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Managerial Risk-Taking Incentives and Merger Decisions

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Abstract

We provide evidence concerning the effect of managerial risk-taking incentives on merger and acquisition (M&A) decisions and outcomes for different types of mergers: vertical, horizontal, and diversifying. Using chief executive officer (CEO) relative inside leverage to proxy for the incentives of risk-averse managers, we find that CEOs with higher inside leverage are more likely to engage in vertical mergers, and those mergers generate lower announcement returns for shareholders. This effect of CEO relative inside leverage on returns for shareholders in vertical acquisitions is more pronounced when the acquirer has a higher degree of informational opacity, weak governance, and excess cash.

I. Introduction

Agency theory provides important implications for the effect of acquisitions on acquirer shareholder wealth. As pointed out in Morck, Shleifer, and Vishny (1990), managerial objectives can drive value-destroying mergers and acquisitions (M&As). One particular type of managerial objective that shareholders may not share is risk aversion. Because managers, unlike shareholders, have undiversified (or undiversifiable) exposure to a firm and their welfare is closely related to the ongoing existence of the firm, to reduce uncertainty, managers potentially engage in activities that reduce firm risk.

As a major form of corporate investment, M&As are potentially an important way to reduce risk. For example, diversifying mergers (where the acquirer and target are in totally unrelated industries) are often regarded as a risk-reducing strategy, because firms can reduce non-systematic risk by entering into new lines

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of business. Vertical mergers (where the acquirer and target have a supply chain relation as supplier and customer) may also be an effective way to reduce firm risk, since through vertical integration firms can reduce cash flow uncertainty and the risk of supply-chain disruption.[1] Since the chief executive officer (CEO) exerts substantial power over firm decision-making, firms' acquisition decisions are likely to be driven by the CEO's risk-taking incentives.

If merger decisions are motivated by the objective of maximizing managers' expected utility, particularly when managers have non-diversified financial and human capital that is tied to the existence of the firm, such corporate decisions may not be value increasing for shareholders (e.g., Smith and Stulz (1985), May (1995), and Tufano (1996)).[2] In this study, we examine how managerial risk-taking incentives affect the merger decisions that firms make. We classify mergers into three types, vertical, horizontal, and diversifying, and study the relation between proxies for managerial risk-taking incentives and the propensity for the firm to engage in these types of acquisitions. We also examine outcomes for acquirer shareholders, by studying the stock price reactions to these deals and their relation with measures of the incentives of risk-averse managers for the different types of mergers.

To test these hypotheses, we need a proxy for the CEO's incentive to reduce risk. Previous research generally uses one element of the CEO's compensation (stock-option delta) to proxy for the CEO's incentive to reduce risk (Knopf, Nam, and Thornton (2002), Brockman, Martin, and Unlu (2010)). This literature assumes that managers with higher delta have stronger incentives to decrease risk. However, delta also captures incentive alignment because it measures whether a manager's wealth is closely tied to their firm's stock price. As Chava and Purnanandam (2010) point out, the mixed signals provided by delta may cause confusion about whether the results of any given empirical test are driven by managerial incentives to reduce risk or incentive alignment.

Therefore, we consider a proxy for managerial incentives to reduce risk that is direct and easier to interpret. Motivated by recent literature on debt-like managerial compensation, we use the CEO's "inside debt" holdings to proxy for the incentives of risk-averse managers.[3] These compensation components (mainly deferred compensation and defined-benefit pensions) are often called inside debt in the literature. In the United States, such compensation is an unsecured and

[1] Economic links along the supply chain (customers and suppliers) are very important. For example, Hertzel, Li, Officer, and Rodgers (2008) find that suppliers experience significantly negative abnormal returns around both the distress and bankruptcy filing of a major customer.

[2] This is the agency problem caused by the separation of ownership and control, which has been widely documented in the finance literature since Jensen and Meckling (1976). In addition, research has demonstrated that agency conflicts between managers and shareholders lead to value-decreasing acquisitions (e.g., Jensen (1986)) and that CEOs often make value-destroying acquisitions to extract large personal gains through empire building and higher compensation (Bliss and Rosen (2001), Harford and Li (2007)).

