustat. This graph shows that acquisitions account for around two-thirds of asset reallocation.

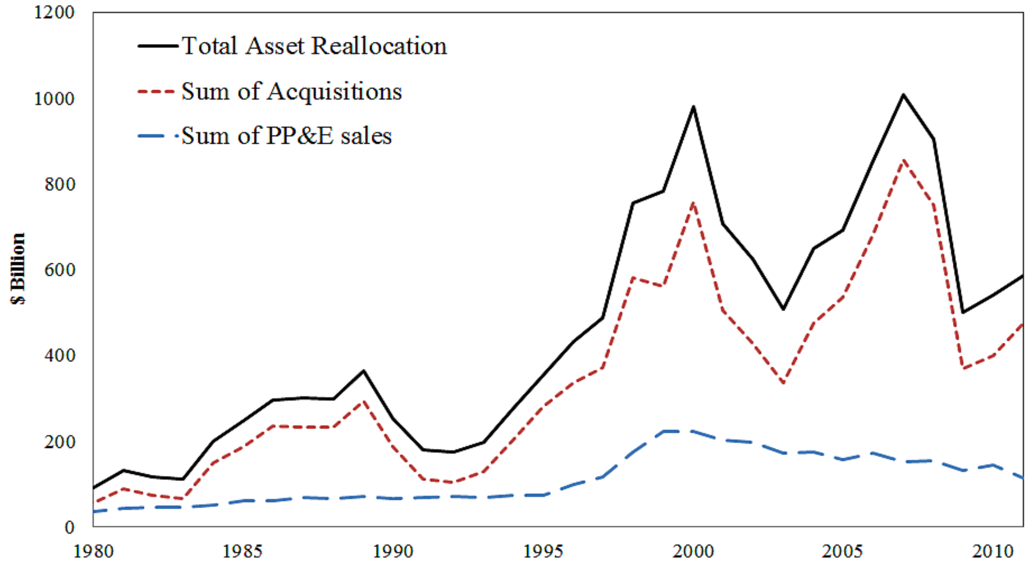

Figure 2: Long-term Abnormal Returns for Acquirers

This figure shows the cumulative abnormal returns (CARs) of acquirers from 20 days before to 200 days after the announcement of acquisitions. The solid line shows CARs for acquirers of a distressed target ($Distress2_T = 1$) in a distressed industry ($Ind.Distress_T = 1$), or fire-sale acquisition. The dotted line shows CARs for acquirers of a distressed target in a non-distressed industry. The dash-dotted line shows CARs for acquirers of a non-distressed target in a distressed industry. The dashed line shows CARs for acquirers of a non-distressed target in a non-distressed industry. Abnormal returns are calculated as the acquirer's return minus a value-weighted market index.

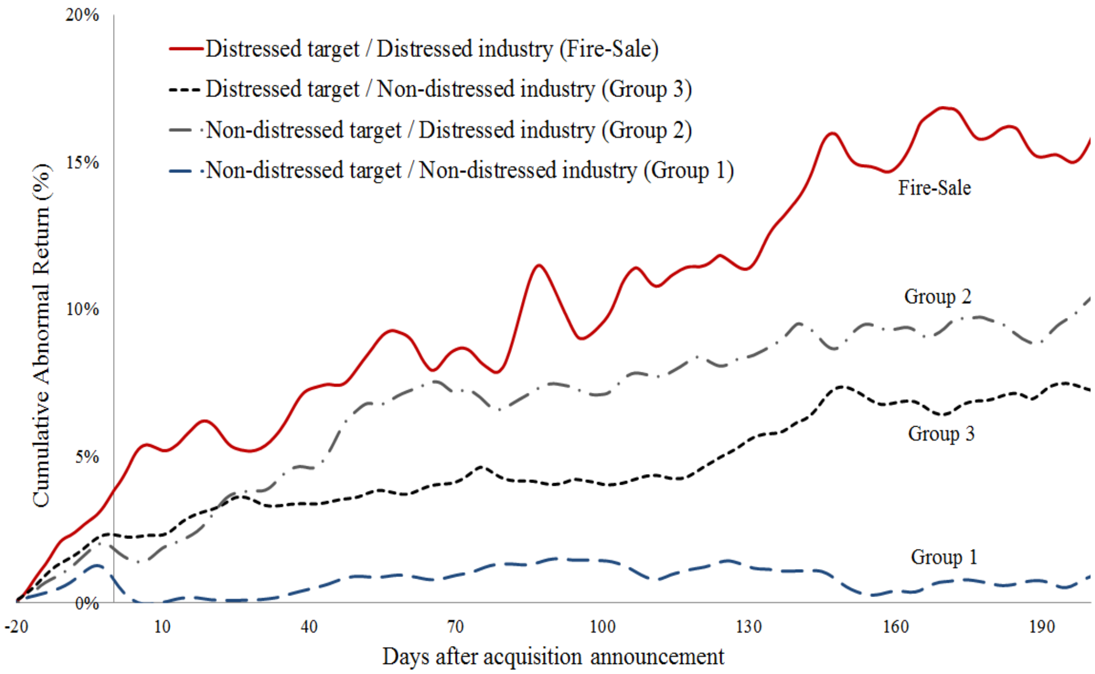

Figure 3: Abnormal Returns for Target Industry Rivals

This figure shows the short-term cumulative abnormal returns (CARs) of target industry rivals from 10 days before to 50 days after the announcement of acquisitions. The solid line shows CARs for rivals of a distressed target ($Distress2_T = 1$) in a distressed industry ($Ind.Distress_T = 1$), or fire-sale acquisition. The dotted line shows CARs for rivals of a distressed target in a non-distressed industry. The dash-dotted line shows CARs for rivals of a non-distressed target in a distressed industry. The dashed line shows CARs for rivals of a non-distressed target in a non-distressed industry. Abnormal returns are calculated as the rival's return minus a value-weighted market index.

