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WORKING PAPER

The risk effects of acquiring distressed firms*

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October 2011

2011/742

*We are grateful for helpful comments and suggestions of Eric De Bodt, Bram Decroix, Olivier De Jonghe, Marc Deloof, Marie Dutordoir, Mathieu Luypaert, Sophie Manigart, Ronald Masulis, Tom Vanacker, Bart Van Hoe, Cynthia Van Hulle, Elisabeth Van Laere and seminar participants at the Corporate Finance day 2011, Lille. Financial support from the Agency for Innovation by Science and Technology (IWT), The Policy Research Centre Entrepreneurship and International Entrepreneurship (STOIO) and Vlerick Academic Research Fund is also gratefully acknowledged.

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D/2011/7012/47

The risk effects of acquiring distressed firms

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October 2011

Abstract

We examine the impact of distressed acquisitions on acquirer volatility and default risk for a worldwide sample of distressed firms using several risk measures. We find that, on average, absolute levels of historical and implied volatility do not change following a distressed acquisition. However, distressed acquisitions generate a significant increase in relative total, systematic and idiosyncratic volatility and default risk, hence risk rises for both shareholders and bondholders. In particular, we show that high market-to-book acquirers, frequent acquirers, low-risk acquirers, higher acquisition premia and deals closed during bull markets are associated with higher levels of post-acquisition risk. Interestingly, high-risk acquirers experience a significant reduction in volatility and default risk. Consequently, risk changes cannot exclusively be explained by transferring risk from distressed target to acquirer. Our results suggest that bidder pre-acquisition levels of performance and risk and market conditions affect the type of distressed acquisitions and consequently the risk effects in such transactions.

Keywords: Distressed acquisitions; M&A; Default risk; Volatility; Risk factors

We are grateful for helpful comments and suggestions of Eric De Bodt, Bram Decroix, Olivier De Jonghe, Marc Deloof, Marie Dutordoir, Mathieu Luypaert, Sophie Manigart, Ronald Masulis, Tom Vanacker, Bart Van Hoe, Cynthia Van Hulle, Elisabeth Van Laere and seminar participants at the Corporate Finance day 2011, Lille. Financial support from the Agency for Innovation by Science and Technology (IWT), The Policy Research Centre Entrepreneurship and International Entrepreneurship (STOIO) and Vlerick Academic Research Fund is also gratefully acknowledged.

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Introduction

In 2008, the world entered a global financial crisis, resulting in a massive number of bankruptcies, fire sales and forced acquisitions. Organisations that came under severe financial pressure struggled with restructurings and workouts, sometimes ending up in bankruptcy. Acquisitions of these troubled firms might in many cases offer a more preferable exit path to many of the stakeholders involved (Jensen, 1991; Hambrick and D'Aveni, 1988; Balcaen et al., 2009). This paper studies the risk effects of acquiring such distressed firms.

To date, research on distressed acquisitions is scant and has mainly focussed on performance. Previous research tends to agree that distressed acquisitions lead to positive abnormal stock returns for acquirers, yet results for operating performance are mixed (Clark and Ofek, 1994; Hotchkiss and Mooradian, 1998; Carapeto et al., 2009). However, to evaluate the success of an acquisition, the impact on risk should be considered as well. Even though the credit crisis has triggered an increasing risk awareness, existing research on risk effects in corporate M&A transactions remains overall scarce. Moreover, research on the risk impact of distressed acquisitions is non-existent.

Most of the earlier studies seem to indicate that, on average, acquirer risk increases following acquisitions. However, rather few investigated the determinants that explain why acquirer risk changes. In prior research, risk reduction is among the reasons commonly cited for mergers. Amihud and Lev (1981) show that conglomerate mergers have a risk-reducing diversification effect on the combined entity. However, more recent studies find that acquirer default risk rises due to changes in financial leverage (Ghosh and Jain, 2000; Morellec and Zhdanov, 2008). Furfine and Rosen (2011) add to this discussion that M&A increases default risk driven by aggressive managerial actions impacting risk enough to outweigh the diversification effect.

Hence, it is important to deepen our understanding of why an acquisition may change acquirer risk. Particularly, distressed M&A represents a unique environment to further study risk in M&A transactions as acquirers are exposed to a number of additional risks. Distressed acquisitions may create attractive opportunities to expand geographically or activity-wise, to increase market share and generate new revenues at discounted prices. Simultaneously, these transactions may contain more risk as they often take place in shorter timeframes and involve more complex valuations increasing the risk of overpayment. Moreover, managers may underestimate the efforts required to turn around and integrate the distressed firm. Consequently, the ability to assess and manage these risks will determine the risk exposure and eventually the return to shareholders.

Our study contributes to the existing M&A literature in several important ways. First, this paper is the first to study the risk impact and drivers of distressed acquisitions. Second, we use

various risk measures to identify potential risk effects as prior studies in the risk literature have reached little consensus in terms of the most appropriate risk measure. By comparing several measures, we try to capture different dimensions of risk and avoid biased results due to methodological issues. Third, we analyse a worldwide data sample of distressed acquisitions over a long time period – acquisitions occurring between 1990 and 2009 - while related literature typically uses relatively small samples and is predominantly US oriented.

Our results point to a significant risk increase for both shareholders and bondholders. In particular, we show that distressed acquisitions have, on average, no impact on absolute levels of bidder historical and implied volatility. However, relative total, systematic and idiosyncratic volatility and default risk rise significantly. Interestingly, volatility and default risk increase for low-risk acquirers, whereas volatility and default risk reduce for high-risk acquirers. This suggests that risk changes cannot solely be explained by a risk transfer from distressed target to acquirer. Especially for high-risk acquirers the asset diversification effect is large enough to outweigh the risk increase generated by the acquisition itself in contrast to transactions involving low-risk acquirers.

We further investigate the influence of diversification, acquirer management quality and expertise, market conditions, bidder overpayment and acquirer pre-acquisition risk. High market-to-book acquirers, frequent acquirers, low-risk acquirers, deals involving higher acquisition premia and deals closed during bull markets are associated with higher levels of post-acquisition risk. Additionally, downside risk increases for acquirers with good recent stock performance. Moreover, the risk increase for low-risk acquirers is mainly driven by closing larger distressed deals and taking up higher levels of leverage. These results may point to management hubris in distressed acquisitions, yet we find some evidence inconsistent with this hypothesis. Overpayment is lower for transactions involving high market-to-book acquirers even though they have more financial flexibility. In addition, high-risk acquirers seem to be reluctant towards additional leverage by preferring stock-financed deals involving less leveraged targets. Hence, our results indicate that bidder pre-acquisition performance and risk and market conditions impact the type of acquisitions and consequently the risk effects in distressed transactions.

This paper proceeds as follows. In the next section, we review related literature, and develop our hypotheses. Section 2 describes our sample and explains the methodology. Section 3 presents the results, while the last section summarizes and concludes.

1 Literature review and hypothesis development

Earlier research on distressed M&A mainly concentrates on performance effects. Clark and Ofek (1994) analyse a sample of 38 US distressed takeovers using several performance measures and find that acquirers have negative post-merger performance. Hotchkiss and Mooradian (1998) analyse a sample of 55 US acquisitions and show that acquirers significantly gain in operating performance and earn positive abnormal returns following the acquisition of a target in Chapter 11. In a recent paper, Carapeto et al. (2009) report that acquirers have positive abnormal announcement returns when taking over a distressed or bankrupt target. Moreover, the combined long-term performance improves compared to the combined pre-bid performance but deteriorates compared to the acquirer pre-acquisition performance. In sum, prior studies show that distressed acquisitions generate positive abnormal stock returns for acquirers while results on operating performance are mixed. Our study extends previous distressed M&A research by investigating the dynamics that may affect acquirer risk. Due to the lack of research in this area, we proceed by reviewing risk in non-distressed M&A literature.

While some studies have examined the risk impact of acquisitions, only few have investigated the determinants of risk changes. In addition, prior research opts for different methodological choices. One of the first and most commonly used methods to study risk around corporate acquisitions is by calculating volatility of stock returns. Correspondingly, Langetieg et al. (1980) collect a sample of 82 US mergers and report that total, systematic and idiosyncratic risk increase due to mergers. Lubatkin and O'Neill (1987) show that mergers are associated with increases in idiosyncratic risk for a sample of 297 US large mergers. Further, they find a significant decline in systematic and total risk for related mergers. More recently, Amihud et al. (2002) and Mishra et al. (2005) use this method to evaluate the impact of bank mergers on risk. Amihud et al. (2002) find overall no significant effect on acquirer risk in the post-merger period for a sample of 214 cross-border bank mergers. Mishra et al. (2005) show that for non-conglomerate bank mergers, total and idiosyncratic risk significantly decline in a sample of 14 US acquiring banks, whereas no significant change was reported in systematic risk.

In two former studies, Bharath and Wu (2005) and Geppert and Kamerschen (2008) investigate effects of corporate US mergers on acquirer risk, by calculating implied volatilities of options. Bharath and Wu (2005) find that there is a strong run-up in total, systematic, and idiosyncratic implied volatility in four years before the merger and one year after the merger announcement. This pre-merger run-up is explained by the hypothesis that M&As are a response to industry shocks. In addition, Geppert and Kamerschen (2008) use a sample of 25 corporate mergers and find that at least for the first 18 months after the merger completion date, mergers do not

reduce risk in the same way that a portfolio of the two individual firms would, suggesting that mergers increase expected risk for shareholders.

More recent work estimates risk changes via default risk measures. As the optimal risk measure is still under discussion in the failure prediction literature, there is a growing number of studies that develop new enhanced measures based on Merton's model (1974), such as implied probability of default in CDS spreads or bond yields (Bharath and Shumway, 2008), option implied probability of default (Capuano, 2008), Expected Default Frequency (EDF) using Moody's KMV, etc. The only study in this area that uses EDF in corporate M&A research is Furfine and Rosen (2011) who show that acquirer default risk increases following mergers, mainly due to managerial actions outweighing the risk-reducing effect of asset diversification. In particular, mergers increase risk when CEOs have large option-based compensation, recent stock performance is poor, and idiosyncratic equity volatility is high. Moreover, Vallascas and Hagendorff (2011) are the first to study risk implications of bank M&A by using Merton's distance to default model. They show that M&A has on average no impact on acquirer risk. However, low-risk banks experience a significant increase in default risk, particularly for cross-border and conglomerate deals and M&A completed under weak regulation, indicating that acquirer pre-merger risk is an important determinant of acquisition-related risk effects. In sum, most of the earlier studies find that, on average, acquirer risk increases following acquisitions. However, a complete understanding of what is driving these risk changes is still lacking.

Based on the literature review, we identify the following factors that may impact risk in distressed acquisitions: activity and geographic diversification, management quality and expertise, bidder pre-acquisition risk, overpayment and market conditions.

1.1 Activity and geographic diversification

In general, risk diversification is amongst one of the most frequently suggested motives for bank and corporate M&As. Craig and dos Santos (1997) claim that acquirers select bank targets that allow for a substantial decline in acquirer risk, through geographic and activity diversification.

Amihud and Lev (1981) show that conglomerate mergers have a risk-reducing diversification effect on the combined entity. Due to non-perfectly correlated cash flows, Lewellen (1971) points to a coinsurance effect. Mergers reduce risk, which results in a lower cost of external financing, more debt capacity and a larger tax shield. The motive of risk reduction through diversification appears not to be beneficial to shareholders since they can achieve the risk reduction on their own by diversifying their portfolio (Amihud and Lev, 1981). Further, they argue that managers look for conglomerate mergers to decrease their personal risk. Managers with more personal wealth tied up in a firm, try to diversify by engaging in diversifying M&As (May, 1995).

Apart from a risk-reducing effect, conglomerate mergers may be risk-increasing due to limited knowledge of the industry environment as opposed to related acquisitions. Hence, Clark and Ofek (1994) report that acquirers of distressed targets are often in the same industry. Hotchkiss and Mooradian (1998) find that bidders for bankrupt firms frequently have some prior relationship with the target and are, as a result, well aware of the value and best use of the target's assets. Moreover, related mergers are more synergistic, leading to reduced costs given the economies of scale and scope (Chatterjee and Lutbatkin, 1990). Therefore, we expect conglomerate distressed transactions to increase acquirer risk.

Risk diversification could also be achieved via foreign expansion and is often a dominant reason for cross-border M&A. As two geographically different markets are imperfectly correlated, earnings volatility may be reduced (Seth, 1990). Fatemi (1984) studied the effect of corporate international diversification and find that shareholders' total risk and systematic risk declines. In addition, internationalisation may increase the likelihood of realizing synergies. We expect that foreign expansion via distressed acquisitions reduces risk given the fast access to new markets, new resources and technology. We include in our multivariate analysis a conglomerate and a cross-border dummy.

1.2 Management quality and expertise

Apart from synergetic effects, M&A may be motivated by agency problems and hubris destroying shareholder value. Management hubris may lead to poor acquisition decisions in case management overestimates its own abilities when determining the potential synergetic effects (Roll, 1986; Rau and Vermaulen, 1997). Consequently, hubris might cause managers to underestimate the cost and effort of the turnaround. Hubris is mainly related to firms that have experienced good performance. In contrast to Roll's hubris hypothesis, Morck et al. (1990) and Shleifer and Vishny (2003) argue that poor prior performance incentivizes managers to perform risk-increasing transactions. Low-performing acquirers may have lower quality managers that pursue their personal objectives and therefore likely make bad acquisitions (Masulis et al., 2007). However, we expect that high-performing acquirers take more risk given the higher level of financial flexibility. We measure acquirer prior performance via the market-adjusted buy-and-hold return and the market-to-book ratio.

Further, we explore whether prior acquisition experience may be related to changes in risk. In M&A and performance literature, the effect of prior experience on the performance of subsequent acquisitions is mixed (Haleblian et al., 2009). Prior experience is found to be positively correlated with acquisition performance. However, Haleblian and Finkelstein (1999) report that the relationship between acquisition experience and acquisition performance is not positively linear.

Moreover, frequent acquisitions may result in higher integration risk because frequent acquirers may not have sufficient time to integrate the targets (Kusewitt, 1985; Bharath and Wu, 2005). In addition, distressed acquisitions may involve more complex valuations than non-distressed M&A. Consequently, applying non-distressed M&A experience to distressed transactions has its limitations. Moreover, we could expect that prior successful acquisitions strengthens management confidence which makes them vulnerable for management hubris. Hence, we hypothesize that risk rises when acquirers have more experience in non-distressed M&A deals. We measure acquisition experience by the number of non-distressed M&A transactions prior to the current deal.

1.3 Bidder pre-acquisition risk

A firm's risk profile and attitude towards risk may influence its acquisition decisions. Moreover, the strategic needs of an acquirer could be different depending on the initial risk profile. In banking literature, Brewer (1989) reports that only high-risk banks gain from diversification, while Vallascas and Hagendorff (2011) show that only low-risk banks increase default risk. In addition, Bruton et al. (1994) argue that high-risk acquirers may acquire firms to exit a difficult environment, to improve resources and their competitive position. Hence, distressed targets create attractive opportunities as the upside restructuring potential is high. Moreover, Furfine and Rosen (2011) suggest that 'mergers are used as a mechanism to achieve a desired level of default risk'. Consequently, we expect that low-risk acquirers will take more risk than high-risk acquirers. We test for bidder pre-acquisition risk by including a dummy variable for low-risk and high-risk acquirers in our regression model.