[3] Prior research on executive compensation has focused primarily on the incentives effects of equity-based compensation (Core and Guay (2002)) and cash compensation (Leone, Wu, and Zimmerman (2006)). Based on the psychometric tests to senior executives, Graham, Harvey, and Puri (2013) find that managerial compensation schemes affect their risk aversion. In a recent study, Anderson and Core (2018) compare the risk-taking properties of different types of managerial incentive packages including inside debt, levered equity, and vega.

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(frequently) unfunded obligation of the firm, exposing managers to the same default risk as outside creditors. Therefore, in contrast with option-based equity-like incentives, inside debt holdings encourage CEOs to manage their firms more conservatively and behave more like (risk-averse) bondholders than like stockholders.

Cassell, Huang, Sanchez, and Stuart (2012) provide empirical evidence suggesting that CEOs with large inside debt holdings prefer safer investment and financial policies. Anantharaman, Fang, and Gong (2013) and Wang, Xie, and Xin (2011) both find that firms whose CEOs hold more inside debt have lower costs of debt financing and fewer restrictive covenants, which is consistent with managers' inside debt holdings aligning their incentives more closely with those of creditors. Inside debt holdings might, however, aggravate the agency problems of outside equity. If a manager's inside debt compensation is too high, managers may make financing and investment decisions that reduce firm risk, even if these diminish shareholder value. Wei and Yermack (2011) find a negative shareholder reaction (and an overall reduction of enterprise value) to the initial report of CEOs' inside debt positions.

Using data on CEO inside debt for a sample of firms from 2007 to 2011 (the period over which such data are available), we show that managerial risk preferences indeed affect firms' merger decisions and outcomes. First, we find that vertical mergers are associated with significant risk reduction for the acquiring firm, while horizontal and diversifying mergers are not. We then test the hypothesis that firms with CEOs with greater inside leverage have a higher likelihood of engaging in vertical mergers. Our results support this hypothesis: In a multinomial logit model, an indicator for vertical mergers is positive and significantly associated with CEO inside leverage while indicators for horizontal or diversifying deal activity are not. These findings are robust to alternative measures of the firm's engagement in acquisitions: specifically, continuous measures of deal values for given types of acquisitions scaled by either total assets or total deal value in a given firm-year. Our results are consistent with the view that CEOs make corporate decisions, such as the decision to engage in a vertical acquisition to reduce firm risk, based at least partly on their personal risk preferences induced by debt-like claims in their compensation packages.[4]

To understand the value implications of acquisition decisions, we next examine the wealth effects for stockholders. We find that firms with CEOs that have greater inside leverage make worse vertical acquisitions for their shareholders. Specifically, ceteris paribus, the acquirer's 5-day cumulative abnormal returns (CARs) in vertical deals decrease by approximately 93 basis points (bps) for every 1-standard-deviation increase in our CEO inside debt measure. The effect of CEO inside debt on acquirer returns in vertical transactions is both statistically and economically significant. Consistent with our prior findings, there is no relation between CEO inside debt and acquirer returns in either horizontal or diversifying M&A deals.

[4]Cronqvist, Makhija, and Yonker (2012) use CEOs' mortgage choices for their primary residences to represent managerial risk preferences and find a strong positive link between the CEOs' personal leverage and corporate leverage choices.

To shed additional light on this relation, we explore the factors that might make the agency conflicts induced by CEO inside debt more severe. We begin with accrual-based earnings management from the accounting literature to proxy for a firm's informational opacity. We find that the negative effect of CEO inside debt on acquirer abnormal returns in vertical acquisitions is more pronounced for firms with a high degree of informational opacity. Using institutional ownership and product market competition to proxy for a firm's corporate governance environment, we find that the negative effect of CEO inside debt on vertical acquisition abnormal returns is particularly strong for firms with weak corporate governance (where agency problems are likely to be the most severe). We also find that the negative effect of CEO inside debt on acquirer returns in vertical acquisitions is concentrated in cases where firms hold excess cash. Again, we do not observe any of these relations for either horizontal or diversifying M&A deals. Overall, our results suggest that vertical integration decreases value for shareholders when the acquisition decision is made by a CEO whose level of inside debt is consistent with high risk aversion, and when the firm's governance and/or information environment allows the latitude for the manager to make decisions that are in their own best interests.