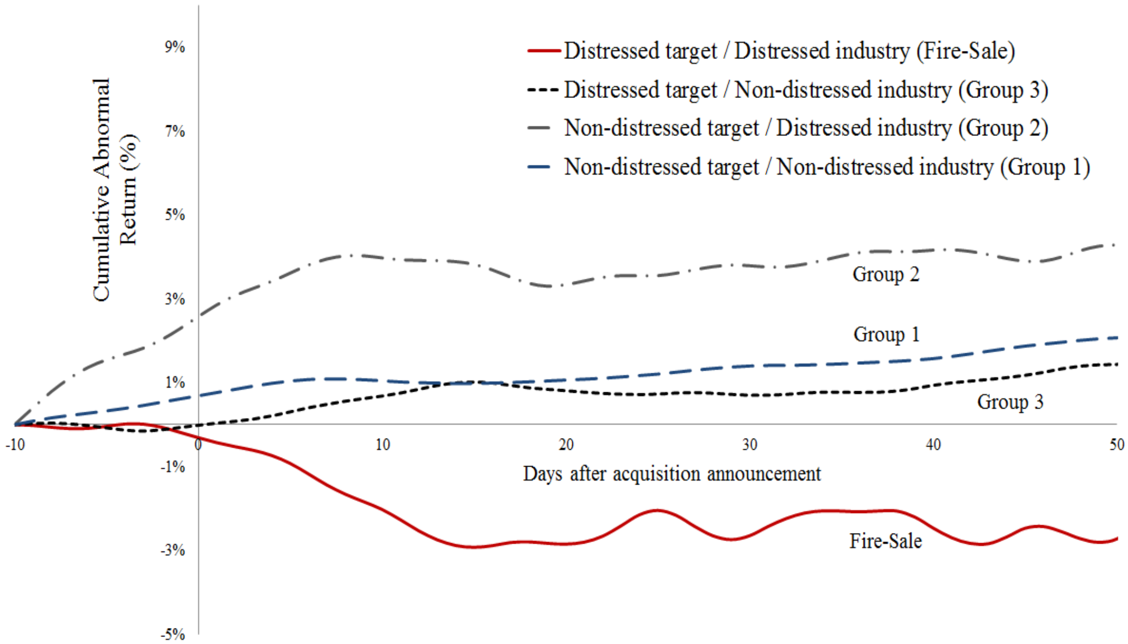

Table 1: Variable Definitions

Variable	Description	Source
$Distress1_T$	EDF index from Distance-to-Default model (Merton (1974))	COMPUSTAT, CRSP
$Distress2_T$	Dummy equal to one if leverage > industry median and current ratio < industry median	COMPUSTAT
$Ind.Distress_T$	Dummy equal to one if median sales growth is negative	COMPUSTAT
CAR(-1, +1)	Cumulative abnormal returns over three days surrounding the announcement (-1, +1) using Fama-French three-factor model	CRSP
$BHAR_A$	The acquirer's buy-and-hold returns during 2 years following acquisition less the buy-and-hold return of a matched firm	COMPUSTAT and CRSP
Ln(Price1)	The log of total enterprise value (RANKVAL)	SDC
Ln(Price2)	The log of total transaction value (TRANSACT)	SDC
Premium	Offer price (PR) divided by target stock price 4 weeks before the announcement (SPRC_4WK)	SDC
$CAR_{Combined}$	The marget equity value weighted average of the target's CAR and acquirer's CAR	COMPUSTAT and CRSP
$DCAR$	CAR(-1, +1) times market equity value 4 weeks prior to the announcement	COMPUSTAT and CRSP
NDCAR (ω^T)	($DCAR_T$ - $DCAR_A$)/(target mkt cap. + acquirer mkt cap.)	Ahern (2011)
$Bargain_T$	$DCAR_T$ /($DCAR_T$ +$DCAR_A$)	
Outsider	Dummy equal to one if the acquirer's 3-digit SIC code is different from the target's	COMPUSTAT
Capital-Specificity	Property, Plant, and. Equipment - Machinery and Equipment (*ppenme*) divided by book value assets	COMPUSTAT
Target Labor Union	Percentage of labor union membership in 3-digit SIC code (Hirsch and Macpherson (2002))	
R&D Intensity	Research and development expense divided by total sales	COMPUSTAT
Size	Market capitalization 4 weeks before announcement	CRSP
Market-to-book	Market value of total assets divided by book value assets	COMPUSTAT and CRSP
Leverage	Total debt (Debt in current liabilities + long-term debt) divided by total book assets	COMPUSTAT
Tangibility	(Total assets - Intangible assets)/Total assets	COMPUSTAT
Profitability	Operating income after depreciation divided by total sales (Profit margin)	COMPUSTAT
Same Industry	Dummy equal to one if target and acquirer in the same 3-digit SIC code	COMPUSTAT
Tender Offer	Dummy equal to one if acquirers issue tender offer	SDC
Toehold	Percentage of shares held by the acquirer at the acquisition announcement	SDC
Competing	Dummy equal to one if the acquirer had to make a counter-offer	SDC
Poison pill	Dummy equal to one if the target has poison pill provision	SDC
Cash Deal	Dummy equal to one if the entire deal value is paid in cash	SDC
Stock Deal	Dummy equal to one if the entire deal value is paid in stock	SDC
Termination Fee	Dummy equal to one if the merger agreement includes a target termination fee	SDC
Recession	NBER defined recession	NBER
ROA-Diff$_T$	Difference of average return on asset for target rivals between post- and pre-acquisition period	COMPUSTAT
Profit-Diff$_T$	Difference of average profitability margin for target rivals between post- and pre-acquisition period	COMPUSTAT

Table 2: Summary Statistics

This table presents the summary statistics for the U.S. acquisitions completed between 1980 and 2010 in which the publicly traded acquiring firm gains control of a public target as listed by SDC. Panels A and B provide pre-acquisition characteristics of target and acquirer, respectively. Panels C and D provide key deal characteristics and major acquisition outcomes. Panel E reports the summary statistics for matched target industry rivals. All variables are defined in Table 1.

	Mean	Std. dev.	25th	50th	75th	Obs.
Panel A. Target Characteristics						
$Distress1_T$ (EDF)	0.112	0.228	0.000	0.001	0.086	1615
$Distress2_T$	0.258	0.438	0.000	0.000	1.000	1615
Industry Distress	0.073	0.260	0.000	0.000	0.000	1615
Log (Assets)	11.776	1.652	10.665	11.658	12.744	1615
Log (Equity)	5.291	1.726	4.092	5.202	6.375	1615
Market/Book	2.106	2.032	1.112	1.491	2.334	1615
Cash	0.231	0.239	0.032	0.137	0.378	1615
Leverage	0.180	0.184	0.010	0.126	0.303	1615
Profitability	0.040	0.254	0.006	0.106	0.164	1612
Tangibility	0.894	0.158	0.853	0.975	1.000	1374
Industry Q	1.771	0.666	1.312	1.619	2.090	1615
Industry Leverage	0.148	0.119	0.047	0.122	0.237	1615
Capital-Specificity	0.157	0.086	1609	0.123	0.128	0.178
Union Membership (%)	9.486	10.849	2.800	5.700	11.500	1525
R&D Intensity	0.108	0.164	0.010	0.073	0.128	1556
Panel B. Acquirer Characteristics						
$Distress1_T$ (EDF)	0.051	0.158	0.000	0.000	0.006	1470
$Distress2_T$	0.315	0.465	0.000	0.000	1.000	1558
Industry Distress	0.081	0.273	0.000	0.000	0.000	1612
Log (Assets)	14.166	2.090	12.652	14.095	15.661	1615
Log (Equity)	7.826	2.207	6.270	7.756	9.401	1615
Market/Book	2.492	2.650	1.310	1.799	2.787	1615
Cash	0.178	0.188	0.034	0.108	0.259	1615
Leverage	0.198	0.161	0.062	0.179	0.293	1615
Profitability	0.144	0.121	0.098	0.154	0.211	1615
Tangibility	0.853	0.174	0.772	0.925	0.992	1353

Table 2: Summary Statistics (continued)

This table presents the summary statistics for the U.S. acquisitions completed between 1980 and 2010 in which the publicly traded acquiring firm gains control of a public target as listed by SDC. Panels A and B provide pre-acquisition characteristics of target and acquirer, respectively. Panels C and D provide key deal characteristics and major acquisition outcomes. Panel E reports the summary statistics for matched target industry rivals. All variables are defined in Table 1.

	Mean	Std. dev.	25th	50th	75th	Obs.
Panel C. Deal Characteristics						
Ln (Price1)	5.388	1.794	4.185	5.285	6.538	1609
Ln (Price2)	5.407	1.762	4.169	5.323	6.550	1615
Premium	0.504	0.932	0.205	0.375	0.633	946
Relative Size	0.841	0.121	0.760	0.849	0.923	1615
Tender Offer	0.251	0.434	0.000	0.000	1.000	1615
Toehold	0.032	0.130	0.000	0.000	0.000	1615
Competing Bidder	0.049	0.216	0.000	0.000	0.000	1615
Cash Payment	0.369	0.483	0.000	0.000	1.000	1615
Stock Payment	0.277	0.448	0.000	0.000	1.000	1615
Termination Fee	0.596	0.491	0.000	1.000	1.000	1536
Same Industry	0.538	0.499	0.000	1.000	1.000	1615
Panel D. Acquisition Outcomes						
CAR_A	-0.010	0.072	-0.040	-0.007	0.020	1615
$BHAR_A$	-0.101	0.802	-0.442	-0.073	0.244	1107
CAR_T	0.233	0.305	0.054	0.176	0.336	1615
$CAR_{Combined}$	0.018	0.078	-0.018	0.009	0.046	1615
NDCAR (ω^T)	0.034	0.074	-0.006	0.022	0.066	1615
$Bargain_T$	0.696	0.388	0.344	1.000	1.000	1469
Panel E. Target Industry Rivals						
Rival CAR	0.003	0.056	-0.027	-0.000	0.034	1154
ROA-Diff$_T$	-0.009	2.168	-0.065	-0.008	0.045	1092
Profit-Diff$_T$	-1.066	20.191	-0.048	0.006	0.064	1048

Table 3: Effects of Fire-Sale on Acquirer Returns: Multivariate Analysis

This table presents the impact of fire-sale on short-run and long-run abnormal returns for acquirers. We specify a regression model:

$$Y_{ijdt} = \beta_1(\underbrace{Ind.D_{it} \times Distress_{it}}_{Fire\text{-}Sale}) + \beta_2 Ind.D_{it} + \beta_3 Distress_{it} + \gamma' X_{ijd} + \alpha_t + \alpha_i + \varepsilon_{ijdt} \quad (11)$$

where $Distress_{it}$ and $Ind.D_{it}$ are the target firm and industry distress measures, respectively, of target i in year t, and X_{ijd} represents control variables for target i, acquirer j, and deal characteristics d. Year fixed effect (α_t) and industry fixed effect (α_i) are also included. In Models (1)-(2), the dependent variable is acquirer's three-day cumulative abnormal return (CAR_A) at announcement of acquisition, estimated using a market model. In Models (3)-(4), the dependent variable is acquirer's buy-and-hold returns ($BHAR_A$) during 2 years following acquisition less buy-and-hold return of a matched firm. The variable of interest is *Fire-Sale* — the interaction between target firm distress ($Distress1_T$, $Distress2_T$) and industry-level distress ($Ind.Distress_T$). $Ind.Distress_T$ is a dummy that equals 1 if the sales growth of the median firm in an industry is negative in the year of the transaction. Control variables for acquirer characteristics are *size*, *leverage*, *m/b*, *tangibility*, and *profitability*. Deal-specific controls include *same industry*, *cash deal*, *stock deal*, *tender offer*, *toehold*, *competing*, *poison pill*, and *termination fee*. Industry fixed effects are at the 3-digit SIC code level. Other variables are defined in Table 1. Robust standard errors clustered at year-industry are reported in parentheses. Coefficients marked ***, ** and * are significant at the 1%, 5%, and 10% level, respectively.