1.4 Acquisition premium

According to Clark and Ofek (1994), the size of the premium is negatively correlated with the success of the restructuring, mainly due to overpayment. Acquirers may pay higher acquisition premia if more synergistic gains are expected from the transaction. However, overpayment might occur when these synergies cannot be realized. In addition, management hubris may lead to higher acquisition premia as management may be overoptimistic. Hence, we expect that higher premia result in higher acquisition risk. The acquisition premium is measured by the ratio of takeover price minus target's stock price to target's stock price.

1.5 Bull and bear markets

Bouwman et al. (2009) suggest that acquisitions in bull markets are of poorer quality. During bear markets, management is expected to be highly risk averse due to market uncertainty. Consequently, management exercises special caution in planning, implementing and controlling the

acquisition processes which increases the likelihood that a firm closes a successful M&A transaction (Lutbatkin and O'Neill, 1987). Opposite behaviour should occur during bull markets. We hypothesize that distressed acquisitions are more risk-increasing during bull markets, measured by the yearly change in MSCI stock return index.

1.6 Control variables

First, we control for the *changes in leverage* surrounding the transaction measured by the change in acquirer total liabilities on total assets. We expect that increased leverage results in more financial risk. According to Ghosh and Jain (2000) firms increase financial leverage following mergers caused by more debt capacity. In addition, transactions financed with debt increase a firm's leverage ratio. Moreover, acquiring a distressed target without a prior debt restructuring, may lead to an upturn in bidder's post-acquisition leverage. Further, we control for the *degree of target risk* in several ways by including respectively the target interest coverage ratio and target distance-to-default in our regression model. We further test whether our results are not driven by high-tech targets by including a *high-tech dummy* variable.

Next, we introduce the *method of payment* via a stock dummy variable. Hansen (1987) argues that an acquirer should pay in stock when an acquirer has less information on the target's value. Given the potential information asymmetry between acquirer and distressed target, we expect that stock-financed deals will be less risk increasing than cash-financed acquisitions. In addition, we evaluate the expected return of the deal, measured by the *cumulative abnormal return* around the event window. If shareholders expect the deal to be risk increasing without positive returns, the effect on acquirer stock price should be negative. Following Furfine and Rosen (2011), we predict a negative correlation between abnormal cumulative returns and changes in risk.

Further, we test for the *target status* via a public dummy variable. We expect that the acquisition of a public distressed target is less likely to increase risk given the higher disclosure requirements for public firms which reduce information asymmetry. We also control for the *relative size* of the target to the acquirer. Larger targets are likely to be more risk diversifying than small targets (Vallascas and Hagendorff, 2011). Opposed to diversification benefits, acquisitions of large targets will make integration more complex than relativity small targets. In addition, larger targets may be more difficult to restructure than smaller targets (Clark and Ofek, 1994). We expect that acquisitions of large targets result in a risk increase. In addition, we control for *acquirer size* itself measured by the log of market value of assets. We expect that larger acquirers are less affected by distressed acquisitions as large acquirers have less business risk.

To control for *market liquidity*, we add the corporate spread measured by the spread on AAA versus BAA corporate bonds. We expect that acquirers that close deals during periods when credit is

easily available take more risk than when credit is scarce. In addition, we include *regional dummies* to control for acquirer and target country bias. We also test for differences in *institutional factors* between countries, which might have an impact on acquirer risk-taking. Therefore, we add the degree of shareholder and creditor protection in a country respectively measured by the anti-director rights index and the creditor rights index (La Porta et al., 1998). Finally, to control for acquirer industry-specific risk factors, we include *industry dummies*.

Table 1 provides an overview of the various hypotheses and describes the measurement of these explanatory variables.

*** Insert Table 1 ***

2 Sample selection and methodology

2.1 Sample selection

This study covers worldwide distressed M&A deals that occurred between 1990 and 2009. We downloaded the M&A deals from Thomson ONE Banker and Zephyr database[1]. Our initial dataset meets the following criteria: (1) the acquiring firm is a publicly quoted company, (2) the acquirer has a pre-acquisition stake of less than 50% and a final stake of more than 50% in the target company, (3) the sample excludes targets and acquirers from the financial industry[2], and (4) deals with all sizes of transaction value are included.

Next, we determine whether a target is healthy or distressed. A vast number of 'corporate distress' definitions exists in business failure and bankruptcy prediction literature. In earlier studies (Beaver, 1967; Altman, 1968; Ohlson, 1980), corporate distress is defined in terms of default, insolvency or bankruptcy. In reality, a failure process evolves from early stages of distress towards insolvency: a company can be distressed without going into default. A company entering distress may be characterized by negative cumulative earnings, a debt overhang and/or a cash shortage, resulting in insufficient cash flow to cover current financial obligations. Therefore, more recent studies use distress measures such as recurring profit after taxes (Balcaen et al., 2009), interest coverage ratio (Asquith et al., 1994; Rajan and Zingales, 1995; Pindado and Rodrigues, 2005; Carapeto, 2009), negative cumulative earnings (Gilbert et al., 1990), leverage ratios (Andrade and Kaplan, 1998), operating margin (Theodossiou et al., 1996), etc. The classification measure we use, is

[1] The Zephyr and Amadeus databases are both commercialized by Bureau van Dijk.
[2] We excluded all finance, insurance, real estate, holding and other investment companies (US SIC code 6).

the Interest Coverage Ratio (ICR) calculated as the Earnings Before Interest, Tax, Depreciation and Amortization (EBITDA) divided by the Net Interest Expense. A target is classified as 'distressed' if the firm has an ICR less than one in the year prior to the transaction[3]. Accounting information was collected from Worldscope and Amadeus[1]. This yields a sample of 1082 distressed M&A deals.[4] Table 2 summarizes the construction of our sample.

*** Insert Table 2 ***

Since most of the transactions covered by Thomson ONE Banker include public M&A transactions, we complement this dataset with M&A deals from Zephyr (Brav, 2009). Consequently, we add a substantial number of European acquisitions with private European targets to our sample. The final distressed sample covers 45% private targets compared to 55% public targets. However, the Zephyr database only includes pan-European transactions dating back to 1997 and US deals from 2001 onwards. Descriptive statistics of the distressed sample are presented in Table 3-5.

*** Insert Table 3-5 ***

Table 3 shows an overrepresentation of US firms, consistent with the geographical distribution of overall M&A activity. 47.60% of the distressed transactions involve a US acquirer, while 44.09% involve a US target. Table 4 presents the industry breakdown for both acquirer and target. Around 40% of the deals are in the manufacturing and services industries. Table 5 summarizes various profitability, liquidity and solvency ratios for acquirer and target in the distressed sample. Not surprisingly, the mean and median of the target profitability ratios are negative, indicating that most of the targets are in economic distress. Some distressed targets are highly leveraged, while others have low leverage. Some acquirers are distressed themselves which explains why the profitability ratios are on average negative. Considering median values, acquirers of distressed targets are profitable, solvent and liquid.

2.2 Methodology

To ensure that our results are not driven by the selected risk measure, we use several volatility measures and Merton's default risk measure.

[3] In section 3.3, we test for the robustness of our results by defining the target as 'distressed' if the ICR is less than one in the first, second and third year prior to the transaction.
[4] The final distressed sample consists of 53% (573) Thomson One Banker deals and 47% (509) Zephyr deals.

2.2.1 Historical volatility: measuring risk via volatility of stock returns

We follow the standard market model methodology (Chatterjee and Lubatkin, 1990; Lubatkin and O'Neill, 1987; Langetieg et al., 1980) in order to estimate risk changes of the bidding firm. Via this model we can split up total risk into systematic and idiosyncratic components.

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$$

where

$t = 1, ..., T$

$i = 1, ..., N$

R_{it} = the daily rate of return on the stock return index of the security

R_{mt} = the average daily rate of return of the MSCI World stock return index

α_i, β_i = firm-specific coefficients

ε_{it} = a stochastic error term

Stock return data are collected from Thomson Datastream. The MSCI World stock return indices and country stock market indices were downloaded from Bloomberg and Thomson Datastream. We estimate total risk by calculating the standard deviation of the firm's daily rate of return (based on daily closing stock prices adjusted for stock splits, stock issues, and dividends) over a 250 days estimation period. The change in bidder's total risk (total risk absolute difference score) is the difference in the standard deviation after the deal announcement (for +2 days to +252 days following the announcement date) and the standard deviation before the deal announcement (for -30 days to -280 days relative to announcement date). Systematic and idiosyncratic risk are measured by regressing the daily rate of return of the acquirer on the daily rate of return of the MSCI All Countries market return over a 250 days estimation window.[5] Systematic risk is estimated by the beta-coefficient of the regression model. Idiosyncratic risk is computed by the standard deviation of the stochastic error term over the 250 days estimation period. The systematic risk absolute difference score and idiosyncratic risk absolute difference score are calculated by subtracting the pre-acquisition estimate from its respective post-acquisition estimate. A positive difference score means that risk has increased. In addition, we examine the percentage change in risk by calculating the relative difference scores as the absolute difference score divided by the pre-acquisition estimate.

[5] In order to check the robustness of our results, we use the Fama-French 3-factor regression approach for the US subsample. The daily Fama-French factors were downloaded from http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

An alternative way to look at risk, is by considering only the downside risk. According to Markowitz (1959) the semi-variance is a more acceptable measure of risk. We compute three downside risk measures: the semi-standard deviation below the mean, the semi-standard deviation below zero and the downside beta. Downside beta is the sensitivity of the return on a firm's stock with respect to the MSCI All Countries market return when both returns simultaneously go down (Estrada, 2007). We use the same estimation windows as described above. Subsequently, we compute the absolute and relative difference scores.

2.2.2 Implied volatility: measuring risk via implied volatility in options

By studying acquisition-related changes in risk, one can calculate historical volatility (see above) or implied volatility. While historical volatility is computed from realized returns, implied volatility is a forward-looking risk measure reflecting the future volatility of returns over the remaining life of the option. We collect standardized implied option volatilities of 30-day call options from the IVY Database of Optionmetrics. As Optionmetrics contains only implied volatilities for the US listed index and equity options market beginning from 1996, our sample will be limited both in time and in geographical scope. We proceed in a similar way as measuring risk via volatility of stock returns (2.2.1). The total implied volatility (σ_i) can be broken down in systematic and idiosyncratic risk via the market model. The capital asset pricing model implies that:

$$\sigma_i^2 = \beta_i^2 \ \sigma_m^2 + \sigma_\varepsilon^2$$

The total risk absolute difference score is equal to the mean implied volatility of the acquirer after the announcement date minus the mean implied volatility of the acquirer before the announcement date (with respective estimation windows: -280 -30 and +2 +252). Systematic risk is estimated by multiplying beta with the implied market volatility (S&P 500 index options) over a 250 days estimation window. The idiosyncratic risk component is calculated as the square root of the squared total implied volatility minus the squared systematic component. Both absolute and relative difference scores are computed.

2.2.3 Default risk: measuring risk via Merton's distance-to-default model

In Merton's model (1974) default occurs when the market value of assets is lower than the book value of total liabilities at maturity. The distance-to-default (DD) measures the number of standard deviations that the market value of assets is away from default. The advantage of Merton's DD model is that accounting and market information is combined. DD on day t is expressed as follows (Hillegeist et al., 2004; Vassalou and Xing, 2004; Akhigbe et al., 2007):

$$DD_t = \frac{\ln(V_{A,t}/L_t) + (r_f - \sigma_{A,t}^2/2)\,T}{\sigma_{A,t}\,T^{0.5}}$$

where

$V_{A,t}$ = the market value of assets

L_t = the book value of total liabilities

r_f = the risk-free rate

$\sigma_{A,t}$ = the annualized standard deviation of asset returns

T = the time to maturity

The following input parameters are aggregated. The market value of equity and book value of total liabilities is collected via Thomson Datastream. Further, we downloaded the yield on the 2Y German government bond and the 2Y US treasury notes as a proxy for the risk-free interest rate. The time to maturity is set to one year. The values of $V_{A,t}$ and $\sigma_{A,t}$ can be inferred through an iterative process based on the Black-Scholes-Merton pricing model. We employ as starting values for the asset volatility the historical volatility of equity computed daily on the basis of a 250-day rolling window. The following non-linear equations need to be solved:

$$V_{E,t} = V_{A,t}N(d_{1,t}) - X_t e^{-r_{ft}T} N(d_{2,t})$$

$$\sigma_{E,t} = \frac{V_{A,t}N(d_{1,t})\sigma_{A,t}}{V_{E,t}}$$

The absolute change in acquirer DD equals mean DD after the announcement date minus mean DD before the announcement date for the respective estimation windows +2 days +252 days and -280 days -30 days.

3 Empirical results

In this section, we first examine whether distressed M&A, on average, significantly impact acquirer risk. Subsequently, we shed light on deal-specific and firm-specific factors that influence acquirer risk via a multivariate regression analysis.

3.1 The impact of distressed acquisitions on acquirer risk

*** Insert Table 6 ***

Table 6 presents the results for the various risk measures broken down in systematic and idiosyncratic risk if applicable. We analyse whether the total risk difference score, the systematic (beta) difference score and the idiosyncratic risk difference score differ from zero. All results are winsorized at 1%. The absolute difference scores for the volatility measures suggest that, on average, total and idiosyncratic risk do change in the post-acquisition period. However systematic risk is significantly decreasing for the downside risk measure (downside beta) and the measure based on the Fama-French model. Our results further show that, on average, acquirer default risk increases after an acquisition. The percentage of positive changes indicates that the number of increases and decreases of volatility are more or less equal. Summarized, distressed M&A, on average, does not significantly impact acquirer volatility, but significantly increases acquirer default risk.

Further, we examine risk changes by looking at the percentage change in risk. Relative risk measures have the advantage of considering acquirer pre-acquisition risk. A given absolute change in risk can be more important for a low-risk acquirer (Furfine and Rosen, 2011). The relative difference score is measured by the absolute difference score divided by pre-acquisition risk. Table 6 reports different results with respect to absolute and relative risk measures. We find strong support for an increase in acquirer relative total, idiosyncratic and systematic volatility. [6] Acquirer total volatility rises on average with 5.52% to 9.53% following an acquisition event, depending on the chosen methodology.

The strong but confounding results for the absolute and relative risk measures underline the importance for further investigation of the risk drivers in distressed M&A transactions. Table 7 ranks the acquirers into quartiles based on their degree of pre-acquisition risk.[7]

*** Insert Table 7 ***

[6] Except for beta difference score of the Fama-French regression model. The beta-coefficient of the Fama-French model cannot be compared to the beta-coefficient of the market model (CAPM) since it considers two additional factors SMB (small minus big market cap) and HML (high minus low book-to-market ratio). None of the three beta-coefficients is statistically significant for the US subsample.

[7] We use the idiosyncratic component as a classification measure for low-high risk acquirers, if available.

We notice that volatility and default risk decline from low-risk to high-risk acquirers. Hence, we find strong evidence of risk increases for low-risk acquirers and risk reduction for high-risk acquirers independent of the risk measure.[8] Consistent with prior research (Vallascas and Hagendorff, 2011; Furfine and Rosen, 2011), these results confirm our expectations that acquirer pre-acquisition risk is an important driver. To test the robustness of our risk measures, we re-run the regression models with different market (country) indices. We also collect and analyse the data both in dollar and local currency when applicable. In addition, we use total financial debt as an input parameter instead of total liabilities for the distance-to-default calculation. We confirm our main findings. However, further tests in a multivariate context are necessary to evaluate the impact of various deal-specific and firm-specific factors on these risk changes.