To better understand a potential channel through which shareholders of acquirers with higher CEO inside debt experience significantly lower vertical acquisition announcement returns, we examine the effect of CEO inside debt on acquisition premiums. Holding acquirer and deal characteristics constant, we find that a 1-standard-deviation increase in (relative) CEO inside debt is associated with acquisition premiums that are higher by 16 percentage points, an economically large effect. This suggests that firms with CEOs that have more inside debt tend to overpay their targets in vertical acquisitions, which at least partially explains the lower value creation for acquirer shareholders.

One concern about our results is the potential endogeneity of CEO inside debt. In our context, simultaneity or reverse causality is unlikely to be a problem because our dependent variable is based on short-term market returns (i.e., acquirer's 5-day abnormal returns). However, it is still possible that some unobservable firm characteristic could be associated with both CEO compensation contracts and the returns to an acquisition. We use three approaches to address this endogeneity concern. First, we estimate time-series change regressions by examining the effect of changes in CEO inside debt on changes in acquirer returns: Change specifications help control for the effect of unobserved or omitted variables on the levels of variables. Our empirical results show a significantly negative relation between the change in acquirer returns in vertical acquisitions and the change in the CEO's inside debt. Second, we employ an instrumental variables approach. We select several instrumental variables for CEO inside debt and find that the effect of CEO inside debt on acquirer returns in vertical mergers remains negative and statistically significant after this correction for endogeneity. Third, we also use a Heckman selection model to control for the decision to engage in an acquisition in the first stage and then explain the acquirer returns in the second stage. We find that the effect of CEO inside debt on returns in vertical acquisitions remains unchanged.

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Our paper makes several contributions to the literature. First, our paper is related to a recent study by Phan (2014), who reports that CEO inside debt is positively associated with a firm's propensity to undertake a diversifying acquisition. Unlike our paper, however, Phan simply defines diversifying acquisitions as those for which the acquirer and target have different (2-digit) Standard Industrial Classification (SIC) codes. This, however, specifically excludes the possibility of *vertical* acquisitions, which may occur between firms with different SIC codes but that have a supply-chain link. As discussed later in the paper, our definition of the different types of M&A deals is considerably more nuanced and specifically considers the acquirer and target's place in the supply chain. This leads us to considerably different conclusions about the type of acquisitions that firms undertake when their CEOs have high levels of inside debt. The Phan (2014) study also does not test for differences in merger propensities or acquirer shareholder returns between the different types of mergers (vertical, horizontal, and diversifying). This is one of the main focuses of our paper. Furthermore, we include controls for other managerial incentives, such as vega and delta, throughout the empirical analyses so that we can better infer the impact of CEO inside debt on acquisition decisions.

Second, our paper contributes to the literature on vertical integration. Classic industrial organization theory (Coase (1937), Williamson (1971), (1979), Klein, Crawford, and Alchian (1978), Grossman and Hart (1986), Tirole (1986), and Hart and Moore (1990)) recognizes vertical integration as a risk management tool in which companies reduce input-supply and input-cost uncertainty and manage their operations more efficiently.[5] Extant empirical evidence confirms that vertical integration is an effective operational hedging mechanism that reduces (the cost of) cash-flow uncertainty (e.g., Fan (2000), Garfinkel and Hankins (2011)). Such existing studies do not, however, explore the interaction between CEO incentives and vertical integration, which we do in this paper.