Dep. variable:	CAR_A		$BHAR_A$	
	(1)	(2)	(3)	(4)
Fire-Sale$_1$	0.11***		1.03*	
	(0.04)		(0.57)	
Fire-Sale$_2$		0.05***		0.85***
		(0.01)		(0.18)
$Ind.Distress_T$	0.00	0.01	0.08	0.09
	(0.01)	(0.01)	(0.09)	(0.08)
$Distress1_T$	-0.01		-0.10	
	(0.01)		(0.16)	
$Distress2_T$		0.01		-0.08
		(0.01)		(0.06)
Med. Ind. Q	0.01**	0.01**	0.05	0.05
	(0.01)	(0.01)	(0.09)	(0.09)
Med. Ind. Leverage	-0.00	-0.00	1.48	1.55
	(0.05)	(0.05)	(1.15)	(1.15)
Target Size	-0.01***	-0.01***	-0.05***	-0.05**
	(0.00)	(0.00)	(0.02)	(0.02)
Target Leverage	-0.00	-0.01	-0.36**	-0.34**
	(0.01)	(0.02)	(0.17)	(0.16)
Target M/B	-0.00***	-0.00***	-0.00	-0.00
	(0.00)	(0.00)	(0.02)	(0.02)
Target Tangibility	0.02	0.02	0.00	-0.01
	(0.02)	(0.02)	(0.19)	(0.18)
Target Profitability	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Control: Acq. & Deal	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Obs.	1098	1098	776	776
Adj-R^2	0.09	0.09	0.16	0.16

Table 4: Source of Fire-Sale Discount

This table tests for the impact of fire-sale on offer price, synergy and bargaining outcome. The dependent variables in Panel A are three different measures of offer price for target shareholders from the SDC database, defined as follows: $Ln(Price1)$: the log of total enterprise value, $Ln(Price2)$: the log of total transaction value, and *Premium*: per share offer price divided by target stock price four weeks before the announcement. Panel B presents the effect of fire-sale on synergy and target's bargaining power. In Models (1) and (2), the dependent variable is combined CAR, measured as the market equity value weighted average of the target's CAR (-1, +1) and acquirer's CAR (-1, +1). In Models (3) and (4), the dependent variable is target's bargaining power, $NDCAR(\omega_T)$, estimated as the difference of abnormal dollar returns for the (-1, +1) window between target and acquirer divided by the sum of market equity value of target and acquirer four weeks prior to acquisition announcement. In Models (5) and (6), the dependent variable is $Bargain_T$, calculated as target's abnormal dollar return divided by the combined abnormal dollar returns of acquirer and target. Industry fixed effects are at the 3-digit SIC code level. Control variables are described in Table 3 and a detailed description of each variable is included in Table 1. Robust standard errors clustered at year-industry are reported in parentheses. Coefficients marked ***, ** and * are significant at the 1%, 5%, and 10% level, respectively.

Panel A. Effects of Fire-Sale on Target Offer Price

	Ln(Price1)		Ln(Price2)		Premium	
	(1)	(2)	(3)	(4)	(5)	(6)
$Fire\text{-}Sale_1$	-0.88*		-0.47***		-0.77***	
	(0.51)		(0.14)		(0.27)	
$Fire\text{-}Sale_2$		-0.23		-0.23*		-0.28**
		(0.22)		(0.12)		(0.12)
$Ind.Distress_T$	0.23**	0.15	0.08	0.06	0.09	0.00
	(0.11)	(0.09)	(0.06)	(0.08)	(0.08)	(0.11)
$Distress1_T$	0.30***		0.28***		0.69**	
	(0.10)		(0.09)		(0.28)	
$Distress2_T$		-0.01		-0.05		0.02
		(0.05)		(0.04)		(0.05)
Control: Target & Ind.	Yes	Yes	Yes	Yes	Yes	Yes
Control: Acq. & Deal	Yes	Yes	Yes	Yes	Yes	Yes
Year & Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1078	1167	1098	1098	668	668
Adj-R^2	0.29	0.21	0.11	0.11	0.63	0.62

Panel A. Effects of Fire-Sale on Synergy and Target Bargaining Power

	$CAR_{Combined}$		NDCAR (ω^T)		$Bargain_T$	
	(1)	(2)	(3)	(4)	(5)	(6)
$Fire\text{-}Sale_1$	0.03		-0.10**		-0.41***	
	(0.04)		(0.04)		(0.10)	
$Fire\text{-}Sale_2$		-0.01		-0.05***		-0.19**
		(0.02)		(0.02)		(0.08)
$Ind.Distress_T$	0.00	0.01	0.00	-0.00	0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.06)	(0.06)
$Distress1_T$	-0.01		0.01		-0.00	
	(0.01)		(0.01)		(0.08)	
$Distress2_T$		0.01		-0.01		-0.05
		(0.01)		(0.01)		(0.04)
Control: Target & Ind.	Yes	Yes	Yes	Yes	Yes	Yes
Control: Acq. & Deal	Yes	Yes	Yes	Yes	Yes	Yes
Year & Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1098	1098	1098	1098	1011	1011
Adj-R^2	0.11	0.11	0.18	0.18	0.06	0.06

Table 5: Effects of Fire-Sale on Acquirer Identity

This table presents estimates from probit regressions that explain acquirer identity using target firm- and industry-level distress and the interaction of these two variables. The dependent variable is *Outsider*, a dummy that equals 1 if the acquirer's 3-digit SIC code is different from the target's. Models (1) and (3) exclude control variables for acquirer and deal characteristics; Models (2) and (4) include control variables, as described in Table 3. The variable of interest is *Fire-Sale* — the interaction between target firm distress ($Distress1_T$, $Distress2_T$) and industry-level distress ($Ind.Distress_T$). Industry fixed effects are at the 3-digit SIC code level. A detailed description of each variable is included in Table 1. Robust standard errors clustered at year-industry are reported in parentheses. Coefficients marked ***, ** and * are significant at the 1%, 5%, and 10% level, respectively.

Dep. variable: Outsider	(1)	(2)	(3)	(4)
Fire-Sale$_1$	-0.65	-0.31		
	(0.59)	(0.70)		
Fire-Sale$_2$			-0.34	-0.29
			(0.35)	(0.39)
$Ind.Distress_T$	0.54**	0.49**	0.50**	0.49**
	(0.22)	(0.23)	(0.20)	(0.22)
$Distress1_T$	-0.15	-0.18		
	(0.23)	(0.28)		
$Distress2_T$			-0.17	-0.11
			(0.13)	(0.14)
Med. Ind. Q	-0.30**	-0.32**	-0.29**	-0.32**
	(0.13)	(0.15)	(0.13)	(0.15)
Med. Ind. Leverage	-1.16	-2.23	-1.18	-2.25
	(1.15)	(1.38)	(1.16)	(1.39)
Target Size	0.03	-0.04	0.03	-0.03
	(0.03)	(0.04)	(0.03)	(0.04)
Target Leverage	-0.58*	-0.58*	-0.39	-0.48
	(0.30)	(0.33)	(0.33)	(0.37)
Target M/B	0.05***	0.06*	0.05***	0.06*
	(0.02)	(0.03)	(0.02)	(0.03)
Target Tangibility	-0.52	-0.55	-0.58*	-0.60*
	(0.33)	(0.34)	(0.33)	(0.35)
Target Profitability	0.01*	0.01	0.01*	0.01
	(0.00)	(0.01)	(0.00)	(0.01)
Control: Acq. & Deal	No	Yes	No	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Obs.	1111	916	1111	916
Pseudo-R^2	0.19	0.22	0.19	0.22

Table 6: Effects of Fire-Sale with Outside Acquirers

This table tests whether fire-sale effects are stronger when acquirers are industry outsiders. The dependent variables for acquisition outcomes are as follows. Acquirer return: CAR_A, target offer price: $Ln(Price1)$, target bargaining power: $NDCAR(\omega_T)$, and synergy: $CAR_{Combined}$. The variable of interest is the interaction between *Fire-Sale* and *Outsider*. *Fire-Sale* is the interaction between target firm distress ($Distress1_T$) and industry-level distress ($Ind.Distress_T$). *Outsider* is a dummy variables that equals 1 if the acquirer's 3-digit SIC code is different from the target's. Industry fixed effects are at the 3-digit SIC code level. Control variables are described in Table 3 and a detailed description of each variable is included in Table 1. Robust standard errors clustered at year-industry are reported in parentheses. Coefficients marked ***, ** and * are significant at the 1%, 5%, and 10% level, respectively.