3.2 Determinants of changes in acquirer risk

In this section, we examine the impact of various factors on distressed acquisition-related risk changes. The dependent variables in the regression models are the historical and implied volatility and default risk measures. The choice of the explanatory and control variables is based on the literature review and hypothesis development summarized in table 1. We checked the variance inflation factors and the correlations among the various explanatory and control variables. Apart from the institutional factors and regional dummies being highly correlated, no multicollinearity is found. Subsequently, we dropped the regional dummies from our regressions. However, we found no regional effects when including the regional dummies instead of the institutional factors as control variables. Further, our regressions are run using robust standard errors.

Table 8 reports the summary statistics of the independent variables. Due to missing data, the number of observations is smaller than the initial distressed sample of 1082 deals. However, note that the summary statistics of both the historical volatility sample and distance-to-default sample are in line with the summary statistics of the overall distressed sample.[9] The option implied volatility sample is slightly different but this can be explained by the geographical scope being restricted to US due to data availability issues and the fact that firms issuing options are mostly larger firms.

*** Insert Table 8 ***

[8] We find consistent results for the volatility measures based on the Fama-French model and the downside risk measures calculated below zero, as well as for the idiosyncratic risk volatility measures (not reported).

[9] Apart from the cumulative abnormal return which is due to the large standard deviation in both the full distressed sample as the other samples.

In the full distressed sample, 51.58% involve deals within related industries, measured via 3-digit SIC code[10] and 31.23% are cross-border transactions. In addition, the acquirer market adjusted buy-and-hold return is on average 16.26% over 250 days, while the average acquirer market-to-book ratio is 2.54. Most of the acquirers (67.51%) have prior acquisition experience with an average of 3.5 non-distressed deals prior to the current transaction. The yearly change in the MSCI world index is 5.4%. The premium paid for the target is on average 77.18%. Moreover, the leverage ratio increases post-acquisition with about 0.0123. Not surprisingly, the mean interest coverage ratio is negative. Further, 23.36% of the distressed targets belongs to a high-tech industry. 31.80% of the deals are fully stock financed, while 44.78% of the deals are fully cash financed. The mean cumulative abnormal return over 5 days is 0.31% with a high standard deviation of 10.51%. 55.17% of the deals involve a public target. The transaction value averages around 30% of the acquirer market value. Finally, the corporate spread is on average 1.09%.

*** Insert Table 9a ***

The regression results are presented in table 9a. We find some support for diversification effects in distressed acquisitions amongst the historical and implied volatility measures. Our results point to a decrease in volatility for conglomerate distressed acquisitions, which is inconsistent with our hypothesis. However, these transactions do not reduce acquirer default risk. A possible explanation could be that the risk-reducing diversification effect does not outweigh the increase in leverage given that the distance-to-default measure explicitly takes leverage into account. There are no diversification effects from cross-border distressed acquisitions. Moreover, we find no significant interaction effect between conglomerate and cross-border transactions.

Further, acquirers with recent poor stock performance (low buy-and-hold return) significantly increase default risk. In contrast, the results for the downside volatility measure indicate that high-performing acquirers increase downside risk more than low-performing acquirers. In addition, we test management quality by acquirer market-to-book ratio. We report that a high market-to-book ratio leads to an increase in volatility and default risk. This confirms our hypothesis that acquirers with more potential resources are able to take on more risk. In addition, high market-to-book companies are associated with growth companies suggesting that these companies have more to gain in distressed acquisitions. However, these companies may also be more exposed to management hubris so that management overestimates its capabilities to successfully restructure the distressed target. Similarly, acquirers with more non-distressed acquisition expertise generate significant increases in volatility and default risk. Subsequently, we check whether an interaction

[10] If we measure industry relatedness via 2-digit SIC code, 60% of the deals are within related industries.

effect exists between acquisition experience and market-to-book. However, no interaction effect is found. As the results of the market-to-book ratio and acquisition experience tend to refer to managerial agency problems, we test Jensen's free cash flow hypothesis (1986). Following this hypothesis, managers with large free cash flows should take more risk in distressed acquisitions as the upward potential is higher which may encompass more private benefits such as higher remuneration and personal prestige. Hence, we control for acquirer EBITDA on total assets and cash on total assets but we find no significant results. Further, we also evaluate the impact of accounting performance on risk by including acquirer return on assets, but find no significant results. Moreover, we test for acquirer distressed acquisition experience, sector-related experience and non-linear relationships between risk and experience but find no significant results.

Further, we confirm our univariate tests that volatility and default risk reduce for high-risk acquirers. In addition, we find strong support that low-risk acquirers generate increases in downside volatility and default risk. Moreover, we report that transactions in bull markets are more risk-increasing than deals closed in bear markets. This confirms our hypothesis that bidders take more risk during (over-)optimistic markets.

Furthermore, we control for leverage changes and disclose that high levels of leverage significantly increase both volatility and default risk. The effect is not surprising for the distance-to-default measure as we use leverage to calculate this measure. However, also historical and implied volatility rise when leverage increases. We find consistent results if we control for total financial debt on total assets instead of total leverage on total assets. To assess the effect of the target's risk profile on acquirer volatility and default risk, we test for the target's degree of risk via its Interest Coverage Ratio and Distance-to-Default (not reported), but find no significant results. In addition, no significant results are reported for the target high-tech dummy, the method of payment and the cumulative abnormal return.[11] Moreover, we find some support that transactions involving large acquirers and public targets are less risk-increasing, whereas large deals increase risk. We also consider the impact of market liquidity and reveal that deals closed in markets with credit scarcity are more risk-increasing. Finally, we control for industry effects and institutional factors but find no significant results.

3.2.1 The impact of management quality

The regression results in table 9a confirm a number of hypotheses. However, the conflicting evidence of acquirer pre-acquisition performance measured by buy-and-hold return and market-to-book ratio is somewhat surprising. Acquirers with low buy-and-hold returns are associated with risk-increasing transactions, consistent with Morck et al. (1990). High market-to-book acquirers tend to

[11] We also control for the cumulative abnormal return over the period [-30 +2] but find no significant results.

take more risk, consistent with the hubris hypothesis of Roll (1986). Therefore, we further investigate the interaction effect between pre-acquisition risk and pre-acquisition performance. We find that high-risk acquirers are associated with significantly higher buy-and-hold returns than low-risk acquirers. Not surprisingly, these companies involve more risk and therefore shareholders should be compensated by receiving a higher return. Consequently, we test for an interaction effect between high-risk acquirers and buy-and-hold return. Most of the regression models in table 9b report a significant interaction effect between both. Moreover, the coefficients of the buy-and-hold return variable are no longer significant, except for downside volatility indicating a positive relation consistent with previous findings. This confirms that our initial findings were driven by high buy-and-hold returns of high-risk acquirers. We conclude that high market-to-book acquirers increase risk probably driven by a higher availability of resources compared to low market-to-book firms. However, given that these companies have more funds, they might be vulnerable to management hubris. Moreover, acquirers with high buy-and-hold returns increase downside risk indicating that following distressed acquisitions their sensitivity to downside market movements rises. In contrast, high-risk acquirers with high buy-and-hold returns decrease volatility and default risk, suggesting that the market perceives these transactions as less risky.

*** Insert Table 9b ***

3.2.2 The impact of overpayment

In this section, we test whether the premium paid for the distressed target has an impact on bidders' volatility and default risk. As the premium is calculated based on the target stock price, this subsample only includes public distressed targets. Table 9c reveals some support for increased implied volatility and default risk due to higher acquisition premia. Higher premia could lead to overpayment. Definitely in distressed acquisitions, overpaying may be higher given that deals are closed in shorter timeframes and involve a more complex analysis. Moreover, management confidence may lead to the payment of higher premia. Given that high market-to-book acquirers have more financial flexibility, we could expect that overpayment is higher in such transactions. Hence, we test the interaction effect between acquirer market-to-book and the premium paid. Table 9d shows that overpayment is lower for high market-to-book acquirers, which is inconsistent with the hubris hypothesis. In addition, we find the same results when we use the target's cumulative abnormal return around the announcement event as a proxy for acquisition premium.

*** Insert Table 9c ***

3.2.3 The impact of bidder pre-acquisition risk

In general, a distressed target has more default risk than the typical acquirer. So, we would expect that, given risk transfer, risk would increase both for acquirers with low and high pre-acquisition risk. Nevertheless, risk still decreases for high-risk acquirers even if we remove all distressed acquirers (acquirers with an ICR less than one). In addition, we remove all acquirers with a higher degree of default risk than the target's degree of default risk and document that default risk still reduces for high-risk acquirers. This suggests that the changes in risk cannot exclusively be explained by a risk transfer from target to acquirer.

To provide further evidence on risk transfer, we calculate default risk of a hypothetical portfolio of acquirer and target 250 days before acquisition, weighted according to market value of assets of acquirer and target. This limits the distressed sample to 232 observations as we only include public targets for which we can measure Merton's distance-to-default. The average distance-to-default prior to acquisition of this subsample is 4.3694 in line with the full sample average. If we compare default risk of this portfolio to acquirer default risk prior to acquisition, then the average distance-to-default of the portfolio is significantly above the acquirer pre-acquisition value (a difference of 0.7676). This indicates that there is asset diversification. In addition, the post-acquisition distance-to-default is significantly below the portfolio's distance-to-default (a difference of -1.4093), again confirming that risk is not solely transferred but may be created by the M&A process itself e.g. uncertainties about expected synergies, integration risk, extra debt capacity, etc.

To control whether the additional evidence is similar for low- and high-risk acquirers, we perform the analysis for both subsamples. For low-risk acquirers we find that although asset diversification is substantial (14%), it is not large enough to outweigh the risk increase generated by the acquisition itself (37%) in contrast to high-risk acquirers. For high-risk acquirers, asset diversification causes a reduction in default risk of 54%, whereas the acquisition itself creates a risk increase of 16%.

Following the above findings, the impact of distressed acquisitions seems to be different for low-risk and high-risk acquirers. Therefore, we examine whether these different risk-effects are linked to diverse acquisition strategies involving different deal and firm characteristics.

First, to get a better understanding of the risk profile of high- and low-risk acquirers, we compare several accounting ratios of the acquirer one year prior to the deal.[12] Table 10a reports that high-risk acquirers are on average smaller than low-risk acquirers, both measured by book size as market value. Moreover, high-risk acquirers score lower on profitability measures than low-risk

[12] The subsamples of low-risk and high-risk acquirers are based on the degree of default risk. However, our findings hold for the subsamples of low-risk and high-risk acquirers based on the degree of historical volatility (including downside risk) apart from high risk acquirers being less leveraged than low risk acquirers.

acquirers. High-risk acquirers have on average a negative ratio of EBITDA to total assets and a negative return on equity. The differences between high-risk and low-risk acquirers are statistically significant at a 1% level. When evaluating the liquidity position, we notice that high-risk acquirers are more liquid than low-risk acquirers. Further, high-risk acquirers are, on average, more leveraged than low-risk acquirers and have a negative interest coverage ratio. Nevertheless, the median value of the interest coverage ratio is positive. In summary, both subsamples have a significantly different risk profile.

*** Insert Table 10a ***

Subsequently, we test whether they acquire targets with different risk profiles as their pre-acquisition risk profile could play an important role in the selection of the target. Table 10a reports several accounting ratios on target's profitability, liquidity and solvency for high- and low-risk acquirers. We find that high-risk acquirers acquire distressed targets that are on average smaller and less leveraged than targets acquired by low-risk acquirers.[13]

In addition, we examine several deal-characteristics for both types of acquirers. Table 10b reports summary statistics of these characteristics. High-risk acquirers execute less cross-border deals (27.65%) than low-risk acquirers (40.12%). High-risk acquirers have, on average, higher buy-and-hold returns, lower market-to-book ratios and less acquisition experience than low-risk acquirers. Further, most of the deals by low-risk acquirers take place in bull markets (84.20%) whereas deals by high risk acquirers are more or less equally spread between bear and bull markets. In addition, high-risk acquirers prefer to pay in stock (42.67%) instead of cash (30.67%) in contrast to low-risk acquirers who prefer to pay in cash (71.65%) rather than stock (15.75%).[14]

*** Insert Table 10b ***

The above results indicate that the different risk-effects of low-risk and high-risk acquirers are motivated by diverse acquisition decisions. Therefore, we run separate regressions on both subsamples (not reported). We find that the risk effects of high-risk acquirers are determined by the same factors as the regression results on the overall sample. This suggests that high-risk acquirers have the potential to decrease risk by taking over distressed targets through deliberate acquisition

[13] The same findings hold for the subsamples of low-risk and high-risk acquirers based on the degree of historical volatility (including downside risk).

[14] The same findings hold for the subsamples of low-risk and high-risk acquirers based on the degree of historical volatility (including downside risk). However, the difference of buy-and-hold returns between both subsamples is significant at 1%.

decisions. For example, high-risk acquirers are more reluctant to take additional leverage on their balance sheet by preferring stock-financed deals involving less leveraged targets. By contrast, risk effects of low-risk acquirers are mainly driven by relative size of the deal and leverage changes. We test these results further via interaction effects and confirm our main findings. Table 10c shows a strong interaction effect between low-risk acquirers and relative size of the deal. This points to a considerable risk increase for low-risk acquirers involved in large and complex deals. Moreover, we find a strong interaction effect between low-risk acquirers and leverage changes indicating that the default risk of low-risk acquirers mainly increases due to increases in leverage surrounding the transaction. We further explore the source of this leverage effect by comparing post-acquisition leverage to combined pre-acquisition leverage and document a significant increase. This indicates that the increased leverage surrounding the acquisition is not solely caused by target's leverage.

*** Insert Table 10c ***

3.3 Robustness checks

To verify the robustness of our results, we perform several additional tests. First, we restrict our sample to deals with a minimum relative size of 5% and add time dummies to our multivariate regression. We find that our main results are invariant.

Second, we drop all deals which fall within 250 trading days between separate acquisition announcements to avoid confounding events (which reduces the sample size by half). We did not impose this restriction initially as it would bias our results towards less frequent acquirers. We document that the acquirer market-to-book ratio is no longer significant for the volatility measures, however default risk still significantly increases for acquirers with high market-to-book ratios. In addition, we do not find overpayment in such acquisitions. However, these results may be biased by the small sample size.[15]

Third, we impose the restriction that distressed targets have an ICR smaller than one in the first, second and third year prior to the acquisition. In addition, we exclude transactions involving bankrupt targets (2%). We confirm our main results. Moreover, we calculate the Altman Z-score of the targets in our distressed sample. We find that 74.68% of the targets have a Z-score smaller than 1.81 indicating that these companies are in the 'distress zone'.

Fourth, to evaluate whether our results are not driven by distressed acquirers, we removed from our distressed sample all acquirers with an interest coverage ratio less than one, one year prior to the deal (which reduces the sample size with about 100 observations). The results confirm our

[15] We only have about 90 observations for the regressions including the variable premium.

main findings. However, the decrease in acquirer post-acquisition volatility is no longer significant for conglomerate distressed acquisitions. This suggests that especially distressed acquirers benefit from the risk-reducing effect of conglomerate transactions. We test the subsample of distressed acquirers and confirm that the coefficient of CONGLOMERATE is significantly negative indicating that volatility decreases post-acquisition. However, future research may examine the specific drivers of M&A by distressed acquirers.