Third, our results complement the literature concerning managerial incentives and acquisition decisions (e.g., Morck et al. (1990), Datta, Iskandar-Datta, and Raman (2001), Lin, Officer, and Zou (2011), and Phan (2014)) by showing that managerial incentives to reduce risk affect firms' merger decisions and outcomes for shareholders. Importantly, as far as we know, this paper is the first to examine the differences in effects of inside debt across different types of mergers. In this regard, this paper also adds to the broader literature on managerial incentives and corporate risk taking (e.g., Lewellen, Loderer, and Martin (1987), Berger, Ofek, and Yermack (1997), Jolls (1998), Guay (1999), Cohen, Hall, and Viceira (2000), Rajgopal and Shevlin (2002), Nam, Ottoo, and Thornton (2003),

[5]Vertical integration plays an important role in organizational economics. The traditional view of why firms vertically integrate is based on transaction cost theory (Coase (1937), Williamson (1971), (1979), and Klein et al. (1978)) and incomplete contracting theory (Grossman and Hart (1986), Tirole (1986), and Hart and Moore (1990)). The transaction cost theory of integration argues that vertical mergers help mitigate holdup problems associated with asset specificity and uncertainty in market transactions. The incomplete contracting literature focuses on the fact that, through vertical integration, ownership and control rights are allocated more efficiently for production decisions. Thus, vertical integration can help alleviate the ex ante underinvestment incentives caused by incomplete contracting.

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MacMinn and Page (2006), Coles, Daniel, and Naveen (2006), Larcker, Richardson, and Tuna (2007), Tchistyi, Yermack, and Yun (2011), Cassell et al. (2012), and Armstrong, Larcker, Ormazabal, and Taylor (2013)).

Fourth, our study adds to the literature on the incentives of risk-averse managers and agency costs. Agency theory predicts that differences in risk preferences between managers and shareholders can impose costs on shareholders. Under this theory, managers are motivated to reduce firm-specific risk because managers' human capital (and possibly financial wealth) is closely related to firm performance while shareholders can hold diversified portfolios. In addition, imperfect monitoring and contracting allows managers to pursue risk-reducing strategies, such as diversification that benefits managers but not (necessarily) shareholders. Early work by Amihud and Lev (1981) finds that conglomerate mergers are more likely to occur in manager-controlled firms, where managers have greater ability to take actions that are in their own best interests. May (1995) reports that firms tend to diversify when CEOs have a greater proportion of their wealth invested in the firm. If mergers can be used to reduce firm risk, managers may integrate as a diversification strategy to their benefit but at the expense of their shareholders. Our paper, therefore, adds to this literature.

The remainder of this paper is organized as follows: Section II describes our data and explains how we construct our key variables. Section III presents and discusses the empirical results. Section IV concludes the paper.

II. Sample, Data, and Variable Construction

A. Sample of M&As

We use the Securities Data Company (SDC) M&As database to construct our sample of M&As during the 2007–2011 period that meet the following criteria:[6]

i) The acquisition is completed.

ii) Both acquirer and target are U.S. firms.

iii) The acquirer controls less than 50% of the target's shares prior to the announcement and owns 100% of the target's shares after the transaction.[7]

iv) The deal value disclosed in the SDC data is greater than $1 million.

The sample period, while short, is dictated by the availability of data on CEO pension benefits and deferred compensation (detailed in Section II.B). We need to identify vertical, horizontal, and diversifying mergers within this sample. Fan and Goyal (2006) use the input–output (IO) data from the Bureau of Economic Analysis (BEA) to build a measure of vertical relatedness between any two industries. Their vertical relatedness coefficient construction procedure is as follows.

[6]This sample period contains the recent financial crisis, potentially causing concern about the confounding effects of that crisis. However, other inside debt studies (e.g., Cassell et al. (2012), Phan (2014)) also focus on a similar sample period (2007–2010) that contains the very same financial crisis. Therefore, in line with other studies, we use this sample period.

[7]Our results are qualitatively unaffected if we define the sample as majority stake acquisitions: The acquirer controls less than 50% of the target's shares before the announcement and owns more than 50% of the target's shares after the transaction.