Dep. variable:	CAR_A	Ln(Price1)	NDCAR (ω^T)	$CAR_{Combined}$
	(1)	(2)	(3)	(4)
Fire-Sale$_1$**Outsider*	0.20**	-2.84**	-0.25***	-0.14*
	(0.09)	(1.33)	(0.10)	(0.08)
Fire-Sale$_1$	0.06	-0.36	-0.03	0.06**
	(0.04)	(0.33)	(0.04)	(0.02)
$Ind.Dist._T$**Outsider*	-0.02	0.10	0.03**	0.01
	(0.02)	(0.15)	(0.01)	(0.02)
$Dist.1_T$**Outsider*	-0.02	0.15	0.02	-0.01
	(0.03)	(0.23)	(0.02)	(0.02)
$Ind.Distress_T$	0.01	0.18*	-0.01	-0.00
	(0.01)	(0.10)	(0.01)	(0.01)
$Distress1_T$	-0.00	0.30**	0.00	-0.01
	(0.01)	(0.14)	(0.01)	(0.01)
Outsider	0.00	-0.11**	-0.01	-0.01
	(0.01)	(0.05)	(0.01)	(0.01)
Med. Ind. Q	0.01**	-0.00	-0.01	0.01*
	(0.01)	(0.05)	(0.01)	(0.01)
Med. Ind. Leverage	-0.01	0.42	0.06	0.06
	(0.05)	(0.40)	(0.06)	(0.07)
Target Size	-0.01***	0.88***	0.02***	0.01**
	(0.00)	(0.03)	(0.00)	(0.00)
Target Leverage	-0.00	0.79***	-0.02	-0.00
	(0.02)	(0.11)	(0.01)	(0.02)
Target M/B	-0.00***	0.00	0.00	-0.01***
	(0.00)	(0.01)	(0.00)	(0.00)
Target Tangibility	0.02	-0.65***	-0.01	0.02
	(0.02)	(0.14)	(0.02)	(0.02)
Target Profitability	0.00	0.00	-0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Control: Acq. & Deal	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Obs.	1098	1093	1098	1098
Adj-R^2	0.09	0.92	0.19	0.12

Table 7: Effects of Fire-Sale and Industry Capital-Specificity

This table examines whether fire-sale effects are stronger when target industries have high industry-level capital-specificity. Industry capital specificity is measured by the industry's machinery and equipment (*ppenme*) scaled by the book value of total assets obtained from Compustat. I define an industry to be a high capital-specificity industry if the median value of *ppenme/at* across firms and year within the 3-digit code is above the overall median. Panel A includes only acquisitions in high capital-specificity industries and Panel B includes only acquisitions in low capital-specificity industries. The dependent variables for acquisition outcomes are as follows. Acquirer return: CAR_A, target offer price: $Ln(Price1)$, target bargaining power: $NDCAR(\omega_T)$, and synergy: $CAR_{Combined}$. Industry fixed effects are at the 3-digit SIC code level. Control variables are described in Table 3 and a detailed description of each variable is included in Table 1. Robust standard errors clustered at year-industry are reported in parentheses. For the robustness check, I also report the result based on a dummy variable $Distress2_T$ in Table A.3. Coefficients marked ***, ** and * are significant at the 1%, 5%, and 10% level, respectively.

Panel A. High Capital-Specificity Industries

Dep. variable:	CAR_A	Ln(Price1)	NDCAR (ω^T)	$CAR_{Combined}$
	(1)	(2)	(3)	(4)
Fire-Sale$_1$	0.13***	-2.75*	-0.12***	-0.01
	(0.04)	(1.43)	(0.04)	(0.05)
$Ind.Distress_T$	0.01	0.16	-0.03	-0.02
	(0.01)	(0.13)	(0.02)	(0.03)
$Distress1_T$	-0.03	0.45**	0.03**	-0.02
	(0.02)	(0.18)	(0.02)	(0.02)
Control: Target & Ind.	Yes	Yes	Yes	Yes
Control: Acq. & Deal	Yes	Yes	Yes	Yes
Year & Industry FE	Yes	Yes	Yes	Yes
Obs.	517	514	517	517
Adj-R^2	0.01	0.92	0.18	0.14

Panel B. Low Capital-Specificity Industries

Dep. variable:	CAR_A	Ln(Price1)	NDCAR (ω^T)	$CAR_{Combined}$
	(1)	(2)	(3)	(4)
Fire-Sale$_1$	0.09**	-0.33	-0.08**	0.08*
	(0.04)	(0.27)	(0.04)	(0.04)
$Ind.Distress_T$	0.01	0.20	0.00	0.01
	(0.01)	(0.14)	(0.01)	(0.01)
$Distress1_T$	-0.01	0.32**	-0.00	-0.01
	(0.01)	(0.14)	(0.02)	(0.01)
Control: Target & Ind.	Yes	Yes	Yes	Yes
Control: Acq. & Deal	Yes	Yes	Yes	Yes
Year & Industry FE	Yes	Yes	Yes	Yes
Obs.	578	576	578	578
Adj-R^2	0.15	0.92	0.17	0.13

Table 8: Effects of Fire-Sale and Labor Union

This table examines whether fire-sale effects are stronger when target industries have strong labor unions. Industry labor unionization is measured by the percentage of unionized workers in each industry. I define an industry to be a strong labor union industry if the union membership at 3-digit SIC industry-level is above the overall median. Panel A includes only acquisitions in strong labor union industries and Panel B includes only acquisitions in weak labor union industries. The dependent variables for acquisition outcomes are as follows. Acquirer return: CAR_A, target offer price: $Ln(Price1)$, target bargaining power: $NDCAR(\omega_T)$, and synergy: $CAR_{Combined}$. Industry fixed effects are at the 3-digit SIC code level. Control variables are described in Table 3 and a detailed description of each variable is included in Table 1. Robust standard errors clustered at year-industry are reported in parentheses. For the robustness check, I also report the result based on a dummy variable $Distress2_T$ in Table A.4. Coefficients marked ***, ** and * are significant at the 1%, 5%, and 10% level, respectively.

Panel A. Strong Labor Union Industries

Dep. variable:	CAR_A	Ln(Price1)	NDCAR (ω^T)	$CAR_{Combined}$
	(1)	(2)	(3)	(4)
Fire-Sale$_1$	0.20***	-4.22**	-0.19***	0.01
	(0.05)	(1.75)	(0.04)	(0.05)
$Ind.Distress_T$	-0.00	0.33*	-0.03	-0.02
	(0.01)	(0.19)	(0.02)	(0.03)
$Distress1_T$	-0.05	0.63***	0.06**	-0.03
	(0.03)	(0.19)	(0.03)	(0.03)
Control: Target & Ind.	Yes	Yes	Yes	Yes
Control: Acq. & Deal	Yes	Yes	Yes	Yes
Year & Industry FE	Yes	Yes	Yes	Yes
Obs.	491	490	491	491
Adj-R^2	0.03	0.91	0.21	0.17

Panel B. Weak Labor Union Industries

Dep. variable:	CAR_A	Ln(Price1)	NDCAR (ω^T)	$CAR_{Combined}$
	(1)	(2)	(3)	(4)
Fire-Sale$_1$	0.08*	-0.29	-0.06	0.08**
	(0.05)	(0.31)	(0.05)	(0.04)
$Ind.Distress_T$	-0.00	0.10	0.01	0.00
	(0.01)	(0.12)	(0.01)	(0.01)
$Distress1_T$	0.01	0.37***	-0.01	-0.00
	(0.02)	(0.14)	(0.02)	(0.01)
Control: Target & Ind.	Yes	Yes	Yes	Yes
Control: Acq. & Deal	Yes	Yes	Yes	Yes
Year & Industry FE	Yes	Yes	Yes	Yes
Obs.	572	568	572	572
Adj-R^2	0.15	0.92	0.19	0.08

Table 9: Effects of Fire-Sale and R&D Intensity

This table examines whether fire-sale effects are stronger when target industries have high R&D intensity. R&D intensity is measured by research and development expenses scaled by sales. I define an industry to be a high (low) R&D industry if the R&D intensity at 3-digit SIC industry-level is above (below) the overall median. Panel A includes only acquisitions in intense R&D industries and Panel B includes only acquisitions in low R&D industries. The dependent variables for acquisition outcomes are as follows. Acquirer return: CAR_A, target offer price: $Ln(Price1)$, target bargaining power: $NDCAR(\omega_T)$, and synergy: $CAR_{Combined}$. Industry fixed effects are at the 3-digit SIC code level. Control variables are described in Table 3 and a detailed description of each variable is included in Table 1. Robust standard errors clustered at year-industry are reported in parentheses. For the robustness check, I also report the result based on a dummy variable $Distress2_T$ in Table A.5. Coefficients marked ***, ** and * are significant at the 1%, 5%, and 10% level, respectively.