Finally, we evaluate the impact of distressed acquisitions on bondholder risk by investigating changes in bond spreads surrounding the acquisition announcement, defined as the difference between bond yield and government bond. We are able to compose a sample of 88 bond spreads (29 acquirers) and find that bond spreads significantly increase post-acquisition both absolutely (12 bps) and relatively (10.9%), which is consistent with our previous findings.[16]

4 Summary and conclusions

This paper analyses the risk effects of distressed M&A transactions. We collect a worldwide sample of 1082 distressed acquisitions occurring between 1990 and 2009 and compare various risk measures. We show that, on average, absolute levels of historical and implied volatility do not change following a distressed acquisition. However, we report a significant increase in relative total, systematic and idiosyncratic volatility. Moreover, distressed acquisitions generate a significant increase in bidder default risk. This indicates that shareholders and bondholders involved in a distressed acquisition are exposed to additional risk. Interestingly, this risk increase cannot solely be explained by a risk transfer from distressed target to acquirer. In particular, volatility and default risk increase for low-risk acquirers, whereas high-risk acquirers may reduce volatility and default risk by taking over a distressed target.

In order to explain these risk effects further, we examine the influence of diversification, acquirer management quality and expertise, market conditions, bidder overpayment and acquirer pre-acquisition risk. We show that high market-to-book acquirers, frequent acquirers, low-risk acquirers, higher acquisition premia and deals closed during bull markets are associated with higher levels of post-acquisition risk. The risk increase for high market-to-book acquirers is probably driven by a higher availability of resources. Yet, these firms might be vulnerable to management hubris. However, overpayment is lower for transactions involving high market-to-book acquirers which is inconsistent with the hubris hypothesis. In addition, downside risk increases for acquirers with high recent stock performance indicating that following a distressed acquisition their sensitivity to

[16] Bond data is downloaded from Thomson Datastream.

downside market movements rises. Not surprisingly, the turnaround and integration process of a distressed target brings more uncertainty in bear markets. Correspondingly, bidders take more risk during (over-)optimistic markets. Further, we find that the risk increase for low-risk acquirers is mainly driven by closing larger distressed deals and taking up higher levels of leverage.

Although some of these results may point to management hubris in distressed acquisitions, it is surprising that default risk for high-risk acquirers even decreases when acquiring a target with a higher degree of default risk. Asset diversification reduces default risk by 54%, whereas the acquisition itself creates a risk increase of only 16%. This could be explained by high-risk acquirers being more reluctant towards additional leverage by preferring stock-financed deals involving less leveraged targets. However, such acquisition decisions are inconsistent with the theory of management hubris. Hence, risk effects in distressed acquisitions cannot exclusively be explained by risk transfer but may be influenced by bidder pre-acquisition levels of performance and risk and market conditions.

From a social point of view, partial risk increases following distressed acquisitions may be justified if the target's alternative is bankruptcy, which often destroy value and lower economic welfare. Therefore, governments should encourage these transactions and consider them rightfully as alternative to bankruptcy or Chapter 11 type of exits.

While our study documents a number of deal- and firm-specific characteristics, managerial biases could further affect risk in distressed acquisitions. Given the separation between ownership and control, future research may well take into account the relation between corporate risk-taking and management entrenchment (Bebchuk et al., 2009; Gompers et al., 2003). Managers that have more freedom in making decisions could influence acquisition choices in significant ways. Moreover, managerial risk-preferences may be associated with incentive systems. Furfine and Rosen (2011) find that managers with large option-based compensation are incentivized to risk-increasing actions in corporate acquisitions. Future investigation of the topic might also extend our analysis by having a detailed look at institutional differences such as the impact of differences in bankruptcy procedures. Clearly, in this unprecedented and challenging environment a better understanding of distressed acquisitions is needed.

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Table 1: Description of independent variables and hypothesized effects

Independent variables		Measurement	Hypothesized effect
Explanatory variables			
Diversification			
Activity diversification	CONGLOMERATE	Dummy variable that equals one if acquirer and target have a different three-digit SIC industry	Increase
Geographic diversification	CROSSBORDER	Dummy variable that equals one if the acquirer and target are in a different nation	Decrease
Management quality and expertise			
Pre-acquirer performance	BHR	Acquirer pre-acquisition Buy-and-Hold return calculated over the window [-280 -30[adjusted for the market return	Increase
	MTB	Acquirer pre-acquisition Market-to-Book calculated as Acquiror Market Value of Assets [-280 -30[divided by Total Assets (Y-1)	Increase
Prior acquisition experience	ACQEXP	Acquirer prior acquisition experience equals the number of non-distressed transactions prior to the current deal	Increase
Acquirer pre-acquisition risk			
Pre-acquirer risk LOW	DUMLOWRISK		
	Historical volatility	Dummy variable that equals 1 if acquirer pre-idiosyncratic risk value falls within the 1st Q	Increase
	Downside risk	Dummy variable that equals 1 if acquirer pre-downside risk value falls within the 1 st Q	Increase
	Distance-to-default	Dummy variable that equals 1 if acquirer pre-distance to default value falls within the 4th Q	Increase
	Implied volatility	Dummy variable that equals 1 if acquirer pre-idiosyncratic risk value falls within the 1st Q	Increase
Pre-acquirer risk HIGH	DUMHIGHRISK		
	Historical volatility	Dummy variable that equals 1 if acquirer pre-idiosyncratic risk value falls within the 4th Q	Decrease
	Downside risk	Dummy variable that equals 1 if acquirer pre-downside risk value falls within the 4th Q	Decrease
	Distance-to-default	Dummy variable that equals 1 if acquirer pre-distance to default value falls within the 1st Q	Decrease
	Implied volatility	Dummy variable that equals 1 if acquirer pre-idiosyncratic risk value falls within the 4th Q	Decrease
Bull and bear markets	BULL_BEAR	Yearly change of MSCI All Countries market return	Increase
Premium paid for target	PREMIUM	Price paid per share minus Stockprice of the target 4 weeks before acquisition, divided by the Stockprice of the target 4 weeks before acquisition	Increase
Control variables			
Leverage changes	CHANGESLEV	Difference in post-acquisition (Y+1) and pre-acquistion (Y-1) Total Liabilities on Total Assets	Increase
Target interest coverage ratio	TARGETICR	Target interest coverage ratio measured by the EBITDA divided by Interest Expense on Debt in Y-1	Increase
Target in high-tech industry	TARGETHIGHTECH	Dummy variable that equals 1 if target is in a high-tech industry measured by the OECD classification	Increase
Stock-paid deals	ALLSTOCK	Dummy variable that equals one if the deal is fully stock financed	Decrease
Cumulative Abnormal Return	CAR	Cumulative Abnormal Return over the window [-2; +2]	Decrease
Target public status	TARGETPUBLIC	Dummy variable that equals one if the target is a quoted company	Decrease
Relative size of the deal	RELATIVESIZE	Deal value divided by acquirer Market Value of Assets	Increase
Acquirer size	SIZE	Log of acquirer pre-acquisition Market Value of Assets calculated as Market Value of Equity plus Book Value Total Debt, Market Value of Equity = mean of daily Market Cap over the window]-30; -280]	Decrease
Corporate spread	C_SPREAD	The difference between corporate AAA bonds and BAA bonds	Decrease
Institutional effects	Institutional effects	Acquirer and target anti-director rights index and creditor rights index (Laporta et al., 1998)	
Regional effects	Regional dummies	Based on acquirer/target nation assigned to Europe_developed, Europe_emerging, UK, US, Other developed countries, Other emerging countries	
Industry effects	Industry dummies	Acquirer industry dummies; acquirer is assigned to a particular industry via the Industry Classification Benchmark (level2) developed by Dow Jones and FTSE, downloaded from Thomson Datastream	

Note. This table provides an overview of the various hypotheses and describes the measurement of the independent variables.

Table 2: Construction of distressed sample

Year	N° of deals with public acquirer				N° of deals with accounting info on ICR of target				N° of deals with target $ICR_{Y-1}<1$ (excl. financial industry)				Final distressed sample	
	Thomson ONE Banker		Zephyr		Thomson ONE Banker		Zephyr		Thomson ONE Banker		Zephyr		Thomson ONE Banker & Zephyr	
1985	875	0.5%			14	0.3%			0	0.0%			0	0.0%
1986	1,575	1.0%			50	0.9%			1	0.2%			1	0.1%
1987	1,866	1.2%			49	0.9%			0	0.0%			0	0.0%
1988	2,613	1.6%			73	1.4%			0	0.0%			0	0.0%
1989	3,368	2.1%			87	1.7%			0	0.0%			0	0.0%
1990	3,413	2.1%			63	1.2%			2	0.3%			2	0.2%
1991	3,730	2.3%			86	1.6%			3	0.5%			3	0.3%
1992	3,962	2.5%			94	1.8%			3	0.5%			3	0.3%
1993	4,604	2.9%			86	1.6%			2	0.3%			2	0.2%
1994	5,710	3.6%			121	2.3%			4	0.7%			4	0.4%
1995	6,516	4.1%			173	3.3%			4	0.7%			4	0.4%
1996	7,703	4.8%			165	3.1%			6	1.0%			6	0.6%
1997	9,769	6.1%	485	0.9%	312	5.9%	5	0.1%	5	0.9%	0	0.0%	5	0.5%
1998	11,039	6.9%	368	0.7%	495	9.4%	8	0.2%	36	6.3%	1	0.2%	36	3.3%
1999	10,438	6.5%	268	0.5%	657	12.5%	8	0.2%	77	13.4%	0	0.0%	77	7.1%
2000	10,368	6.5%	2,837	5.2%	493	9.4%	30	0.6%	64	11.2%	3	0.5%	65	6.0%
2001	7,476	4.7%	1,674	3.0%	360	6.8%	35	0.7%	71	12.4%	3	0.5%	71	6.6%
2002	6,608	4.1%	1,985	3.6%	233	4.4%	203	4.0%	45	7.9%	46	7.3%	81	7.5%
2003	6,589	4.1%	4,973	9.0%	251	4.8%	370	7.3%	49	8.6%	80	12.8%	112	10.4%
2004	7,925	4.9%	6,300	11.5%	227	4.3%	492	9.7%	29	5.1%	56	8.9%	79	7.3%
2005	9,224	5.7%	7,458	13.6%	267	5.1%	729	14.4%	38	6.6%	83	13.2%	107	9.9%
2006	9,858	6.1%	7,979	14.5%	262	5.0%	824	16.3%	33	5.8%	96	15.3%	111	10.3%
2007	10,262	6.4%	8,499	15.5%	292	5.5%	1,086	21.5%	33	5.8%	98	15.6%	107	9.9%
2008	8,417	5.2%	7,078	12.9%	191	3.6%	798	15.8%	38	6.6%	96	15.3%	121	11.2%
2009	6,660	4.1%	5,102	9.3%	169	3.2%	473	9.3%	30	5.2%	65	10.4%	85	7.9%
Total	**160,568**	**100%**	**55,006**	**100%**	**5,270**	**100%**	**5,061**	**100%**	**573**	**100%**	**627**	**100%**	**1,082**	**100%**

Note. The table presents the construction of the distressed sample of 1082 deals. We completed the Thomson ONE Banker M&A sample with M&A deals collected from the Zephyr database. Zephyr is a database of M&A, IPO and venture capital deals, with pan-European transactions dating back to 1997 and US deals from 2001.

Table 3: Transactions by region

		N° of transactions by acquirer region		N° of transactions by target region	
US		*515*	*47.60%*	*477*	*44.09%*
Europe		*477*	*44.09%*	*569*	*52.59%*
	UK	140	12.94%	168	15.53%
	Europe excluding UK	337	31.15%	401	37.06%
	Austria	6	0.55%	3	0.28%
	Belgium	8	0.74%	12	1.11%
	Bulgaria	1	0.09%	0	0.00%
	Czech Republic	1	0.09%	5	0.46%
	Denmark	3	0.28%	0	0.00%
	Finland	13	1.20%	13	1.20%
	France	83	7.67%	127	11.74%
	Germany	37	3.42%	41	3.79%
	Greece	15	1.39%	13	1.20%
	Hungary	0	0.00%	3	0.28%
	Ireland	6	0.55%	3	0.28%
	Italy	20	1.85%	34	3.14%
	Luxembourg	1	0.09%	1	0.09%
	Netherlands	15	1.39%	4	0.37%
	Norway	28	2.59%	34	3.14%
	Poland	10	0.92%	14	1.29%
	Portugal	2	0.18%	3	0.28%
	Romania	0	0.00%	3	0.28%
	Serbia	1	0.09%	3	0.28%
	Slovakia	0	0.00%	2	0.18%
	Slovenia	0	0.00%	1	0.09%
	Spain	22	2.03%	30	2.77%
	Sweden	48	4.44%	50	4.62%
	Switzerland	16	1.48%	1	0.09%
	Ukraine	1	0.09%	1	0.09%
Excluding Europe and US		*90*	*8.32%*	*36*	*3.33%*
Total		**1,082**	**100.00%**	**1,082**	**100.00%**

Note. This table presents the geographical distribution of the 1082 distressed M&A deals.

Table 4: Transactions by industry

2-digit SIC code	Acquirer industry		Target industry	
Division A: Agriculture, fishing and hunting	*3*	*0.14%*	*7*	*0.32%*
01 Agricultural production crops	1	0.05%	4	0.19%
09 Fishing, hunting, and trapping	2	0.09%	3	0.14%
Division B: Mining	*48*	*2.23%*	*42*	*1.95%*
10 Metal mining	19	0.88%	22	1.02%
12 Coal mining	1	0.05%	1	0.05%
13 Oil and gas extraction	22	1.02%	16	0.74%
14 Non-metallic minerals, except fuels	6	0.28%	3	0.14%
Division C: Construction	*14*	*0.65%*	*12*	*0.56%*
15 General building contractors	3	0.14%	9	0.42%
16 Heavy construction, ex. building	10	0.46%	2	0.09%
17 Construction special trade contractors	1	0.05%	1	0.05%
Division D: Manufacturing	*470*	*21.83%*	*410*	*19.01%*
20 Food and kindred products	25	1.16%	26	1.21%
21 Tobacco products	1	0.05%	0	0.00%
22 Textile mill products	5	0.23%	3	0.14%
23 Apparel and other fishing products	8	0.37%	4	0.19%
24 Lumber and wood products	3	0.14%	3	0.14%
25 Furniture and fixtures	2	0.09%	0	0.00%
26 Paper and allied products	8	0.37%	6	0.28%
27 Printing and publishing	20	0.93%	16	0.74%
28 Chemicals and allied products	142	6.60%	129	5.98%
29 Petroleum and coal products	8	0.37%	2	0.09%
30 Rubber and misc. plastic products	4	0.19%	3	0.14%
31 Leather and leather products	1	0.05%	0	0.00%
32 Stone, clay and glass products	5	0.23%	3	0.14%
33 Primary metal industries	11	0.51%	10	0.46%
34 Fabricated metal products	12	0.56%	11	0.51%
35 Industrial machinery and equipment	53	2.46%	40	1.85%
36 Electronic and other electronic equipment	92	4.27%	81	3.76%
37 Transportation equipment	14	0.65%	14	0.65%
38 Measuring, analysing, and controlling Instruments; photographic, medical and optical Goods; watches and clocks	50	2.32%	54	2.50%
39 Miscellaneous manufacturing industries	6	0.28%	5	0.23%
Division E: Transportation, Communications, Electric, Gas, And Sanitary Services	*129*	*5.99%*	*119*	*5.52%*
40 Railroad transportation	1	0.05%	1	0.05%
42 Trucking and warehousing	1	0.05%	3	0.14%
44 Water transportation	6	0.28%	9	0.42%
45 Transportation by air	4	0.19%	4	0.19%
46 Pipelines, expect natural gas	0	0.00%	1	0.05%
47 Transportation services	4	0.19%	4	0.19%
48 Communication	85	3.95%	73	3.38%
49 Electric, gas and sanitary services	28	1.30%	24	1.11%
Division F: Wholesale trade	*28*	*1.30%*	*27*	*1.25%*
50 Wholesale trade-durable goods	15	0.70%	18	0.83%
51 Wholesale trade-nondurable goods	13	0.60%	9	0.42%
Division G: Retail trade	*39*	*1.81%*	*40*	*1.85%*
52 Building materials and garden supplies	0	0.00%	0	0.00%
53 General merchandise stores	2	0.09%	2	0.09%
54 Food stores	4	0.19%	2	0.09%
55 Automotive dealers and gasoline service stations	1	0.05%	1	0.05%
56 Apparel and accessory stores	4	0.19%	6	0.28%
57 Furniture and home furnishing stores	4	0.19%	6	0.28%
58 Eating and drinking places	7	0.33%	8	0.37%
59 Miscellaneous retail	17	0.79%	15	0.70%
Division H: Services	*347*	16.12%	*422*	*19.56%*
70 Hotels, rooming Houses, camps, and other lodging places	2	0.09%	2	0.09%
72 Personal services	3	0.14%	5	0.23%
73 Business services	257	11.94%	305	14.14%
75 Automotive repair, services and parking	1	0.05%	0	0.00%
76 Miscellaneous repair services	0	0.00%	3	0.14%
78 Motion pictures	6	0.28%	5	0.23%
79 Amusement and recreation services	9	0.42%	11	0.51%
80 Health services	10	0.46%	13	0.60%
81 Legal services	1	0.05%	0	0.00%
82 Educational services	2	0.09%	3	0.14%
83 Social services	5	0.23%	6	0.28%
87 Engineering and management services	51	2.37%	69	3.20%
Division J: Public administration	*0*	*0.00%*	*3*	*0.14%*
92 Justice, public order, and safety	0	0.00%	1	0.05%
95 Administration of environmental quality and housing programs	0	0.00%	2	0.09%
Total	**1,079**	**100.00%**	**1,082**	**100.00%**

Note. This table presents the industry distribution of the 1082 distressed M&A deals.