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First, they calculate the dollar value of industry i's output required to produce 1 dollar's worth of industry j's output, which is denoted v_{ij}. Similarly, then they get from calculating the dollar value of industry j's output required to produce 1 dollar's worth of industry i's output. The vertical relatedness coefficient (V_{ij}) is the maximum of the two input requirement coefficients ($V_{ij} = \max(v_{ij}, v_{ji})$), which represents the opportunity for vertical integration between industries i and j. In order to find V_{ij} for firms involved in an acquisition, we use the acquirer and target firms' North American Industry Classification System (NAICS) codes to identify the primary industry affiliations and convert these NAICS codes to IO industry codes used in the BEA data.

As in Fan and Goyal (2006), Ahern and Harford (2012), and Garfinkel and Hankins (2011), we categorize an acquisition as a vertical merger if the vertical relatedness coefficient between the acquirer and target is larger than 1%. The BEA tables are reported every 5 years, and we use the 2002 IO table to calculate the vertical relatedness measure for each acquisition since our sample period is from 2007 to 2011. We classify an acquisition as a horizontal merger if the acquirer and target share the same 2-digit SIC code and do not have vertical relation. The remaining deals, those that are neither horizontal nor vertical, are classified as diversifying.

B. CEO Risk-Taking Incentives and Compensation Structure

We obtain CEO compensation data from Compustat's ExecuComp database. Our key independent variable is a measure of inside debt (Jensen and Meckling (1976), Cassell et al. (2012)), the defined-benefit pensions and deferred compensation arrangements that executives at many corporations accumulate as part of their compensation. Such compensation is an unsecured and unfunded obligation of the firm, therefore exposing managers (who are owed the accrued compensation or benefits by their employer) to the same default risk as unaffiliated outside creditors. In Dec. 2006, the SEC adopted new regulations that require firms to provide detailed information about executive pension benefits and deferred compensation. Therefore, inside debt data are available for firms with fiscal years ending in or after 2006.

Jensen and Meckling (1976) suggest that when the CEO's inside leverage ratio mirrors that of the firm, the CEO would have no incentive to transfer wealth between equity and debt holders.[8] In other words, when the CEO has an equal proportional claim to the firm's equity and debt (making her inside leverage ratio equal to the firm's leverage ratio), the CEO has neither the incentive to favor equity holders nor debt holders in terms of investment policy decisions that alter the firm's risk profile. If the CEO has an inside leverage ratio greater than the firm's leverage ratio, she has the incentive to make financial policy choices that favor creditors over stockholders (since her personal claims against the firm more closely resemble debt-like claims), and vice versa if the CEO's inside leverage ratio is lower than the firm's.

[8]Edmans and Liu (2011) also justify the use of inside debt as an efficient instrument for compensation to alleviate the agency cost of debt.

Based on this argument and recent empirical tests (e.g., Wei and Yermack (2011), Cassell et al. (2012)), we construct two alternative measures of inside debt that are likely to be associated strongly with CEOs' incentives to shift risk in favor of one type of security holder or the other.[9] Our first measure is CEO_FIRM_DE_RATIO, which is constructed as the CEO's inside debt-to-equity ratio scaled by the firm's debt-to-equity ratio:

$$\text{(1)} \quad \text{CEO_FIRM_DE_RATIO} = \frac{\text{CEO_INS_DEBT_HOLDINGS/CEO_EQUITY_HOLDINGS}}{\text{FIRM_DE_RATIO}}.$$

For our second measure, we estimate the marginal change in the value of the CEO's inside debt relative to the marginal change in the value of her inside equity holdings for a $1 change in the value of the firm, scaled by the ratio of the marginal change in the value of the firm's external debt over the marginal change in its external equity for the same $1 change in firm value. The CEO relative incentive ratio is constructed as follows:

$$\text{(2)} \quad \text{CEO_REL_INCENTIVE} = \frac{\Delta\text{CEO_INS_DEBT_HOLDINGS}/\Delta\text{CEO_EQUITY_HOLDINGS}}{\Delta\text{FIRM_DEBT}/\Delta\text{FIRM_EQUITY}}.$$

We provide a detailed description of the construction of the two CEO inside debt measures in the Appendix.