Panel A. High R&D Industries

Dep. variable:	CAR_A	Ln(Price1)	NDCAR (ω^T)	$CAR_{Combined}$
	(1)	(2)	(3)	(4)
Fire-Sale$_1$	0.16***	-1.07**	-0.13***	0.07
	(0.05)	(0.43)	(0.05)	(0.05)
$Ind.Distress_T$	-0.02	0.10	0.02	0.01
	(0.04)	(0.29)	(0.03)	(0.04)
$Distress1_T$	0.01	0.25	-0.01	-0.01
	(0.02)	(0.15)	(0.02)	(0.02)
Control: Target & Ind.	Yes	Yes	Yes	Yes
Control: Acq. & Deal	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Obs.	538	533	538	538
Adj-R^2	0.09	0.91	0.20	-0.04

Panel B. Low R&D Industries

Dep. variable:	CAR_A	Ln(Price1)	NDCAR (ω^T)	$CAR_{Combined}$
	(1)	(2)	(3)	(4)
Fire-Sale$_1$	-0.07	1.59	0.22	0.17
	(0.17)	(1.08)	(0.22)	(0.21)
$Ind.Distress_T$	-0.09	-0.01	0.10	-0.06
	(0.07)	(0.45)	(0.09)	(0.09)
$Distress1_T$	-0.01	0.96***	0.00	-0.02
	(0.04)	(0.27)	(0.06)	(0.05)
Control: Target & Ind.	Yes	Yes	Yes	Yes
Control: Acq. & Deal	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Obs.	522	522	522	522
Adj-R^2	0.25	0.96	0.09	0.26

Table 10: Effects of Fire-Sale on Target Industry Rival CARs(%)

This table presents the impact of fire-sale on abnormal returns for target industry rivals in the same 4-digit SIC code. The dependent variables are matched rivals' abnormal stock returns (%) at the announcement of acquisition. Models (1) and (2) are for all matched rivals, Models (3)-(4) for the matched sample in high R&D industries, and Models (5)-(6) for the matched sample in low R&D industries. I define an industry to be a high (low) R&D industry if the industry-level R&D intensity is above (below) the overall median. R&D intensity is measured by research and development expenses scaled by total sales. The target rivals are matched based on same industry, size, and M/B. CARs (%) are cumulative abnormal returns for the (-1, +1) window surrounding the announcement of acquisitions. The variable of interest is *Fire-Sale* — the interaction between target firm distress ($Distress1_T$, $Distress2_T$) and industry-level distress ($Ind.Distress_T$). Control variables are described in Table 3 and a detailed description of each variable is included in Table 1. Additional control variables for rival characteristics are *industry concentration(HHI)*, *size*, *leverage*, *m/b*, *tangibility*, and *profitability*. Robust standard errors clustered at year-industry are reported in parentheses. Coefficients marked ***, ** and * are significant at the 1%, 5%, and 10% level, respectively.

Dep. variable: Rival CAR(%)	All Matched Rivals		High R&D Industries		Low R&D Industries	
	(1)	(2)	(3)	(4)	(5)	(6)
$Fire\text{-}Sale_1$	-4.59*		-6.15**		-3.88	
	(2.45)		(2.75)		(3.56)	
$Fire\text{-}Sale_2$		-3.96**		-5.97***		-4.19
		(1.97)		(2.18)		(2.67)
$Ind.Distress_T$	0.44	0.35	0.22	-0.17	2.60	3.14
	(1.19)	(1.30)	(1.66)	(1.61)	(1.81)	(2.57)
$Distress1_T$	-0.06		-1.15		1.12	
	(1.83)		(2.52)		(2.58)	
$Distress2_T$		0.30		-1.26		1.88
		(0.68)		(1.02)		(1.14)
Med. Ind. Q	0.93	0.89	1.65	1.45	-0.41	0.39
	(0.87)	(0.83)	(1.09)	(1.04)	(1.78)	(1.60)
Med. Ind. Leverage	5.06	5.74	9.19	6.76	-5.70	0.53
	(7.19)	(7.16)	(12.24)	(12.17)	(10.34)	(10.73)
HHI	-4.19	-3.43	-8.82	-8.26	-5.56	-3.07
	(4.28)	(4.25)	(5.69)	(5.93)	(8.80)	(8.05)
Rival Size	0.26	0.18	0.94	0.74	-0.54	-0.52
	(0.59)	(0.50)	(0.79)	(0.70)	(1.06)	(0.79)
Rival Leverage	0.49*	0.45*	0.48	0.28	0.74	1.07*
	(0.27)	(0.26)	(0.34)	(0.35)	(0.65)	(0.61)
Rival M/B	2.76	2.45	1.88	1.06	2.69	2.81
	(1.80)	(1.70)	(2.86)	(2.94)	(2.39)	(2.07)
Rival Tangibility	-1.91	-2.25	0.32	0.53	-8.28**	-8.77**
	(2.00)	(2.14)	(2.43)	(2.77)	(3.70)	(3.61)
Rival Profitability	0.00***	0.00***	0.00***	0.00***	-0.01	0.01
	(0.00)	(0.00)	(0.00)	(0.00)	(0.02)	(0.02)
Control: Target & Deal	Yes	Yes	Yes	Yes	Yes	Yes
Control: Acq.	No	No	No	No	No	No
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	714	753	367	382	347	371
R^2	0.24	0.24	0.21	0.20	0.40	0.40

Table 11: Effects of Fire-Sale on Target Industry Rivals' Operating Performance

This table presents the impact of fire-sale on matched target rivals' operating performance. In Models (1) and (2), the dependent variable is the difference of average ROA (net income/total book assets), before (t-3, t-1) and after (t+1, t+3) acquisition. In Models (3) and (4), the dependent variable is the difference of average profitability margin (operating cash flow/total sales), before (t-3, t-1) and after (t+1, t+3) acquisition. The variable of interest is *Fire-Sale* — the interaction between target firm distress ($Distress1_T$, $Distress2_T$) and industry-level distress ($Ind.Distress_T$). Control variables are described in Table 3 and a detailed description of each variable is included in Table 1. Additional control variables for rival characteristics are *industry concentration(HHI)*, *size*, *leverage*, *m/b*, *tangibility*, and $profitability$. Robust standard errors clustered at year-industry are reported in parentheses. Coefficients marked ***, ** and * are significant at the 1%, 5%, and 10% level, respectively.

Dep. variable:	Profit_Diff		ROA_Diff	
	(1)	(2)	(3)	(4)
Fire-Sale$_1$	1.05		-0.44	
	(15.98)		(0.60)	
Fire-Sale$_2$		-3.42		-0.29
		(10.00)		(0.39)
$Ind.Distress_T$	-4.11	0.34	0.15	0.38
	(6.60)	(6.28)	(0.31)	(0.38)
$Distress1_T$	11.35		0.10	
	(16.70)		(0.27)	
$Distress2_T$		6.20		0.26
		(6.70)		(0.23)
Med. Ind. Q	10.45	5.71	0.03	0.12
	(8.98)	(7.66)	(0.24)	(0.29)
Med. Ind. Leverage	54.08	38.10	2.88	3.22
	(58.16)	(50.08)	(3.01)	(3.26)
HHI	-23.12	-31.65	-0.05	0.03
	(31.08)	(30.19)	(0.56)	(0.75)
Rival Size	-1.59	-1.90	-0.03	-0.03
	(2.96)	(3.13)	(0.06)	(0.11)
Rival Leverage	-17.51	-15.06	0.10	0.08
	(11.89)	(11.16)	(0.08)	(0.12)
Rival M/B	-24.71	-20.88	0.01	0.41
	(19.02)	(17.05)	(0.28)	(0.46)
Rival Tangibility	13.00	13.38	-0.14	0.02
	(16.55)	(15.69)	(0.26)	(0.40)
Rival Profitability	0.00***	0.00***	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Control: Target	Yes	Yes	Yes	Yes
Control: Acq. & Deal	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Obs.	286	305	294	314
Adj-R^2	0.65	0.68	0.30	0.37

APPENDIX

A Distance-to-Default Model

The KMV-Merton model estimates a default probability based on the bond pricing model by Merton (1974). It calculates the probability that the value of the firm will be less than the face value of debt at given point in time. The model requires market equity value (E) and face value of debt (F) from COMPUSTAT and risk-free rate of return(r). Following Vassalou and Xing (2004), the face value of debt (F) is calculated by (Current liability + 0.5 * Long-term debt).[30] I follow Bharath and Shumway (2008) to construct this measure as given below.

Step 1: Estimate the equity volatility (σ_E) from historical stock returns over the past one year (set T=1).

Step 2: Simultaneously solve the below two equations numerically for values of V and σ_V.

$$E = VN(d_1) - e^{-rT}FN(d_2)$$
$$\sigma_E = (\frac{V}{E})N(d_1)\sigma_V$$

Step 3: Calculate the distance to default using

$$DD = \frac{ln(V/F) + (r + 0.5\sigma_V^2)T}{\sigma_V \sqrt{T}}$$

The corresponding probability of default (EDF) is $N(-DD)$.

[30]Vassalou and Xing (2004) highlights that long-term liabilities should be taken into account for corporate default risk because long-term debt influences the solvency of firm through interest payments and the roll-over decision of short-term debt.