Table 5: Accounting ratios target and acquirer Y-1

Target Y-1	Obs	Median	Mean	Sd	Min	Max
TOTAL ASSETS ($ Th)	964	22,658	155,871	509,706	1	7,946,086
MARKET VALUE OF ASSETS ($ Mio)	418	84.02	371.32	962.34	1.23	12,644.21
Profitability						
EBITDA/SALES	847	-0.34	-5.81	78.84	-2,245.33	0.65
NET INCOME/TOTAL EQUITY	718	-49.94	-136.31	606.87	-14,403.23	265.24
EBITDA/TOTAL ASSETS	1067	-0.19	-2.26	32.40	-695.00	0.54
EBIT/TOTAL ASSETS	1005	-0.25	-1.18	16.75	-522.00	0.54
SALES/TOTAL ASSETS	871	0.57	2.46	13.76	0.00	249.10
Liquidity						
CASH & EQ/TOTAL ASSETS	916	0.17	0.28	0.28	0.00	0.93
CURRENT ASSETS/CURRENT LIABILITIES	1056	1.33	3.04	5.42	0.00	70.55
Solvency						
EBITDA/INTEREST EXPENSE	1082	-12.10	-235.38	1,914.79	-51,924.33	0.99
TOTAL LIABILITIES/TOTAL ASSETS	1067	0.68	1.84	10.16	0.02	195.33
TOTAL LIABILITIES/MV OF ASSETS	415	0.25	0.54	1.72	0.01	30.89
TOTAL FINANCIAL DEBT/TOTAL ASSETS	897	0.15	0.53	2.15	0.00	46.38
TOTAL EQUITY/TOTAL LIABILITIES	1004	0.44	1.98	5.22	-10.58	64.71

Acquirer Y-1	Obs	Median	Mean	Sd	Min	Max
TOTAL ASSETS ($ Th)	952	539,736	8,043,094	23,300,000	3	243,000,000
MARKET VALUE OF ASSETS ($ Mio)	905	907.22	14,847.46	41,114.14	0.93	407,513.20
Profitability						
EBITDA/SALES	649	0.11	-0.21	2.06	-33.07	7.15
NET INCOME/TOTAL EQUITY	865	9.07	-36.60	579.84	-14,346.33	997.71
EBITDA/TOTAL ASSETS	785	0.09	-0.03	1.18	-28.26	0.92
SALES/TOTAL ASSETS	701	0.72	0.84	0.63	0.00	4.83
Liquidity						
CASH & EQ/TOTAL ASSETS	938	0.16	0.25	0.24	0.00	0.98
CURRENT ASSETS/CURRENT LIABILITIES	934	1.76	3.15	6.66	0.01	117.60
Solvency						
EBITDA/INTEREST EXPENSE	824	7.32	39.88	1,453.24	-24,270.00	31,643.00
TOTAL LIABILITIES/TOTAL ASSETS	935	0.48	0.94	9.03	0.01	195.33
TOTAL LIABILITIES/MV OF ASSETS	904	0.30	0.40	0.39	0.00	2.94
TOTAL FINANCIAL DEBT/TOTAL ASSETS	934	0.15	0.35	3.09	0.00	66.67
TOTAL EQUITY/TOTAL LIABILITIES	938	1.09	2.84	10.02	-44.75	190.58

Note: This table reports the median, mean, standard deviation, minimum and maximum of bidder and target accounting ratios in the year before the M&A. As some data is missing in the full distressed sample, we report the number of observations as well.

Table 6: Do distressed acquisitions impact acquirer risk?

Risk measure	Obs	*Absolute Total risk difference* Mean	Sd	P-value	*Relative Total risk difference* Mean	Sd	P-value	% positive changes
Historical volatility								
Stock return volatility (Market Model)	790	-0.0589	1.4423	0.2508	0.0699***	0.4209	0.0000	49.87%
Stock return volatility (Fama-French Model)[a]	395	-0.0285	2.2608	0.8022	0.0552**	0.4379	0.0128	47.09%
Downside risk (Semi deviation) with respect to average	877	-0.0496	1.6362	0.3692	0.0953***	0.4908	0.0000	49.72%
Downside risk (Semi deviation) with respect to zero	879	-0.0521	1.3317	0.2462	0.0829***	0.4540	0.0000	50.06%
Implied option volatility[a]	221	0.0088	0.1451	0.3684	0.0699***	0.2912	0.0004	50.68%
Distance-to-default	687	-0.3493***	1.7906	0.0000	0.01856	0.3706	0.1891	45.85%

Risk measure	Obs	*Absolute Systematic risk (beta) difference* Mean	Sd	P-value	*Relative Systematic risk (beta) difference* Mean	Sd	P-value	% positive changes
Historical volatility								
Stock return volatility (Market Model)	790	0.0049	0.5239	0.7939	0.4115***	1.6573	0.0000	49.62%
Stock return volatility (Fama-French Model)[a]	395	-0.0601*	0.7136	0.0949	-0.0973	1.1749	0.1006	46.33%
Downside beta	875	-0.1606***	1.2280	0.0001	0.0727***	0.6520	0.0010	44.13%
Implied option volatility[a]	210	0.0100	0.1371	0.2895	0.2150***	0.6544	0.0000	53.33%

Risk measure	Obs	*Absolute Idiosyncratic risk difference* Mean	Sd	P-value	*Relative Idiosyncratic risk difference* Mean	Sd	P-value	% positive changes
Historical volatility								
Stock return volatility (Market Model)	790	-0.0763	1.3461	0.1117	0.0555***	0.4015	0.0001	48.68%
Stock return volatility (Fama-French Model)[a]	395	-0.0467	2.1280	0.6628	0.0351*	0.4074	0.0876	45.82%
Implied option volatility[a]	210	-0.0036	0.1274	0.6863	0.0623**	0.3489	0.0105	51.20%

****(**;*) denotes significance at 1% (5%; 10%)*

[a] United States subsample

Note: This table reports the absolute and relative difference scores for total risk, systematic risk and idiosyncratic risk. The differences scores are calculated over various risk measures by computing acquirer average volatility or default risk over the post-announcement period]+2 +252] minus the average volatility or default risk over the pre-announcement period [-280 -30[. The t-test evaluates whether the difference scores are equal to zero. In addition, we report the percentage of positive difference scores per risk measure. The results are winsorized at 1% level.

Table 7: Average difference scores – quartiles

Absolute Total risk difference

	Historical volatility								Implied option volatility[a]				Distance-to-default			
	Stock return volatility (Market Model)				Downside risk											
	Obs	**Mean**	**Sd**	**P-value**	**Obs**	**Mean**	**Sd**	**P-value**	**Obs**	**Mean**	**Sd**	**P-value**	**Obs**	**Mean**	**Sd**	**P-value**
Quartile 1	197	0.3858***	0.7010	0.0000	219	0.4719***	0.8488	0.0000	53	0.0464***	0.0923	0.0006	172	0.5183***	0.9897	0.0000
Quartile 2	198	0.2467***	0.9905	0.0006	219	0.3751***	1.0280	0.0000	52	0.0449***	0.1112	0.0053	173	0.2433***	1.2963	0.0146
Quartile 3	197	0.0115	1.3350	0.9036	221	0.0479	1.5059	0.6368	53	0.0183	0.1262	0.2958	172	-0.4312***	1.4174	0.0000
Quartile 4	198	-0.8774***	2.0292	0.0000	218	-1.0992***	2.2693	0.0000	52	-0.0851***	0.1941	0.0026	173	-1.6093***	2.3811	0.0000

Relative Total risk difference

	Historical volatility								Implied option volatility[a]				Distance-to-default			
	Stock return volatility (Market Model)				Downside risk											
	Obs	**Mean**	**Sd**	**P-value**	**Obs**	**Mean**	**Sd**	**P-value**	**Obs**	**Mean**	**Sd**	**P-value**	**Obs**	**Mean**	**Sd**	**P-value**
Quartile 1	197	0.2624***	0.4274	0.0000	218	0.3376***	0.5055	0.0000	53	0.1842***	0.3121	0.0001	172	0.3176***	0.5488	0.0000
Quartile 2	198	0.1168***	0.4197	0.0001	219	0.1764***	0.4734	0.0000	52	0.1208***	0.2849	0.0035	173	0.0740***	0.3506	0.0061
Quartile 3	197	0.0133	0.3980	0.6390	221	0.0157	0.4576	0.6109	53	0.0469	0.2447	0.1690	172	-0.0727***	0.2540	0.0002
Quartile 4	198	-0.1122***	0.3438	0.0000	218	-0.1475***	0.3839	0.0000	52	-0.0852**	0.2463	0.0158	173	-0.1613***	0.2403	0.0000

****(**;*) denotes significance at 1% (5%; 10%)*

[a] United States subsample

Note: This table reports the absolute and relative total risk difference scores by risk quartiles. The risk quartiles are computed using the idiosyncratic risk component if applicable. The differences scores are calculated over various risk measures by computing acquirer average volatility or default risk over the post-announcement period]+2 +252] minus the average volatility or default risk over the pre-announcement period [-280 -30[. The t-test evaluates whether the difference scores are equal to zero. The results are winsorized at 1% level.

Table 8: Summary descriptive statistics of independent variables

Independent variables	Full sample (1082 obs)			Historical volatility sample (536 obs)[a]		Distance-to-default sample (504 obs)		Option implied volatility sample (182 obs)[b]	
	Obs	**Mean**	**Sd**	**Mean**	**Sd**	**Mean**	**Sd**	**Mean**	**Sd**
Explanatory variables									
CONGLOMERATE	1078	0.4842	0.5000	0.4493	0.4978	0.4507	0.4980	0.3388	0.4746
CROSSBORDER	1082	0.3123	0.4636	0.2989	0.4582	0.3133	0.4643	0.1530	0.3609
BHR	872	0.1626	0.6070	0.1639	0.5873	0.1439	0.5515	0.1673	0.5620
MTB	904	2.5412	3.2160	2.5922	3.0756	2.6559	3.4247	3.3863	3.9231
ACQEXP	1065	3.4884	7.3810	4.5093	7.9296	4.3790	7.9480	8.5989	11.1022
LOWRISK									
Historical volatility				0.2210	0.4153				
Downside risk				0.2373	0.4258				
Distance-to-default						0.2302	0.4214		
Implied volatility								0.2186	0.4144
HIGHRISK									
Historical volatility				0.2717	0.4453				
Downside risk				0.2246	0.4177				
Distance-to-default						0.2746	0.4468		
Implied volatility								0.2623	0.4411
BULL_BEAR	1082	0.0538	0.2141	0.0638	0.1986	0.0673	0.1983	0.0725	0.1865
PREMIUM	428	0.7718	1.2093	0.7212	1.0140	0.7437	1.0423	0.6028	0.4947
Control variables									
CHANGESLEV	859	0.0135	0.2025	0.0222	0.1864	0.0232	0.1806	0.0372	0.1703
TARGETICR	1082	-152.9772	571.6636	-153.9608	497.8440	-142.1773	426.5685	-125.8417	290.9676
TARGETHIGHTECH	1082	0.2336	0.4233	0.2948	0.4564	0.2857	0.4522	0.4396	0.4977
ALLSTOCK	871	0.3180	0.4659	0.2627	0.4405	0.2708	0.4448	0.2404	0.4285
CAR	872	0.3189	10.5100	-0.2556	10.1343	-0.4125	9.3353	-1.0664	9.8358
TARGETPUBLIC	1082	0.5517	0.4975	0.6467	0.4784	0.6306	0.4831	0.8743	0.3324
RELSIZE	732	0.2939	0.8621	0.2500	0.7359	0.2743	0.8222	0.1298	0.2293
ACQSIZE	905	6.6864	2.5984	7.3031	2.5132	7.1490	2.5307	8.6706	1.9934
C_SPREAD	1082	1.0881	0.5510	1.0469	0.4454	1.0442	0.4351	1.0256	0.4150
Institutional effects									
Regional dummies									
Industry dummies									

a Same sample for downside volatility

b United States subsample

Note: This table reports summary statistics for the explanatory and control variables across the full sample, the historical volatility sample (equal to downside risk sample), the distance-to-default risk sample and implied option volatility sample. As some data is missing, the sample sizes over the various subsamples are different. The variables are winsorized at 1% level.