In this paper, we also include two CEO incentive measures derived from the equity compensation structure only (CEO delta and vega).[10] We follow Guay (1999) and Core and Guay (2002) in calculating delta and vega.[11] These authors calculate these measures using the Black–Scholes (1973) option valuation model, as modified by Merton (1973) to account for dividends. VEGA is defined as the change in the dollar value of the CEO's option portfolio for a 0.01 change in the annualized standard deviation of stock returns. Guay (1999) suggests that the CEO's combined stock and option portfolio vega can be estimated using the option portfolio vega since option vega is many times higher than stock vega. Coles et al. (2006), Knopf et al. (2002), and Rajgopal and Shevlin (2002) adopt the same approximation. DELTA is defined as the change in the dollar value of the CEO's stock and option portfolio for a 1-percentage-point change in stock price.

[9] We use CEO_FIRM_DE_RATIO and CEO_REL_INCENTIVE as our main measures of risk incentives. However, these measures do not incorporate the sensitivity of stock-option value to firm volatility. Anderson and Core (2018) point out the drawback of these measures and argue that the relative leverage ratio measures are based on ad hoc adjustments for options that are incorrect because the option sensitivity to firm volatility is different from the option's delta or value. Further, Anderson and Core (2018) propose a new risk incentive measure that correctly weights the manager's debt, stock, and option sensitivities.

[10] Carpenter (2000) indicates that stock options create two opposing effects on managerial incentives. One effect is the sensitivity of compensation to stock return volatility, or vega. Due to the convexity of the option portfolio, the value of option-based compensation increases with stock return volatility. Therefore, higher vega gives executives a strong incentive to take risk. The second effect is caused by the sensitivity of compensation to stock price, or delta.

[11] It is notable that due to the emergence of performance-vesting grants of stock, cash, and options (e.g., Bettis, Bizjak, Coles, and Kalpathy (2010)), traditional measures such as vega may not be able to fully capture the risk-taking incentives caused by compensation convexity.

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C. Acquirer Abnormal Returns and Acquisition Premiums

We measure acquirer abnormal announcement returns using market-model-adjusted stock returns around the acquisition announcement dates from the SDC of M&As in our sample. We compute 5-day CARs during the event window (−2, +2), where event day 0 is the acquisition announcement date. We use the CRSP value-weighted return as the market return and estimate the market model parameters over the 200-day period from event day −210 to event day −11. For acquisitions of publicly traded targets, we are able to obtain the acquisition premium from the SDC, defined as the ratio of the offer price to the target's stock price 1 week before the acquisition announcement minus 1.

D. Control Variables

We consider two categories of control variables that are commonly employed in the M&A literature in regressions on acquirer CARs (e.g., Masulis, Wang, and Xie (2007), Ishii and Xuan (2014)): acquirer characteristics and deal characteristics. The acquirer characteristics that we control for are size (ln(ASSETS)), return on assets (ROA), Tobin's Q, and leverage, all of which are measured at the fiscal year-end immediately prior to the acquisition announcement using data from Compustat. We also control for the acquirer's pre-announcement market-adjusted stock price runup, which is measured over the 200-day window from event day −210 to event day −11.

The deal characteristics that we control for include target ownership status, method of payment, relative deal size, whether a deal is friendly, and whether an acquisition is a tender offer. These variables are all taken from the SDC. We use indicator variables for the various categories of target public status (public, private, and subsidiary) and an indicator variable for all-cash deals (equals 1 for acquisitions financed fully with cash). Relative deal size is defined as the ratio of deal value to the acquirer's market value of equity measured on event day −11.

For acquisitions involving public targets, we are also able to control for target characteristics in our regressions. These target characteristics include ROA, Tobin's Q, leverage, and stock price runup, all of which are measured as described above for the acquirer. To eliminate the effect of outliers, we winsorize all continuous variables in this study at the 1st and 99th percentiles. Detailed definitions of all these variables can be found in the Appendix.