B Computation of target undervaluation

Follow Rhodes-Kropf et al. (2005), I construct the measure for target undervaluation by decomposing the market-to-book ratio into three components: the firm-specific error; industry-wide short-run error and long-run growth option based on the below equation.

$$m_{it} - b_{it} = \underbrace{m_{it} - v(\theta_{it}; \alpha_{jt})}_{\text{firm}} + \underbrace{v(\theta_{it}; \alpha_{jt}) - v(\theta_{it}; \alpha_j)}_{\text{sector}} + \underbrace{v(\theta_{it}; \alpha_j) - b_{it}}_{\text{long-run}}$$

where $m_{it} - b_{it}$ is the natural log of the market to book ratio of firm i at time t. $v(\theta_{it}; \alpha_{jt})$ is the estimated fundamental value of the firm i at time t by applying industry-specific model parameter α_{jt} for industry j at time t, and $v(\theta_{it}; \alpha_j)$ is the long-run average fundamental value of the firm estimated based on industry average parameter α_j. The first step is to estimate the market value of firm i at time t, m_{it} based on the below regression (Model 3 in Rhodes-Kropf et al. (2005)).

$$m_{it} = \alpha_{0jt} + \alpha_{1jt} b_{it} + \alpha_{2jt} ni^+_{it} + \alpha_{3jt} I_{(<0)}(ni^+)_{it} + \alpha_{4jt} Lev_{it} + \varepsilon_i$$

Where b_{it} is the logs of book asset value, ni^+_{it} is natural log of the absolute value of net income and $I_{(<0)}$ is an indicator function for negative net income. This estimation provides the set of firm-specific loading α_{jt} for each accounting variable. Then, I calculate α_j by aggregating α_{jt} over the sample period. Lastly, using the fitted parameters, I calculate $v(\theta_{it}; \alpha_{jt})$ and $v(\theta_{it}; \alpha_j)$.

$$v(\theta_{it}; \alpha_{jt}) = \alpha_{0jt} + \alpha_{1jt} b_{it} + \alpha_{2jt} ni^+_{it} + \alpha_{3jt} I_{(<0)}(ni^+)_{it} + \alpha_{4jt} Lev_{it}$$

$$v(\theta_{it}; \alpha_j) = \alpha_{0j} + \alpha_{1j} b_{it} + \alpha_{2j} ni^+_{it} + \alpha_{3j} I_{(<0)}(ni^+)_{it} + \alpha_{4j} Lev_{it}$$

Table A.1: Robustness Check: Quantile Regression for Acquirer Returns

This table presents coefficient estimates from quantile regressions on abnormal returns for acquirers. CARs are acquirer's three-day cumulative abnormal returns (CAR_A) at announcement of acquisition, estimated using a market model. Column (1) is for mean, column (2) for 25th quantile, column (3) for 50th quantile, and column (4) for 75th quantile. The variable of interest is *Fire-Sale* — the interaction between target firm distress ($Distress1_T$) and industry-level distress ($Ind.Distress_T$). Industry fixed effects are at the 3-digit SIC code level. Control variables are described in Table 3 and a detailed description of each variable is included in Table 1. Robust standard errors clustered at year-industry are reported in parentheses. Coefficients marked ***, ** and * are significant at the 1%, 5%, and 10% level, respectively.

Dep. variable: CAR_A	(1) Mean	(2) QR_25th	(3) QR_50th	(4) QR_75th
Fire-Sale$_1$	0.11***	0.06***	0.04*	0.11***
	(0.04)	(0.02)	(0.02)	(0.02)
$Ind.Distress_T$	0.00	-0.00	-0.00	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)
$Distress1_T$	-0.01	-0.02***	-0.01*	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Med. Ind. Q	0.01**	0.00	0.01**	0.00
	(0.01)	(0.00)	(0.00)	(0.00)
Med. Ind. Leverage	-0.00	0.01	0.03	0.02
	(0.05)	(0.02)	(0.02)	(0.02)
Target Size	-0.01***	-0.01***	-0.01***	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
Target Leverage	-0.00	-0.01	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Target M/B	-0.00***	-0.00*	-0.00*	-0.00**
	(0.00)	(0.00)	(0.00)	(0.00)
Target Tangibility	0.02	0.01	-0.01	0.01
	(0.02)	(0.01)	(0.01)	(0.01)
Target Profitability	0.00	-0.00	0.00**	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)
Control: Acq. & Deal	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Obs.	1098	1199	1098	1098
Adj-R^2	0.09	0.11	0.06	0.04

Table A.2: Robustness Check: Effects of Fire-Sale with Outside Acquirers (2-digit SIC)

This table tests whether fire-sale effects are stronger when acquirers are industry outsiders. The dependent variables for acquisition outcomes are as follows. Acquirer return: CAR_A, target offer price: $Ln(Price1)$, target bargaining power: $NDCAR(\omega_T)$, and synergy: $CAR_{Combined}$. The variable of interest is the interaction between *Fire-Sale* and *Outsider*. *Fire-Sale* is the interaction between target firm distress ($Distress1_T$, $Distress2_T$) and industry-level distress ($Ind.Distress_T$). *Outsider* is a dummy variables that equals 1 if the acquirer's 2-digit SIC code is different from the target's. Industry fixed effects are at the 3-digit SIC code level. Control variables are described in Table 3 and a detailed description of each variable is included in Table 1. Robust standard errors clustered at year-industry are reported in parentheses. Coefficients marked ***, ** and * are significant at the 1%, 5%, and 10% level, respectively.

Dep. variable: Outsider	(1)	(2)	(3)	(4)
Fire-Sale$_1$	-0.77	-0.39		
	(0.63)	(0.71)		
Fire-Sale$_2$			-0.22	-0.15
			(0.34)	(0.40)
$Ind.Distress_T$	0.67***	0.57**	0.60***	0.53**
	(0.22)	(0.24)	(0.21)	(0.22)
$Distress1_T$	-0.11	-0.08		
	(0.24)	(0.28)		
$Distress2_T$			-0.22*	-0.16
			(0.13)	(0.15)
Med. Ind. Q	-0.29**	-0.24	-0.28**	-0.23
	(0.13)	(0.15)	(0.13)	(0.15)
Med. Ind. Leverage	-1.69	-2.46*	-1.75	-2.54*
	(1.21)	(1.38)	(1.22)	(1.39)
Target Size	0.01	-0.06	0.02	-0.06
	(0.03)	(0.04)	(0.03)	(0.04)
Target Leverage	-0.38	-0.39	-0.12	-0.22
	(0.31)	(0.34)	(0.35)	(0.37)
Target M/B	0.04**	0.04	0.04**	0.04
	(0.02)	(0.03)	(0.02)	(0.03)
Target Tangibility	-0.46	-0.49	-0.51	-0.54
	(0.33)	(0.35)	(0.34)	(0.35)
Target Profitability	0.01**	0.01***	0.01**	0.01**
	(0.00)	(0.00)	(0.00)	(0.00)
Control: Acq. & Deal	No	Yes	No	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes
Obs.	1107	926	1107	926
Pseudo-R^2	0.16	0.20	0.16	0.20

Table A.3: Robustness Check: Effects of Fire-Sale and Industry Capital-Specificity

This table examines whether fire-sale effects are stronger when target industries have high industry-level capital-specificity. Industry capital specificity is measured by the industry's machinery and equipment (*ppenme*) scaled by the book value of total assets obtained from Compustat. I define an industry to be a high capital-specificity industry if the median value of *ppenme/at* across firms and year within the 3-digit code is above the overall median. Panel A includes only acquisitions in high capital-specificity industries and Panel B includes only acquisitions in low capital-specificity industries. The dependent variables for acquisition outcomes are as follows. Acquirer return: CAR_A, target offer price: $Ln(Price1)$, target bargaining power: $NDCAR(\omega_T)$, and synergy: $CAR_{Combined}$. Industry fixed effects are at the 3-digit SIC code level. Control variables are described in Table 3 and a detailed description of each variable is included in Table 1. Robust standard errors clustered at year-industry are reported in parentheses. Coefficients marked ***, ** and * are significant at the 1%, 5%, and 10% level, respectively.

Panel A. High Capital-Specificity Industries

Dep. variable:	CAR_A	Ln(Price1)	NDCAR (ω^T)	$CAR_{Combined}$
	(1)	(2)	(3)	(4)
Fire-Sale$_2$	0.11***	-0.62**	-0.10***	0.03
	(0.04)	(0.28)	(0.03)	(0.02)
$Ind.Distress_T$	0.01	0.07	-0.03	-0.02
	(0.01)	(0.15)	(0.02)	(0.03)
$Distress2_T$	-0.01	0.04	0.01	-0.00
	(0.01)	(0.08)	(0.01)	(0.01)
Control: Target & Ind.	Yes	Yes	Yes	Yes
Control: Acq. & Deal	Yes	Yes	Yes	Yes
Year & Industry FE	Yes	Yes	Yes	Yes
Obs.	517	514	517	517
Adj-R^2	0.03	0.91	0.18	0.14

Panel B. Low Capital-Specificity Industries

Dep. variable:	CAR_A	Ln(Price1)	NDCAR (ω^T)	$CAR_{Combined}$
	(1)	(2)	(3)	(4)
Fire-Sale$_2$	0.00	-0.06	-0.01	-0.02
	(0.01)	(0.16)	(0.01)	(0.02)
$Ind.Distress_T$	0.03	0.18	-0.01	0.03
	(0.02)	(0.13)	(0.01)	(0.02)
$Distress2_T$	0.01	0.10	-0.01	0.02
	(0.01)	(0.06)	(0.01)	(0.01)
Control: Target & Ind.	Yes	Yes	Yes	Yes
Control: Acq. & Deal	Yes	Yes	Yes	Yes
Year & Industry FE	Yes	Yes	Yes	Yes
Obs.	578	576	578	578
Adj-R^2	0.15	0.92	0.17	0.13

Table A.4: Robustness Check: Effects of Fire-Sale and Labor Union

This table examines whether fire-sale effects are stronger when target industries have strong labor unions. Industry labor unionization is measured by the percentage of unionized workers in each industry. I define an industry to be a strong labor union industry if the union membership at 3-digit SIC industry-level is above the overall median. Panel A includes only acquisitions in strong labor union industries and Panel B includes only acquisitions in weak labor union industries. The dependent variables for acquisition outcomes are as follows. Acquirer return: CAR_A, target offer price: $Ln(Price1)$, target bargaining power: $NDCAR(\omega_T)$, and synergy: $CAR_{Combined}$. Industry fixed effects are at the 3-digit SIC code level. Control variables are described in Table 3 and a detailed description of each variable is included in Table 1. Robust standard errors clustered at year-industry are reported in parentheses. Coefficients marked ***, ** and * are significant at the 1%, 5%, and 10% level, respectively.