Table 9a: Multivariate regression results

	DD	*DD*	*Historical vol*	*Historical vol*	*Historical vol - Downside_avg*	*Historical vol - Downside_avg*	*Historical vol - Downside_zero*	*Historical vol - Downside_zero*	*Implied vol*	*Implied vol*
	ABS	REL	ABS	REL	ABS	REL	ABS	REL	ABS	REL
CONGLOMERATE	-0.0319	-0.0127	**-0.306*** **	**-0.0677** **	**-0.193***	-0.0500	**-0.227** **	**-0.0597***	**-0.0301**	-0.0375
	(0.809)	(0.724)	(0.006)	(0.036)	(0.078)	(0.163)	(0.018)	(0.080)	(0.149)	(0.418)
CROSSBORDER	0.181	0.0295	0.0653	0.00641	0.0698	0.0174	0.0442	0.0158	-0.0505	-0.110
	(0.304)	(0.521)	(0.557)	(0.866)	(0.600)	(0.707)	(0.650)	(0.696)	(0.273)	(0.248)
BHR	**0.289*** **	**0.140*** **	-0.162	**-0.0389**	**0.317*** **	**0.0536** **	**0.268*** **	**0.0559** **	0.0251	0.0102
	(0.004)	(0.003)	(0.155)	(0.109)	(0.006)	(0.047)	(0.006)	(0.027)	(0.208)	(0.760)
MTB	**-0.0821*** **	-0.0153	**0.0501***	**0.0108***	**0.0572** **	**0.0145** **	**0.0443***	**0.0120***	**0.00520**	0.00595
	(0.002)	(0.179)	(0.084)	(0.059)	(0.048)	(0.037)	(0.062)	(0.063)	(0.109)	(0.350)
ACQEXP	**-0.0207***	**-0.00370***	**0.0127***	**0.00630** **	**0.0128***	**0.00697** **	**0.0136** **	**0.00650** **	**0.00181** **	**0.00482** **
	(0.071)	(0.094)	(0.074)	(0.023)	(0.087)	(0.017)	(0.035)	(0.020)	(0.042)	(0.032)
LOWRISK	**-1.160*** **	**-0.0981*** **	0.135	**0.144*** **	**0.261** **	**0.231*** **	**0.151**	**0.219*** **	-0.00369	0.0490
	(0.000)	(0.004)	(0.211)	(0.003)	(0.025)	(0.000)	(0.134)	(0.000)	(0.873)	(0.429)
HIGHRISK	**0.481*** **	**0.316*** **	**-0.864*** **	**-0.164*** **	**-1.096*** **	**-0.207*** **	**-0.841*** **	**-0.210*** **	**-0.0821*** **	**-0.0849***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)	(0.064)
BULL_BEAR	**-1.980*** **	**-0.469*** **	**2.856*** **	**0.797*** **	**2.350*** **	**0.704*** **	**2.554*** **	**0.759*** **	**0.460*** **	**0.883*** **
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
CHANGESLEV	**-2.512*** **	**-0.746*** **	**0.865** **	**0.248*** **	**0.905** **	**0.285*** **	**0.823*** **	**0.297*** **	0.0636	**0.162**
	(0.000)	(0.000)	(0.027)	(0.003)	(0.022)	(0.003)	(0.009)	(0.000)	(0.228)	(0.101)
TARGETICR	-0.0000545	-0.0000117	-0.0000468	-0.0000138	-0.0000611	-0.00000854	-0.0000273	-0.00000346	0.00000700	0.0000452
	(0.663)	(0.775)	(0.705)	(0.588)	(0.518)	(0.756)	(0.743)	(0.896)	(0.695)	(0.179)
TARGETHIGHTECH	0.109	0.0619	0.0442	0.0263	0.126	0.0790	0.0444	0.0390	0.00513	-0.00541
	(0.570)	(0.179)	(0.767)	(0.542)	(0.434)	(0.125)	(0.717)	(0.380)	(0.847)	(0.926)
ALLSTOCK	-0.0573	0.00705	0.220	0.0510	0.0380	0.0362	0.0714	0.0405	-0.00822	-0.00273
	(0.736)	(0.884)	(0.123)	(0.183)	(0.787)	(0.405)	(0.549)	(0.313)	(0.740)	(0.956)
CAR	0.00322	0.00345	0.00153	0.000123	-0.00826	-0.00125	-0.00402	-0.000449	-0.00118	-0.00117
	(0.561)	(0.118)	(0.837)	(0.933)	(0.214)	(0.460)	(0.500)	(0.776)	(0.357)	(0.551)
TARGETPUBLIC	-0.0563	-0.0643	**-0.279***	-0.0632	**-0.314** **	**-0.0742**	**-0.256***	-0.0488	-0.0145	0.00352
	(0.770)	(0.307)	(0.065)	(0.161)	(0.046)	(0.131)	(0.050)	(0.302)	(0.790)	(0.969)
RELSIZE	-0.133	0.0500	0.0659	0.0263	0.112	**0.0862***	**0.113***	**0.0588***	-0.0694	-0.123
	(0.292)	(0.293)	(0.431)	(0.427)	(0.500)	(0.074)	(0.096)	(0.052)	(0.291)	(0.225)
ACQSIZE	0.0618	**0.0170***	-0.0313	**-0.0158***	-0.0442	**-0.0197** **	**-0.0392**	**-0.0181** **	-0.00733	-0.0217
	(0.186)	(0.099)	(0.314)	(0.084)	(0.165)	(0.041)	(0.133)	(0.045)	(0.331)	(0.216)
C_SPREAD	**-1.271*** **	**-0.281*** **	**0.434*** **	**0.145*** **	**0.327** **	**0.141*** **	**0.312** **	**0.127** **	**0.106*** **	**0.196*** **
	(0.000)	(0.000)	(0.005)	(0.007)	(0.032)	(0.010)	(0.028)	(0.015)	(0.004)	(0.007)
Institutional effects	No	No	No	No	No	No	No	No	No	No
Industry effects	No	No	No	No	No	No	No	No	No	No
_cons	1.331**	0.289**	-0.419	-0.0712	-0.106	-0.0914	-0.112	-0.0348	0.0831	0.434
	(0.015)	(0.041)	(0.310)	(0.615)	(0.801)	(0.555)	(0.773)	(0.810)	(0.492)	(0.113)
N	504	504	536	536	535	535	536	536	182	182
R-sq	0.366	0.357	0.303	0.273	0.336	0.298	0.359	0.315	0.479	0.402
adj. R-sq	0.327	0.318	0.261	0.230	0.297	0.256	0.321	0.274	0.387	0.297

**p<0.10, ** p<0.05, *** p<0.01 Note: The dependent variable is the absolute or relative total risk difference score. The model is estimated via OLS with robust standard errors; p-values are in parentheses. We include a dummy which is equal to 1 if the acquirer and target do not share the same two-digit SIC-code (CONGLOMERATE), a dummy equal to 1 for a cross-border transaction (CROSSBORDER), the acquirer market-adjusted buy-and-hold return for the period from -280 to -30 days (BHR), the acquirer average market-to-book ratio for the period from -280 to -30 days (MTB), acquirer prior experience (ACQEXP), a dummy equal to 1 if the bidder is in the first (last) quartile of the distribution of pre-acquisition volatility (distance-to- default) (LOWRISK), a dummy equal to 1 if the bidder is in the fourth (first) quartile of the distribution of pre-acquisition volatility (distance-to-default) (HIGHRISK), the yearly change in MSCI market return index (BULL_BEAR), the change in the ratio total leverage to total assets post-announcement minus pre-announcement (CHANGESLEV), the target interest coverage ratio one year before the deal (TARGETICR), a dummy that equals one if the target is in a high-tech company (TARGETHIGHTECH), dummy indicating the acquisition is fully paid in stock (ALLSTOCK), the cumulative abnormal returns from -2 to +2 days relative to the announcement date computed from a market model estimated over -280 to -30 days before the announcement (CAR), a dummy which equals 1 if the target is listed (TARGETPUBLIC), the ratio of deal value to the acquirer market value of assets (RELSIZE), log of acquirer market value of assets prior to the announcement (ACQSIZE), the corporate bond spread (C_SPREAD). The variables are winsorized at 1% level.*

Table 9b Multivariate regression results: interaction effect HIGH-RISK*BHR

	DD	*DD*	*Historical vol*	*Historical vol*	*Historical vol - Downside_avg*	*Historical vol - Downside_avg*	*Historical vol - Downside_zero*	*Historical vol - Downside_zero*	*Implied vol*	*Implied vol*
	ABS	REL	ABS	REL	ABS	REL	ABS	REL	ABS	REL
CONGLOMERATE	-0.0309	-0.0107	**-0.301*** **	**-0.0668** **	**-0.189***	-0.0477	**-0.223** **	**-0.0576***	-0.0297	-0.0359
	(0.815)	(0.763)	(0.006)	(0.038)	(0.082)	(0.178)	(0.019)	(0.089)	(0.152)	(0.441)
CROSSBORDER	0.180	0.0272	0.0553	0.00452	0.0654	0.0148	0.0352	0.0110	-0.0511	-0.112
	(0.307)	(0.552)	(0.624)	(0.906)	(0.627)	(0.750)	(0.721)	(0.786)	(0.278)	(0.246)
BHR	0.240	0.0420	0.195	0.0282	**0.538*** **	**0.187*** **	**0.487*** **	**0.174*** **	0.0300	0.0284
	(0.171)	(0.319)	(0.195)	(0.580)	(0.001)	(0.000)	(0.000)	(0.001)	(0.320)	(0.623)
HIGHRISK*BHR	0.0968	**0.192** **	**-0.531** **	**-0.0999***	**-0.323**	**-0.194*** **	**-0.322***	**-0.173*** **	-0.00822	-0.0305
	(0.611)	(0.021)	(0.013)	(0.075)	(0.108)	(0.001)	(0.068)	(0.002)	(0.835)	(0.643)
MTB	**-0.0807*** **	-0.0125	**0.0536***	**0.0115** **	**0.0595** **	**0.0158** **	**0.0463** **	**0.0131** **	0.00507	0.00548
	(0.002)	(0.264)	(0.061)	(0.043)	(0.038)	(0.018)	(0.049)	(0.036)	(0.143)	(0.413)
ACQEXP	**-0.0207***	**-0.00367***	**0.0120***	**0.00617** **	**0.0124***	**0.00675** **	**0.0132** **	**0.00630** **	**0.00181** **	**0.00481** **
	(0.071)	(0.093)	(0.087)	(0.026)	(0.094)	(0.019)	(0.039)	(0.023)	(0.042)	(0.033)
LOWRISK	**-1.164*** **	**-0.106*** **	**0.163**	**0.149*** **	**0.266** **	**0.234*** **	**0.153**	**0.220*** **	-0.00382	0.0486
	(0.000)	(0.001)	(0.128)	(0.002)	(0.021)	(0.000)	(0.128)	(0.000)	(0.868)	(0.433)
HIGHRISK	**0.463*** **	**0.280*** **	**-0.746*** **	**-0.141*** **	**-1.041*** **	**-0.173*** **	**-0.780*** **	**-0.177*** **	**-0.0799*** **	**-0.0767**
	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.008)	(0.121)
BULL_BEAR	**-1.999*** **	**-0.506*** **	**2.975*** **	**0.820*** **	**2.419*** **	**0.744*** **	**2.627*** **	**0.798*** **	**0.462*** **	**0.889*** **
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
CHANGESLEV	**-2.500*** **	**-0.721*** **	**0.907** **	**0.256*** **	**0.936** **	**0.303*** **	**0.852*** **	**0.313*** **	**0.0637**	**0.162***
	(0.000)	(0.000)	(0.019)	(0.002)	(0.017)	(0.001)	(0.006)	(0.000)	(0.227)	(0.100)
TARGETICR	-0.0000554	-0.0000134	-0.0000638	-0.0000170	-0.0000718	-0.0000150	-0.0000377	-0.00000907	0.00000758	0.0000473
	(0.658)	(0.731)	(0.594)	(0.497)	(0.444)	(0.574)	(0.644)	(0.724)	(0.684)	(0.178)
TARGETHIGHTECH	0.103	0.0500	0.0339	0.0244	0.121	0.0761	0.0361	0.0345	0.00569	-0.00334
	(0.594)	(0.280)	(0.818)	(0.572)	(0.453)	(0.140)	(0.766)	(0.434)	(0.831)	(0.954)
ALLSTOCK	-0.0523	0.0170	0.199	0.0470	0.0279	0.0301	0.0603	0.0345	-0.00876	-0.00471
	(0.759)	(0.728)	(0.152)	(0.209)	(0.841)	(0.475)	(0.608)	(0.376)	(0.724)	(0.923)
CAR	0.00327	0.00357	0.000561	-0.0000601	-0.00880	-0.00158	-0.00458	-0.000753	-0.00117	-0.00114
	(0.553)	(0.101)	(0.940)	(0.967)	(0.186)	(0.338)	(0.441)	(0.626)	(0.363)	(0.563)
TARGETPUBLIC	-0.0534	-0.0583	**-0.277***	-0.0629	**-0.314** **	**-0.0746**	**-0.259** **	-0.0503	-0.0160	-0.00221
	(0.782)	(0.322)	(0.066)	(0.165)	(0.047)	(0.133)	(0.049)	(0.290)	(0.778)	(0.981)
RELSIZE	-0.132	0.0521	0.0588	0.0250	0.109	**0.0843***	**0.110**	**0.0568***	-0.0679	-0.117
	(0.297)	(0.279)	(0.471)	(0.444)	(0.515)	(0.082)	(0.109)	(0.057)	(0.315)	(0.261)
ACQSIZE	0.0615	0.0164	-0.0281	**-0.0152***	-0.0438	**-0.0194** **	-0.0375	**-0.0172***	-0.00705	-0.0207
	(0.190)	(0.108)	(0.365)	(0.099)	(0.168)	(0.041)	(0.150)	(0.055)	(0.361)	(0.245)
C_SPREAD	**-1.270*** **	**-0.279*** **	**0.440*** **	**0.146*** **	**0.329** **	**0.143*** **	**0.317** **	**0.129** **	**0.106*** **	**0.196*** **
	(0.000)	(0.000)	(0.005)	(0.007)	(0.032)	(0.010)	(0.027)	(0.015)	(0.004)	(0.007)
Institutional effects	No	No	No	No	No	No	No	No	No	No
Industry effects	No	No	No	No	No	No	No	No	No	No
_cons	1.337**	0.302**	-0.479	-0.0825	-0.117	-0.0983	-0.127	-0.0428	0.0807	0.425
	(0.015)	(0.032)	(0.248)	(0.563)	(0.781)	(0.524)	(0.745)	(0.768)	(0.510)	(0.127)
N	504	504	536	536	535	535	536	536	182	182
R-sq	0.366	0.370	0.313	0.277	0.340	0.311	0.364	0.326	0.479	0.403
adj. R-sq	0.326	0.330	0.271	0.233	0.299	0.268	0.325	0.285	0.384	0.293

**p<0.10, ** p<0.05, *** p<0.01 Note: The dependent variable is the absolute or relative total risk difference score. The model is estimated via OLS with robust standard errors; p-values are in parentheses. We include a dummy which is equal to 1 if the acquirer and target do not share the same two-digit SIC-code (CONGLOMERATE), a dummy equal to 1 for a cross-border transaction (CROSSBORDER), the acquirer market-adjusted buy-and-hold return for the period from -280 to -30 days (BHR), the interaction effect of high-risk acquirers and buy-and-hold return, the acquirer average market-to-book ratio for the period from -280 to -30 days (MTB), acquirer prior experience (ACQEXP), a dummy equal to 1 if the bidder is in the first (last) quartile of the distribution of pre-acquisition volatility (distance-to- default) (LOWRISK), a dummy equal to 1 if the bidder is in the fourth (first) quartile of the distribution of pre-acquisition volatility (distance-to-default) (HIGHRISK), the yearly change in MSCI market return index (BULL_BEAR), the change in the ratio total leverage to total assets post-announcement minus pre-announcement (CHANGESLEV), the target interest coverage ratio one year before the deal (TARGETICR), a dummy that equals one if the target is in a high-tech company (TARGETHIGHTECH), dummy indicating the acquisition is fully paid in stock (ALLSTOCK), the cumulative abnormal returns from -2 to +2 days relative to the announcement date computed from a market model estimated over -280 to -30 days before the announcement (CAR), a dummy which equals 1 if the target is listed (TARGETPUBLIC), the ratio of deal value to the acquirer market value of assets (RELSIZE), log of acquirer market value of assets prior to the announcement (ACQSIZE), the corporate bond spread (C_SPREAD). The variables are winsorized at 1% level.*