E. Summary Statistics

Panel A of Table 1 describes our CEO incentive measures and their interaction with our merger sample. The base sample in Panel A is all firm-years in ExecuComp between 2006 and 2011 with sufficient data to estimate our inside leverage (incentive) variables. The mean (median) values of CEO_FIRM_DE_RATIO and CEO_REL_INCENTIVE are 2.64 (0.29) and 1.93 (0.22), respectively. These statistics are generally consistent with the averages and medians in Cassell et al. (2012) (see Table 2 in that paper, which uses the same techniques as employed in our paper). These statistics do, however, indicate that our CEO relative leverage measures are severely right-skewed. Therefore, in addition to the winsorizing described above, we use the natural log transformation of these variables in our multivariate analysis (as do Cassell et al. (2012)).

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TABLE 1
Summary Statistics

Panel A of Table 1 contains all ExecuComp firm-years between 2006 and 2011 with relevant inside debt data. Vertical acquisitions are determined using the vertical relatedness coefficient from Fan and Goyal (2006) with a 1% cutoff. The merger indicator (or value ratio) is constructed based on all announced deals (regardless of completion). In Panel B, the sample contains all completed acquisitions from SDC between 2007 and 2011 with relevant data. With the exception of the PREMIUM_1WEEK, ROA_TARGET, Q_TARGET, LEVERAGE_TARGET, and STOCK_RUNUP_TARGET, all variables are for the acquirer. Panel C compares the incentive variables between the full sample and the merger sample. Panel D shows the industry distribution of acquirers and targets in the merger sample. Panel E compares the acquisition announcement returns (acquirer CAR(−2,+2)) between the groups of firms with high inside debt ratio (CEO_REL_INCENTIVE > 2) and low inside debt ratio (CEO_REL_INCENTIVE ≤ 2). The difference tests are based on *t*-tests. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Variables	*N*	Mean	Std. Dev.	P25	Median	P75
Panel A. Full Sample of Firm-Years						
CEO_FIRM_DE_RATIO	5,562	2.641	10.241	0.000	0.286	1.383
CEO_REL_INCENTIVE	5,349	1.926	7.460	0.000	0.219	1.004
ln(CEO_FIRM_DE_RATIO)	5,562	0.594	0.839	0.000	0.251	0.868
ln(CEO_REL_INCENTIVE)	5,349	0.500	0.749	0.000	0.198	0.695
ln(VEGA)	5,562	3.660	1.844	2.644	3.943	5.000
ln(DELTA)	5,562	5.448	1.447	4.491	5.426	6.361
VERTICAL_MERGER_INDICATOR	5,562	0.234	0.423	0.000	0.000	0.000
VERTICAL_VALUE_TOTAL_ASSETS	5,562	0.026	0.079	0.000	0.000	0.000
VERTICAL_VALUE_DEAL_VALUE	2,132	0.582	0.483	0.000	1.000	1.000
HORIZONTAL_MERGER_INDICATOR	5,562	0.127	0.333	0.000	0.000	0.000
HORIZONTAL_VALUE_TOTAL_ASSETS	5,562	0.016	0.061	0.000	0.000	0.000