Panel A. Strong Labor Union Industries

Dep. variable:	CAR_A	Ln(Price1)	NDCAR (ω^T)	$CAR_{Combined}$
	(1)	(2)	(3)	(4)
Fire-Sale$_2$	0.12*	-0.86	-0.10*	0.02
	(0.06)	(0.77)	(0.05)	(0.02)
$Ind.Distress_T$	-0.00	0.13	-0.03	-0.03
	(0.01)	(0.18)	(0.02)	(0.03)
$Distress2_T$	-0.02	0.01	-0.00	-0.02
	(0.01)	(0.09)	(0.01)	(0.01)
Control: Target & Ind.	Yes	Yes	Yes	Yes
Control: Acq. & Deal	Yes	Yes	Yes	Yes
Year & Industry FE	Yes	Yes	Yes	Yes
Obs.	491	490	491	491
Adj-R^2	0.03	0.90	0.19	0.17

Panel B. Weak Labor Union Industries

Dep. variable:	CAR_A	Ln(Price1)	NDCAR (ω^T)	$CAR_{Combined}$
	(1)	(2)	(3)	(4)
Fire-Sale$_2$	0.02	-0.01	-0.03**	0.00
	(0.02)	(0.14)	(0.01)	(0.03)
$Ind.Distress_T$	0.01	0.08	0.01	0.01
	(0.01)	(0.11)	(0.01)	(0.01)
$Distress2_T$	0.01*	0.10*	-0.00	0.02*
	(0.01)	(0.05)	(0.01)	(0.01)
Control: Target & Ind.	Yes	Yes	Yes	Yes
Control: Acq. & Deal	Yes	Yes	Yes	Yes
Year & Industry FE	Yes	Yes	Yes	Yes
Obs.	572	568	572	572
Adj-R^2	0.15	0.92	0.18	0.09

Table A.5: Robustness Check: Effects of Fire-Sale and R&D Intensity

This table examines whether fire-sale effects are stronger when target industries have high R&D intensity. R&D intensity is measured by research and development expenses scaled by sales. I define an industry to be a high (low) R&D industry if the R&D intensity at 3-digit SIC industry-level is above (below) the overall median. Panel A includes only acquisitions in intense R&D industries and Panel B includes only acquisitions in low R&D industries. The dependent variables for acquisition outcomes are as follows. Acquirer return: CAR_A, target offer price: $Ln(Price1)$, target bargaining power: $NDCAR(\omega_T)$, and synergy: $CAR_{Combined}$. Industry fixed effects are at the 3-digit SIC code level. Control variables are described in Table 3 and a detailed description of each variable is included in Table 1. Robust standard errors clustered at year-industry are reported in parentheses. Coefficients marked ***, ** and * are significant at the 1%, 5%, and 10% level, respectively.

Panel A. High R&D Industries

Dep. variable:	CAR_A	Ln(Price1)	NDCAR (ω^T)	$CAR_{Combined}$
	(1)	(2)	(3)	(4)
Fire-Sale$_2$	0.05*	-0.55**	-0.06**	-0.00
	(0.03)	(0.25)	(0.03)	(0.03)
$Ind.Distress_T$	0.00	0.01	0.00	0.02
	(0.04)	(0.28)	(0.01)	(0.04)
$Distress2_T$	0.02	0.16*	-0.00	0.02
	(0.01)	(0.08)	(0.01)	(0.01)
Control: Target & Ind.	Yes	Yes	Yes	Yes
Control: Acq. & Deal	Yes	Yes	Yes	Yes
Year & Industry FE	Yes	Yes	Yes	Yes
Obs.	538	533	538	538
Adj-R^2	0.08	0.91	0.16	-0.04

Panel B. Low R&D Industries

Dep. variable:	CAR_A	Ln(Price1)	NDCAR (ω^T)	$CAR_{Combined}$
	(1)	(2)	(3)	(4)
Fire-Sale$_2$	0.02	0.72	0.04	0.07
	(0.07)	(0.51)	(0.10)	(0.09)
$Ind.Distress_T$	-0.07	-0.15	0.08	-0.06
	(0.07)	(0.48)	(0.09)	(0.09)
$Distress2_T$	0.02	0.17	-0.03	-0.00
	(0.02)	(0.11)	(0.02)	(0.02)
Control: Target & Ind.	Yes	Yes	Yes	Yes
Control: Acq. & Deal	Yes	Yes	Yes	Yes
Year & Industry FE	Yes	Yes	Yes	Yes
Obs.	522	522	522	522
Adj-R^2	0.26	0.95	0.10	0.25

Table A.6: Robustness Check: Descriptive Statistics

The table contains the descriptive statistics for key variables in robustness tests. Panel A provides the summary for target misvaluation by decomposing market-to-book ratio (M/B) into target firm-specific error, industry-wide short-run error, and long-run growth option based on Appendix B. Panel B provides the summary for macroeconomic variables including *Recession*, annual GDP growth rate(%) and spread between Aaa corporate bond and Bbb bond (%).A target is classified as distressed, based on a dummy variable $Distress2_T$, if the firm's leverage ratio is greater than the median leverage ratio of all firms in the same industry, and the firm's current ratio (current assets/current liabilities) is less than the median current ratio of the industry. Industry is defined as distressed, based on a dummy variable $Ind.Distress_T$. $Ind.Distress_T$ is a dummy that equals 1 if the sales growth of the median firm in an industry is negative in the year of the transaction. The industry of a firm is defined as the set of firms with the same 3-digit SIC code.

	All		Distressed Target		Non-distressed Target	
	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.
Panel A. Target Misvaluation						
Ln(M/B): $m_{it} - b_{it}$	0.52	0.60	0.42	0.51	0.55	0.63
Target error: $m_{it} - v(\theta_{it}; \alpha_{jt})$	0.05	0.55	-0.02	0.49	0.07	0.58
Sector error: $v(\theta_{it}; \alpha_{jt}) - v(\theta_{it}; \alpha_j)$	-0.06	0.21	-0.08	0.23	-0.05	0.20
Growth Option: $v(\theta_{it}; \alpha_j) - b_{it}$	0.55	0.40	0.54	0.43	0.55	0.38
Panel B. Recession						
Recession	0.11	0.32	0.13	0.33	0.11	0.31
Annual GDP growth (%)	5.50	2.09	5.42	1.98	5.53	2.13
Spread (Aaa-Bbb) (%)	0.96	0.41	0.95	0.44	0.97	0.40
Number of Observations	1627		421		1206	

Table A.7: Robustness Check: Fire-Sale Effects and Stock Market Misvaluation

This table presents coefficient estimates from OLS regressions on outcome variables after controlling for the misvaluation of target. *Target Ind. Misvaluation* is target industry-wide short-run error and *Target Misvaluation* is target-specific error. The dependent variables for acquisition outcomes are as follows. Acquirer return: CAR_A, target offer price: $Ln(Price1)$, target bargaining power: $NDCAR(\omega_T)$, and synergy: $CAR_{Combined}$. The variable of interest is the interaction between *Fire-Sale* and *Outsider*. *Fire-Sale* is the interaction between target firm distress ($Distress1_T$, $Distress2_T$) and industry-level distress ($Ind.Distress_T$). Industry fixed effects are at the 3-digit SIC code level. Control variables are described in Table 3 and a detailed description of each variable is included in Table 1. Robust standard errors clustered at year-industry are reported in parentheses. Coefficients marked ***, ** and * are significant at the 1%, 5%, and 10% level, respectively.