Table 9c: Multivariate regression results: PREMIUM

	DD	*DD*	*Historical vol*	*Historical vol*	*Historical vol - Downside_avg*	*Historical vol - Downside_avg*	*Historical vol - Downside_zero*	*Historical vol - Downside_zero*	*Implied volatility*	*Implied volatility*
	ABS	REL	ABS	REL	ABS	REL	ABS	REL	ABS	REL
CONGLOMERATE	0.0213	0.000820	**-0.362****	-0.0452	**-0.333****	-0.0629	**-0.301****	-0.0528	-0.0232	-0.0263
	(0.913)	(0.986)	(0.033)	(0.333)	(0.037)	(0.211)	(0.037)	(0.279)	(0.347)	(0.634)
CROSSBORDER	0.0394	-0.0119	0.472*	0.0975	0.223	0.0309	0.319	0.0926	-0.0335	-0.0999
	(0.919)	(0.893)	(0.081)	(0.180)	(0.327)	(0.682)	(0.126)	(0.230)	(0.506)	(0.310)
BHR	0.144	0.0778*	0.315	0.0803	0.332	**0.138***	**0.557****	**0.205****	0.0389	0.0309
	(0.502)	(0.067)	(0.163)	(0.252)	(0.141)	(0.059)	(0.016)	(0.022)	(0.339)	(0.702)
HIGHRISK*BHR	0.207	**0.189***	**-0.650****	**-0.148***	-0.0882	**-0.124**	-0.332	**-0.177***	-0.00706	-0.0326
	(0.334)	(0.066)	(0.023)	(0.051)	(0.740)	(0.109)	(0.212)	(0.061)	(0.878)	(0.692)
MTB	**-0.0538**	**-0.0214****	0.0255	0.00446	0.0303	0.00696	0.0258	0.00652	0.00431	0.00567
	(0.141)	(0.013)	(0.417)	(0.501)	(0.224)	(0.323)	(0.292)	(0.379)	(0.268)	(0.463)
ACQEXP	-0.00986	-0.000338	0.00646	0.00458	0.00258	0.00396	0.00667	0.00404	**0.00226****	**0.00667****
	(0.529)	(0.908)	(0.495)	(0.228)	(0.786)	(0.286)	(0.435)	(0.273)	(0.037)	(0.011)
LOWRISK	**-0.922*****	-0.0529	0.0193	0.0991	0.228	**0.219****	0.151	**0.224****	-0.00176	0.0511
	(0.009)	(0.310)	(0.918)	(0.209)	(0.245)	(0.015)	(0.436)	(0.023)	(0.948)	(0.469)
HIGHRISK	**0.588*****	**0.304*****	**-0.636*****	**-0.0983***	**-0.996*****	**-0.132****	**-0.738*****	**-0.157*****	**-0.0507**	-0.0391
	(0.005)	(0.000)	(0.004)	(0.055)	(0.000)	(0.013)	(0.000)	(0.007)	(0.112)	(0.489)
BULL_BEAR	**-2.638*****	**-0.671*****	**4.208*****	**1.006*****	**3.470*****	**0.952*****	**3.749*****	**0.995*****	**0.569*****	**1.081*****
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
PREMIUM	**-0.113**	-0.0206	0.0113	0.0134	-0.0530	-0.00244	-0.0412	-0.00165	**0.0464***	**0.136*****
	(0.101)	(0.231)	(0.884)	(0.510)	(0.336)	(0.889)	(0.456)	(0.923)	(0.058)	(0.005)
CHANGESLEV	**-1.877*****	**-0.484*****	0.500	0.128	0.507	**0.200****	0.501	**0.198****	0.0863	**0.201**
	(0.000)	(0.001)	(0.310)	(0.241)	(0.214)	(0.048)	(0.204)	(0.047)	(0.152)	(0.108)
TARGETICR	-0.000190	-0.0000395	-0.0000453	-0.00000416	-0.0000698	0.000000985	-0.00000629	0.0000118	0.00000536	0.0000690
	(0.417)	(0.548)	(0.809)	(0.915)	(0.658)	(0.981)	(0.961)	(0.756)	(0.820)	(0.124)
TARGETHIGHTECH	0.125	0.0767	-0.232	-0.0150	-0.169	0.00107	-0.184	-0.0211	-0.00414	-0.0184
	(0.583)	(0.179)	(0.310)	(0.798)	(0.426)	(0.986)	(0.353)	(0.735)	(0.892)	(0.772)
ALLSTOCK	-0.150	-0.0212	0.323*	0.0646	0.150	0.0507	0.146	0.0655	0.00154	0.0381
	(0.487)	(0.691)	(0.069)	(0.150)	(0.366)	(0.322)	(0.347)	(0.187)	(0.953)	(0.467)
CAR	0.00610	0.00325	-0.000846	0.000160	-0.00535	-0.00119	-0.00433	-0.000310	-0.000991	-0.00160
	(0.381)	(0.139)	(0.930)	(0.929)	(0.523)	(0.547)	(0.588)	(0.873)	(0.480)	(0.481)
RELSIZE	0.140	0.0474	-0.225	-0.0354	-0.0330	-0.0368	-0.0440	-0.0190	-0.0933	**-0.230****
	(0.490)	(0.460)	(0.564)	(0.665)	(0.921)	(0.652)	(0.880)	(0.806)	(0.164)	(0.043)
ACQSIZE	0.0578	0.0114	-0.0163	-0.0113	-0.00836	-0.0132	-0.0271	-0.0162	-0.0108	**-0.0377***
	(0.423)	(0.438)	(0.721)	(0.345)	(0.848)	(0.313)	(0.521)	(0.214)	(0.251)	(0.072)
SPREAD	**-1.354*****	**-0.268*****	**0.744*****	**0.171****	**0.647*****	**0.178****	**0.602*****	**0.167****	**0.179*****	**0.326*****
	(0.000)	(0.001)	(0.003)	(0.027)	(0.004)	(0.016)	(0.006)	(0.023)	(0.000)	(0.000)
Institutional effects	No	No	No	No	No	No	No	No	No	No
Industry effects	No	No	No	No	No	No	No	No	No	No
_cons	0.695	0.347	-0.994	-0.161	-0.148	-0.0442	-0.464	-0.102	-0.470***	-0.334
	(0.494)	(0.147)	(0.263)	(0.531)	(0.850)	(0.867)	(0.546)	(0.704)	(0.001)	(0.281)
N	266	266	288	288	288	288	288	288	141	141
R-sq	0.359	0.430	0.368	0.301	0.418	0.316	0.418	0.344	0.572	0.509
adj. R-sq	0.277	0.357	0.292	0.216	0.348	0.233	0.348	0.265	0.466	0.387

**p<0.10, ** p<0.05, *** p<0.01 Note: The dependent variable is the absolute or relative total risk difference score. The model is estimated via OLS with robust standard errors; p-values are in parentheses. We include a dummy which is equal to 1 if the acquirer and target do not share the same two-digit SIC-code (CONGLOMERATE), a dummy equal to 1 for a cross-border transaction (CROSSBORDER), the acquirer market-adjusted buy-and-hold return for the period from -280 to -30 days (BHR), the interaction effect of high-risk acquirers and buy-and-hold return, the acquirer average market-to-book ratio for the period from -280 to -30 days (MTB), acquirer prior experience (ACQEXP), a dummy equal to 1 if the bidder is in the first (last) quartile of the distribution of pre-acquisition volatility (distance-to- default) (LOWRISK), a dummy equal to 1 if the bidder is in the fourth (first) quartile of the distribution of pre-acquisition volatility (distance-to-default) (HIGHRISK), the yearly change in MSCI market return index (BULL_BEAR), the acquisition premium (PREMIUM), the change in the ratio total leverage to total assets post-announcement minus pre-announcement (CHANGESLEV), the target interest coverage ratio one year before the deal (TARGETICR), a dummy that equals one if the target is in a high-tech company (TARGETHIGHTECH), dummy indicating the acquisition is fully paid in stock (ALLSTOCK), the cumulative abnormal returns from -2 to +2 days relative to the announcement date computed from a market model estimated over -280 to -30 days before the announcement (CAR), a dummy which equals 1 if the target is listed (TARGETPUBLIC), the ratio of deal value to the acquirer market value of assets (RELSIZE), log of acquirer market value of assets prior to the announcement (ACQSIZE), the corporate bond spread (C_SPREAD). The variables are winsorized at 1% level.*

Table 9d: Multivariate regression results – interaction effect PREMIUM*MTB

	DD	*DD*	*Historical vol*	*Historical vol*	*Historical vol - Downside_avg*	*Historical vol - Downside_avg*	*Historical vol - Downside_zero*	*Historical vol - Downside_zero*	*Implied volatility*	*Implied volatility*
	ABS	REL	ABS	REL	ABS	REL	ABS	REL	ABS	REL
CONGLOMERATE	0.0464	0.00579	**-0.356****	-0.0448	**-0.327****	-0.0620	**-0.295****	-0.0521	-0.0247	-0.0304
	(0.813)	(0.903)	(0.035)	(0.340)	(0.038)	(0.218)	(0.038)	(0.286)	(0.328)	(0.589)
CROSSBORDER	0.0357	-0.0126	0.473*	0.0976	0.222	0.0308	0.319	0.0926	-0.0362	-0.107
	(0.926)	(0.886)	(0.081)	(0.180)	(0.328)	(0.683)	(0.127)	(0.231)	(0.454)	(0.256)
BHR	0.103	0.0697*	0.291	0.0784	**0.350**	**0.141***	**0.522****	**0.201****	0.0535	0.0702
	(0.608)	(0.093)	(0.202)	(0.263)	(0.118)	(0.054)	(0.025)	(0.023)	(0.190)	(0.373)
HIGHRISK*BHR	0.254	**0.198***	**-0.598****	**-0.144***	-0.0828	**-0.124**	-0.267	**-0.169***	-0.0126	-0.0476
	(0.223)	(0.054)	(0.041)	(0.057)	(0.752)	(0.106)	(0.325)	(0.070)	(0.778)	(0.544)
MTB	**-0.0996*****	**-0.0305*****	0.0533	0.00664	**0.0692****	0.0124	**0.0545***	0.00981	**0.00811****	**0.0159****
	(0.008)	(0.000)	(0.176)	(0.434)	(0.016)	(0.174)	(0.065)	(0.311)	(0.030)	(0.034)
ACQEXP	-0.00686	0.000256	0.00548	0.00450	0.00125	0.00378	0.00577	0.00393	**0.00198***	**0.00592****
	(0.671)	(0.932)	(0.567)	(0.239)	(0.894)	(0.309)	(0.497)	(0.284)	(0.073)	(0.028)
LOWRISK	**-0.940*****	-0.0565	0.0327	0.100	0.255	**0.223****	0.161	**0.225****	-0.00555	0.0409
	(0.008)	(0.283)	(0.862)	(0.208)	(0.191)	(0.014)	(0.404)	(0.023)	(0.839)	(0.558)
HIGHRISK	**0.607*****	**0.307*****	**-0.658*****	**-0.100***	**-1.019*****	**-0.135****	**-0.762*****	**-0.160*****	**-0.0481**	-0.0321
	(0.004)	(0.000)	(0.003)	(0.052)	(0.000)	(0.011)	(0.000)	(0.006)	(0.136)	(0.572)
BULL_BEAR	**-2.591*****	**-0.661*****	**4.121*****	**1.000*****	**3.357*****	**0.937*****	**3.655*****	**0.984*****	**0.580*****	**1.111*****
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
PREMIUM	**-0.271*****	**-0.0519****	0.0979	0.0202	0.0666	0.0142	0.0493	0.00876	**0.0781****	**0.221*****
	(0.006)	(0.041)	(0.348)	(0.417)	(0.335)	(0.520)	(0.523)	(0.692)	(0.013)	(0.000)
PREMIUM*MTB	**0.0715****	**0.0141***	-0.0372	-0.00291	**-0.0511****	-0.00710	-0.0386	-0.00444	**-0.00867****	**-0.0233*****
	(0.029)	(0.082)	(0.268)	(0.541)	(0.020)	(0.183)	(0.167)	(0.443)	(0.029)	(0.002)
CHANGESLEV	**-1.813*****	**-0.471*****	0.562	0.133	0.601	**0.213****	**0.568**	**0.206****	**0.0908**	**0.213***
	(0.000)	(0.002)	(0.241)	(0.234)	(0.130)	(0.040)	(0.137)	(0.044)	(0.128)	(0.084)
TARGETICR	-0.000171	-0.0000358	-0.0000422	-0.00000392	-0.0000670	0.00000138	-0.00000192	0.0000123	0.00000607	0.0000709
	(0.461)	(0.584)	(0.822)	(0.920)	(0.670)	(0.974)	(0.988)	(0.746)	(0.801)	(0.112)
TARGETHIGHTECH	0.154	0.0824	-0.238	-0.0155	-0.183	-0.000885	-0.191	-0.0219	-0.00703	-0.0262
	(0.497)	(0.147)	(0.302)	(0.792)	(0.394)	(0.989)	(0.342)	(0.726)	(0.822)	(0.687)
ALLSTOCK	-0.163	-0.0238	0.333*	0.0654	0.161	0.0522	0.157	0.0667	0.00462	0.0464
	(0.446)	(0.655)	(0.061)	(0.147)	(0.332)	(0.309)	(0.316)	(0.182)	(0.856)	(0.364)
CAR	0.00471	0.00298	0.000506	0.000266	-0.00357	-0.000937	-0.00296	-0.000153	-0.000516	-0.000326
	(0.495)	(0.181)	(0.958)	(0.884)	(0.674)	(0.640)	(0.716)	(0.939)	(0.720)	(0.887)
RELSIZE	0.0337	0.0264	-0.222	-0.0351	-0.0256	-0.0358	-0.0420	-0.0188	-0.0846	**-0.206***
	(0.872)	(0.695)	(0.575)	(0.669)	(0.940)	(0.665)	(0.887)	(0.810)	(0.212)	(0.065)
ACQSIZE	0.0474	0.00931	-0.0187	-0.0114	-0.0119	-0.0137	-0.0292	-0.0164	-0.00873	-0.0322
	(0.516)	(0.531)	(0.672)	(0.338)	(0.776)	(0.295)	(0.474)	(0.208)	(0.361)	(0.124)
C_SPREAD	**-1.358*****	**-0.268*****	**0.724*****	**0.169****	**0.620*****	**0.175****	**0.579*****	**0.165****	**0.187*****	**0.347*****
	(0.000)	(0.001)	(0.003)	(0.029)	(0.005)	(0.019)	(0.007)	(0.026)	(0.000)	(0.000)
Institutional effects	No	No	No	No	No	No	No	No	No	No
Industry effects	No	No	No	No	No	No	No	No	No	No
N	266	266	288	288	288	288	288	288	141	141
R-sq	0.366	0.434	0.372	0.301	0.426	0.318	0.423	0.345	0.583	0.528
adj. R-sq	0.282	0.359	0.294	0.213	0.354	0.232	0.351	0.263	0.473	0.405

**p<0.10, ** p<0.05, *** p<0.01 Note: The dependent variable is the absolute or relative total risk difference score. The model is estimated via OLS with robust standard errors; p-values are in parentheses. We include a dummy which is equal to 1 if the acquirer and target do not share the same two-digit SIC-code (CONGLOMERATE), a dummy equal to 1 for a cross-border transaction (CROSSBORDER), the acquirer market-adjusted buy-and-hold return for the period from -280 to -30 days (BHR), the interaction effect of high-risk acquirers and buy-and-hold return, the acquirer average market-to-book ratio for the period from -280 to -30 days (MTB), acquirer prior experience (ACQEXP), a dummy equal to 1 if the bidder is in the first (last) quartile of the distribution of pre-acquisition volatility (distance-to- default) (LOWRISK), a dummy equal to 1 if the bidder is in the fourth (first) quartile of the distribution of pre-acquisition volatility (distance-to-default) (HIGHRISK), the yearly change in MSCI market return index (BULL_BEAR), the acquisition premium (PREMIUM), the interaction effect of premium and market-to-book, the change in the ratio total leverage to total assets post-announcement minus pre-announcement (CHANGESLEV), the target interest coverage ratio one year before the deal (TARGETICR), a dummy that equals one if the target is in a high-tech company (TARGETHIGHTECH), dummy indicating the acquisition is fully paid in stock (ALLSTOCK), the cumulative abnormal returns from -2 to +2 days relative to the announcement date computed from a market model estimated over -280 to -30 days before the announcement (CAR), a dummy which equals 1 if the target is listed (TARGETPUBLIC), the ratio of deal value to the acquirer market value of assets (RELSIZE), log of acquirer market value of assets prior to the announcement (ACQSIZE), the corporate bond spread (C_SPREAD). The variables are winsorized at 1% level.*

Table 10a: Accounting ratios acquirer and target (Y-1)

	High- risk acquirers				*Low-risk acquirers*				t-statistic	p-value
ACQUIRER (Y-1)	***Obs***	***Mean***	***Median***	***Sd***	***Obs***	***Mean***	***Median***	***Sd***		
TOTAL ASSETS ($ th)	169	746,971	142,630	1,623,873	172	17,100,000	3,529,860	26,000,000	-8.1882	0.0000
MARKET VALUE OF ASSETS ($ mio)	169	1,315	145	2,656	172	43,787	6,378	64,468	-8.5571	0.0000
Profitability										
EBITDA/TOTAL ASSETS	152	-0.0812	0.0116	0.3193	164	0.1354	0.1464	0.1110	-8.1700	0.0000
EBITDA/SALES	148	-0.5384	0.0182	1.8093	162	0.0707	0.1880	1.0012	-3.7089	0.0002
SALES/TOTAL ASSETS	169	0.7993	0.6195	0.7148	171	0.8574	0.7903	0.4741	-0.8834	0.3776
NET INCOME/TOTAL EQUITY	156	-22.52	-4.605	50.6119	168	18.2839	18.4750	18.8966	-9.4749	0.0000
Liquidity										
CASH & EQ/TOTAL ASSETS	170	0.3167	0.2172	0.2613	172	0.2324	0.1785	0.2118	3.2793	0.0011
CURRENT ASSETS/CURRENT LIABILITIES	169	2.9589	1.971	2.8271	171	2.5407	1.8228	2.4072	1.4692	0.1427
Solvency										
EBITDA/INTEREST EXPENSE	137	-32.386	2.7116	301.456	148	133.8764	20.6224	459.9123	-3.5789	0.0004
TOTAL LIABILITIES/TOTAL ASSETS	170	0.4769	0.4508	0.252	172	0.4177	0.4132	0.2019	2.3996	0.017
TOTAL LIABILITIES/MV OF ASSETS	169	0.4688	0.3572	0.372	172	0.2541	0.1738	0.2275	6.4284	0.0000
TOTAL FINANCIAL DEBT/TOTAL ASSETS	169	0.1696	0.1086	0.1874	172	0.1445	0.1177	0.1424	1.3919	0.1649
	High-risk acquirers				*Low-risk acquirers*				t-statistic	p-value
TARGET (Y-1)	***Obs***	***Mean***	***Median***	***Sd***	***Obs***	***Mean***	***Median***	***Sd***		
TOTAL ASSETS ($ th)	147	81,704	26,841	170,989	161	122,004	16,825	314,528	-1.3784	0.1691
MARKET VALUE OF ASSETS ($ mio)	89	229	57	488	68	342	110	526	-1.3891	0.1668
Profitability										
EBITDA/TOTAL ASSETS	170	-0.376	-0.1800	0.5405	169	-0.4524	-0.1946	0.6684	1.1577	0.2478
EBITDA/SALES	143	-2.6824	-0.3126	9.3277	126	-2.5579	-0.4481	9.8767	-0.1063	0.9154
NET INCOME/TOTAL EQUITY	125	-90.314	-58.2100	132.7856	115	-81.6599	-44.6300	124.4600	-0.5197	0.6037
Liquidity										
CASH & EQ/TOTAL ASSETS	146	0.3177	0.2352	0.2848	152	0.3306	0.2301	0.3136	-0.37	0.7116
CURRENT ASSETS/CURRENT LIABILITIES	168	3.5906	1.5318	5.1065	165	3.3187	1.3797	5.048	0.4886	0.6255
Solvency										
EBITDA/INTEREST EXPENSE	170	-190.64	-22.9867	424.6746	169	-105.4125	-14.3600	304.2749	-2.1228	0.0345
TOTAL LIABILITIES/TOTAL ASSETS	170	0.7337	0.5186	0.8053	169	1.1334	0.6699	1.6885	-2.7797	0.0057
TOTAL FINANCIAL DEBT/TOTAL ASSETS	141	0.2589	0.0823	0.5206	151	0.3840	0.1423	0.5732	-1.9476	0.0524

Note: This table reports summary statistics of profitability, liquidity and solvency ratios for the target and acquirer one year prior to the announcement across the subsample of low- and high-risk acquirers. Low-risk acquirers are classified according to the last quartile of the distribution of pre-acquisition distance-to-default. High-risk acquirers are classified according to the first quartile of the distribution of pre-acquisition distance-to-default. As some data is missing, we mention as well the number of observations in each subsample. The t-test evaluates whether the differences are equal to zero. The variables are winsorized at 1% level.

Table 10b: Summary statistics on deal-characteristics for high- and low-risk acquirers

Deal-characteristics	*High risk acquirers*		*Low risk acquirers*		t-statistic	p-value
	Obs	**Mean**	**Obs**	**Mean**		
Diversification						
Activity diversification	170	0.5118	172	0.5058	0.1097	0.9127
Geographic diversification	170	0.2765	172	0.4012	-2.4495	0.0148
Management quality and expertise						
Buy-and-hold return	168	0.1318	169	0.0631	1.1544	0.2492
Market-to-book	167	1.8626	169	2.7220	-3.1239	0.0019
Acquisition experience	168	1.3988	169	8.1716	-7.9926	0.0000
Economic cycle						
Bear market	170	0.5294	172	0.1570	7.8691	0.0000
Bull market	170	0.4706	172	0.8420	-7.8691	0.0000
Method of payment						
Stock only	150	0.4267	127	0.1575	5.0591	0.0000
Cash only	150	0.3067	127	0.7165	-7.4212	0.0000

Note: This table reports summary statistics of various deal characteristics across the subsample of low- and high-risk acquirers. Low-risk acquirers are classified according to the last quartile of the distribution of pre-acquisition distance-to-default. High-risk acquirers are classified according to the first quartile of the distribution of pre-acquisition distance-to-default. We report the variable Activity diversification if the target and acquirer do not share the same two digit SIC-code, the variable Geographical diversification if the transaction is cross-border, the variable Buy-and-Hold return, the variable Market-to-book, the variable Acquisition experience, the variable Bear market if the yearly change in MSCI market return index is negative and the variable Bull market if the yearly change in MSCI market return index is positive, the variable Changes in financial leverage as the difference between the leverage ratio one year after the announcement minus the leverage ratio one year before the announcement, the variable Stock only if the transaction is fully paid in stock, the variable Cash only if the transaction is fully paid in cash. As some data is missing, we mention as well the number of observations in each subsample. The t-test evaluates whether the differences are equal to zero. The variables are winsorized at 1% level.

Table 10c: Multivariate regression results - low-risk acquirers with interaction effects

	DD	*DD*	*Historical vol*	*Historical vol*	*Historical vol - Downside_avg*	*Historical vol - Downside_avg*	*Historical vol - Downside_zero*	*Historical vol - Downside_zero*
	ABS	REL	ABS	REL	ABS	REL	ABS	REL
CONGLOMERATE	-0.0547	-0.0139	**-0.295*** **	**-0.0652** **	**-0.205***	-0.0497	**-0.234** **	**-0.0594***
	(0.667)	(0.694)	(0.007)	(0.042)	(0.061)	(0.165)	(0.014)	(0.080)
CROSSBORDER	0.316*	0.0318	0.0503	0.00171	0.0628	0.0119	0.0414	0.0116
	(0.070)	(0.481)	(0.656)	(0.965)	(0.636)	(0.800)	(0.672)	(0.775)
BHR	0.227	0.0349	0.173	0.0178	**0.300***	**0.106** **	**0.401** **	**0.152** **
	(0.184)	(0.411)	(0.248)	(0.724)	(0.061)	(0.046)	(0.010)	(0.012)
HIGHRISK*BHR	0.125	**0.196** **	**-0.524** **	**-0.0898**	0.0131	-0.0867	-0.202	**-0.140** **
	(0.509)	(0.017)	(0.014)	(0.108)	(0.951)	(0.139)	(0.304)	(0.032)
MTB	**-0.0838*** **	-0.0135	**0.0495***	**0.0123** **	**0.0556***	**0.0152** **	**0.0441***	**0.0124** **
	(0.001)	(0.221)	(0.084)	(0.030)	(0.054)	(0.026)	(0.060)	(0.046)
ACQEXP	**-0.0253** **	**-0.00397***	**0.0120***	**0.00656** **	**0.0134***	**0.00699** **	**0.0140** **	**0.00646** **
	(0.026)	(0.074)	(0.091)	(0.018)	(0.073)	(0.017)	(0.030)	(0.021)
LOWRISK	**-0.668** **	**-0.0745***	**0.236** **	**0.0995***	**0.466*** **	**0.245*** **	**0.403*** **	**0.251*** **
	(0.015)	(0.062)	(0.036)	(0.054)	(0.000)	(0.000)	(0.000)	(0.000)
LOWRISK*CHANGESLEV	**-3.941*** **	**0.407***	-0.722	0.0681	-0.154	0.158	-0.169	0.170
	(0.001)	(0.082)	(0.299)	(0.828)	(0.800)	(0.618)	(0.740)	(0.590)
LOWRISK*RELSIZE	**-0.605*** **	**-0.116***	**0.206** **	**0.167*** **	-0.119	0.00599	-0.109	0.0336
	(0.000)	(0.070)	(0.031)	(0.000)	(0.669)	(0.949)	(0.268)	(0.540)
HIGHRISK	**0.486*** **	**0.273*** **	**-0.697*** **	**-0.136*** **	**-1.084*** **	**-0.185*** **	**-0.794*** **	**-0.176*** **
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
BULL_BEAR	**-1.711*** **	**-0.499*** **	**3.237*** **	**0.789*** **	**2.597*** **	**0.737*** **	**2.822*** **	**0.833*** **
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
CHANGESLEV	**-1.925*** **	**-0.764*** **	**0.990** **	**0.248*** **	**0.953** **	**0.276*** **	**0.880** **	**0.288*** **
	(0.000)	(0.000)	(0.020)	(0.003)	(0.027)	(0.006)	(0.010)	(0.001)
TARGETICR	-0.0000780	-0.0000148	-0.0000718	-0.0000166	-0.0000652	-0.0000127	-0.0000418	-0.0000111
	(0.530)	(0.702)	(0.541)	(0.499)	(0.500)	(0.642)	(0.616)	(0.670)
TARGETHIGHTECH	0.0980	0.0517	0.0261	0.0266	0.124	0.0780	0.0452	0.0386
	(0.593)	(0.269)	(0.859)	(0.539)	(0.436)	(0.131)	(0.711)	(0.386)
ALLSTOCK	-0.0745	0.0214	0.171	0.0405	0.0254	0.0321	0.0578	0.0380
	(0.645)	(0.662)	(0.217)	(0.276)	(0.855)	(0.457)	(0.620)	(0.331)
CAR	0.00490	0.00385*	-0.0000721	-0.000574	-0.00775	-0.00146	-0.00378	-0.000691
	(0.354)	(0.079)	(0.992)	(0.694)	(0.272)	(0.396)	(0.527)	(0.652)
TARGETPUBLIC	-0.0779	-0.0640	**-0.272***	-0.0615	**-0.304***	-0.0733	**-0.234***	-0.0435
	(0.676)	(0.276)	(0.073)	(0.167)	(0.054)	(0.140)	(0.076)	(0.362)
RELSIZE	0.0970	0.0870	0.00361	-0.00835	0.145	0.0797	0.137	0.0384
	(0.151)	(0.177)	(0.965)	(0.636)	(0.597)	(0.213)	(0.140)	(0.200)
ACQSIZE	**0.0814***	**0.0191***	-0.0228	**-0.0173***	-0.0446	**-0.0192** **	-0.0381	**-0.0174***
	(0.054)	(0.063)	(0.465)	(0.051)	(0.176)	(0.047)	(0.146)	(0.051)
C_SPREAD	**-1.196*** **	**-0.295*** **	**0.427*** **	**0.129*** **	**0.352** **	**0.143*** **	**0.332** **	**0.127** **
	(0.000)	(0.000)	(0.005)	(0.010)	(0.024)	(0.009)	(0.023)	(0.015)
Institutional effects	No	No	No	No	No	No	No	No
Industry effects	No	No	No	No	No	No	No	No
_cons	0.878	0.283*	-0.423	-0.0292	-0.103	-0.0906	-0.148	-0.0312
	(0.106)	(0.052)	(0.307)	(0.833)	(0.816)	(0.567)	(0.711)	(0.834)
N	504	504	536	536	535	535	536	536
R-sq	0.410	0.381	0.321	0.293	0.343	0.301	0.369	0.326
adj. R-sq	0.369	0.338	0.275	0.245	0.298	0.254	0.327	0.280

**p<0.10, ** p<0.05, *** p<0.01 Note: The dependent variable is the absolute or relative total risk difference score. The model is estimated via OLS with robust standard errors; p-values are in parentheses. We include a dummy which is equal to 1 if the acquirer and target do not share the same two-digit SIC-code (CONGLOMERATE), a dummy equal to 1 for a cross-border transaction (CROSSBORDER), the acquirer market-adjusted buy-and-hold return for the period from -280 to -30 days (BHR), the interaction effect of high-risk acquirers and buy-and-hold return, the acquirer average market-to-book ratio for the period from -280 to -30 days (MTB), acquirer prior experience (ACQEXP), a dummy equal to 1 if the bidder is in the first (last) quartile of the distribution of pre-acquisition volatility (distance-to- default) (LOWRISK), the interaction effect of low-risk acquirers and changes in leverage, the interaction effect of low-risk acquirers and relative size of the deal, a dummy equal to 1 if the bidder is in the fourth (first) quartile of the distribution of pre-acquisition volatility (distance-to-default) (HIGHRISK), the yearly change in MSCI market return index (BULL_BEAR), the change in the ratio total leverage to total assets post-announcement minus pre-announcement (CHANGESLEV), the target interest coverage ratio one year before the deal (TARGETICR), a dummy that equals one if the target is in a high-tech company (TARGETHIGHTECH), dummy indicating the acquisition is fully paid in stock (ALLSTOCK), the cumulative abnormal returns from -2 to +2 days relative to the announcement date computed from a market model estimated over -280 to -30 days before the announcement (CAR), a dummy which equals 1 if the target is listed (TARGETPUBLIC), the ratio of deal value to the acquirer market value of assets (RELSIZE), log of acquirer market value of assets prior to the announcement (ACQSIZE), the corporate bond spread (C_SPREAD). The variables are winsorized at 1% level.*