Dep. variable:	CAR_A		Ln(Price1)		NDCAR (ω^T)		$CAR_{Combined}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Fire-Sale$_1$	0.10**		-1.03***		-0.10**		0.02	
	(0.04)		(0.28)		(0.04)		(0.02)	
Fire-Sale$_2$		0.05***		-0.25		-0.05***		-0.01
		(0.01)		(0.17)		(0.02)		(0.02)
$Ind.Distress_T$	0.01	0.01	0.20**	0.14	0.00	-0.00	0.01	0.01
	(0.01)	(0.01)	(0.09)	(0.09)	(0.01)	(0.01)	(0.01)	(0.01)
$Distress1_T$	-0.01		0.41***		0.01		-0.01	
	(0.01)		(0.09)		(0.01)		(0.01)	
$Distress2_T$		0.00		0.06		-0.00		0.01
		(0.01)		(0.05)		(0.01)		(0.01)
Target Misval.	-0.02**	-0.02**	0.18***	0.17***	0.01	0.01	-0.02**	-0.02**
	(0.01)	(0.01)	(0.05)	(0.05)	(0.01)	(0.01)	(0.01)	(0.01)
Target Ind. Misval.	-0.01	-0.01	-0.04	-0.01	0.01	0.01	-0.00	-0.00
	(0.02)	(0.02)	(0.13)	(0.14)	(0.02)	(0.02)	(0.02)	(0.02)
Med. Ind. Q	0.01*	0.01*	-0.02	-0.02	-0.01	-0.01	0.01*	0.01*
	(0.01)	(0.01)	(0.06)	(0.06)	(0.01)	(0.01)	(0.01)	(0.01)
Med. Ind. Leverage	-0.01	-0.00	0.46	0.51	0.06	0.05	0.07	0.07
	(0.05)	(0.05)	(0.47)	(0.47)	(0.06)	(0.07)	(0.07)	(0.07)
Target Size	-0.00***	-0.00**	0.86***	0.85***	0.01***	0.01***	0.01***	0.01***
	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
Target Leverage	0.00	-0.01	0.74***	0.77***	-0.02	-0.01	-0.00	-0.01
	(0.01)	(0.01)	(0.12)	(0.13)	(0.01)	(0.01)	(0.01)	(0.02)
Target M/B	-0.00	-0.00	-0.03*	-0.03*	-0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
Target Tangibility	0.02	0.02	-0.67***	-0.65***	-0.01	-0.01	0.02	0.02
	(0.02)	(0.02)	(0.13)	(0.13)	(0.01)	(0.02)	(0.02)	(0.02)
Target Profitability	0.00	0.00	0.00	0.00	-0.00	-0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control: Acq. & Deal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1098	1098	1093	1093	1098	1098	1098	1098
Adj-R^2	0.09	0.09	0.92	0.91	0.18	0.18	0.12	0.12

Table A.8: Robustness Check: Fire-Sale Effects and Recession

This table presents coefficient estimates from OLS regressions on outcome variables after controlling for the recession. Recessions is defined as recessionary months identified by NBER. The dependent variables for acquisition outcomes are as follows. Acquirer return: CAR_A, target offer price: $Ln(Price1)$, target bargaining power: $NDCAR(\omega_T)$, and synergy: $CAR_{Combined}$. The variable of interest is the interaction between *Fire-Sale* and *Outsider*. *Fire-Sale* is the interaction between target firm distress ($Distress1_T$, $Distress2_T$) and industry-level distress ($Ind.Distress_T$). Industry fixed effects are at the 3-digit SIC code level. Control variables are described in Table 3 and a detailed description of each variable is included in Table 1. Robust standard errors clustered at year-industry are reported in parentheses. Coefficients marked ***, ** and * are significant at the 1%, 5%, and 10% level, respectively.

Dep. variable:	CAR_A		Ln(Price1)		NDCAR (ω^T)		$CAR_{Combined}$	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Fire-Sale$_1$	0.11***		-1.11***		-0.10**		0.03	
	(0.04)		(0.28)		(0.04)		(0.04)	
Fire-Sale$_2$		0.05***		-0.25		-0.05***		-0.00
		(0.01)		(0.17)		(0.02)		(0.02)
$Ind.Distress_T$	0.00	0.01	0.23**	0.15	0.00	-0.00	0.00	0.01
	(0.01)	(0.01)	(0.09)	(0.09)	(0.01)	(0.01)	(0.01)	(0.01)
$Distress1_T$	-0.01		0.36***		0.01		-0.01	
	(0.01)		(0.09)		(0.01)		(0.01)	
$Distress2_T$		0.01		0.06		-0.00		0.01
		(0.01)		(0.05)		(0.01)		(0.01)
Recession	-0.02	-0.02*	-0.04	-0.01	0.02***	0.02***	-0.01	-0.01
	(0.01)	(0.01)	(0.10)	(0.11)	(0.01)	(0.01)	(0.02)	(0.02)
Med. Ind. Q	0.02**	0.02**	-0.01	-0.01	-0.01	-0.01	0.01	0.01
	(0.01)	(0.01)	(0.05)	(0.05)	(0.01)	(0.01)	(0.01)	(0.01)
Med. Ind. Leverage	-0.00	0.00	0.43	0.48	0.05	0.05	0.07	0.07
	(0.05)	(0.05)	(0.47)	(0.48)	(0.07)	(0.07)	(0.07)	(0.07)
Target Size	-0.01***	-0.01***	0.88***	0.87***	0.02***	0.02***	0.01**	0.01***
	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
Target Leverage	-0.00	-0.01	0.78***	0.79***	-0.02	-0.01	-0.01	-0.02
	(0.01)	(0.02)	(0.12)	(0.13)	(0.01)	(0.02)	(0.02)	(0.02)
Target M/B	-0.00***	-0.00***	0.00	0.00	0.00	0.00	-0.01**	-0.01**
	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
Target Tangibility	0.02	0.02	-0.66***	-0.65***	-0.01	-0.01	0.02	0.02
	(0.02)	(0.02)	(0.13)	(0.13)	(0.01)	(0.02)	(0.02)	(0.02)
Target Profitability	0.00	0.00	0.00	0.00	-0.00	-0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Control: Acq. & Deal	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1098	1098	1093	1093	1098	1098	1098	1098
Adj-R^2	0.09	0.09	0.92	0.91	0.18	0.18	0.11	0.11

Table A.9: Robustness Check: Fire-Sale Effects and Alternative Industry Distress Measures

This table presents coefficient estimates from OLS regressions on outcome variables with alternative industry distress measures. In Panel A, target industry is classified as distressed, if the sales growth of the median firm in an industry is lower than -1% in the year of the transaction. In Panel B, target industry is classified as distressed, if the sales growth of the median firm in an industry is negative for the two previous consecutive years of the transaction. The dependent variables for acquisition outcomes are as follows. Acquirer return: CAR_A, target offer price: $Ln(Price1)$, target bargaining power: $NDCAR(\omega_T)$, and synergy: $CAR_{Combined}$. *Fire-Sale* is the interaction between target firm distress ($Distress1_T$) and industry-level distress ($Ind.Distress_T$). Industry fixed effects are at the 3-digit SIC code level. Control variables are described in Table 3 and a detailed description of each variable is included in Table 1. Robust standard errors clustered at year-industry are reported in parentheses. Coefficients marked ***, ** and * are significant at the 1%, 5%, and 10% level, respectively.

Panel A. Industry Distress2 (if median sales growth < -1%)

Dep. variable:	CAR_A	Ln(Price1)	NDCAR (ω^T)	$CAR_{Combined}$
	(1)	(2)	(3)	(4)
$Distress1_T$*$Ind.Distress2_T$	0.10***	-1.99*	-0.10**	-0.02
	(0.03)	(1.04)	(0.04)	(0.04)
$Ind.Distress2_T$	-0.00	0.19	0.00	-0.00
	(0.01)	(0.12)	(0.01)	(0.01)
$Distress1_T$	-0.01	0.36***	0.01	-0.01
	(0.01)	(0.10)	(0.01)	(0.01)
Control: Target & Ind.	Yes	Yes	Yes	Yes
Control: Acq. & Deal	Yes	Yes	Yes	Yes
Year & Industry FE	Yes	Yes	Yes	Yes
Obs.	1098	1093	1098	1098
Adj-R^2	0.09	0.92	0.18	0.11

Panel B. Industry Distress3 (if median sales growth is negative for two years)

Dep. variable:	CAR_A	Ln(Price1)	NDCAR (ω^T)	$CAR_{Combined}$
	(1)	(2)	(3)	(4)
$Distress1_T$*$Ind.Distress3_T$	0.14***	-4.16***	-0.14***	-0.06*
	(0.03)	(0.80)	(0.03)	(0.03)
$Ind.Distress3_T$	-0.01	0.52***	0.01	-0.01
	(0.01)	(0.11)	(0.01)	(0.01)
$Distress1_T$	-0.00	0.34***	0.01	-0.00
	(0.01)	(0.10)	(0.01)	(0.01)
Control: Target & Ind.	Yes	Yes	Yes	Yes
Control: Acq. & Deal	Yes	Yes	Yes	Yes
Year & Industry FE	Yes	Yes	Yes	Yes
Obs.	1098	1093	1098	1098
Adj-R^2	0.09	0.92	0.18	0.11