HORIZONTAL_VALUE_DEAL_VALUE	2,132	0.312	0.457	0.000	0.000	1.000
DIVERSIFYING_MERGER_INDICATOR	5,562	0.057	0.233	0.000	0.000	0.000
DIVERSIFYING_VALUE_TOTAL_ASSETS	5,562	0.003	0.017	0.000	0.000	0.000
DIVERSIFYING_VALUE_DEAL_VALUE	2,132	0.106	0.292	0.000	0.000	0.000
Panel B. Merger Sample						
CAR(−2, +2) (%)	1,405	0.392	6.323	−2.408	0.229	3.187
CEO_FIRM_DE_RATIO	1,405	2.769	9.970	0.000	0.218	1.312
CEO_REL_INCENTIVE	1,352	1.938	6.888	0.000	0.169	1.030
ln(CEO_FIRM_DE_RATIO)	1,405	0.590	0.879	0.000	0.198	0.838
ln(CEO_REL_INCENTIVE)	1,352	0.498	0.772	0.000	0.156	0.708
ln(VEGA)	1,405	3.945	1.922	2.899	4.171	5.331
ln(DELTA)	1,405	5.734	1.511	4.798	5.667	6.620
VERTICAL	1,405	0.493	0.500	0.000	0.000	1.000
HORIZONTAL	1,405	0.252	0.434	0.000	0.000	1.000
DIVERSIFYING	1,405	0.255	0.436	0.000	0.000	1.000
ln(ASSETS)	1,405	8.273	1.854	6.933	8.007	9.463
ROA	1,405	0.136	0.076	0.086	0.132	0.177
Q	1,405	1.784	0.851	1.201	1.547	2.065
LEVERAGE	1,405	0.218	0.154	0.108	0.200	0.310
STOCK_RUNUP	1,400	0.037	0.284	−0.138	−0.004	0.160
RELATIVE_SIZE	1,405	0.126	0.231	0.013	0.038	0.117
PRIVATE_TARGET_DUMMY	1,405	0.444	0.497	0.000	0.000	1.000
PUBLIC_TARGET_DUMMY	1,405	0.217	0.412	0.000	0.000	0.000
ALL_CASH_DEAL	1,405	0.451	0.498	0.000	0.000	1.000
FRIENDLY_DEAL	1,405	0.994	0.080	1.000	1.000	1.000
TENDER_OFFER	1,405	0.046	0.209	0.000	0.000	0.000
CEO_EQUITY_OWNERSHIP	1,352	0.021	0.044	0.004	0.010	0.020
CEO_AGE	1,394	54.585	6.936	50.000	55.000	59.000
CEO_TENURE	1,376	6.705	6.174	2.000	5.000	9.000
G_INDEX	1,204	9.091	2.546	7.000	9.000	11.000
INSTITUTIONAL_OWNERSHIP	1,331	0.792	0.159	0.698	0.809	0.912
HHI	1,405	0.188	0.165	0.076	0.133	0.248
PREMIUM_1WEEK (%)	246	40.942	39.056	19.900	36.070	50.710
ROA_TARGET	242	0.048	0.184	0.017	0.081	0.139
Q_TARGET	242	1.768	1.105	1.063	1.378	2.032
LEVERAGE_TARGET	241	0.203	0.211	0.023	0.137	0.316
STOCK_RUNUP_TARGET	246	0.019	0.568	−0.252	−0.082	0.135
IND_YR_AVG_ln(CEO_REL_INCENTIVE)	1,405	0.474	0.393	0.211	0.356	0.624
TAX_RATE_WAGES	1,404	39.080	2.137	37.650	39.220	40.900
TAX_RATE_LTGAINS	1,404	19.019	2.148	17.650	19.110	20.895
TAX_RATE_MORTGAGE	1,404	37.247	2.390	35.000	37.130	38.900

(continued on next page)

TABLE 1 (continued)
Summary Statistics

Panel C. CEO Incentive Variables Test

	Full Sample		Merger Sample		Full – Merger	
Variables	*N*	Mean	*N*	Mean	Diff.	*t*-Stat.
CEO_FIRM_DE_RATIO	5,562	2.641	1,405	2.769	−0.128	−0.43
CEO_REL_INCENTIVE	5,349	1.926	1,352	1.938	−0.012	−0.06
ln(CEO_FIRM_DE_RATIO)	5,562	0.594	1,405	0.590	0.005	0.18
ln(CEO_REL_INCENTIVE)	5,349	0.500	1,352	0.498	0.003	0.11
ln(VEGA)	5,562	3.660	1,405	3.945	−0.285***	−5.00
ln(DELTA)	5,562	5.448	1,405	5.734	−0.287***	−6.40

Panel D. Industry Distribution of Acquirer and Target in Mergers

Acquirer		Target	
2-Digit SIC Code	Percent	2-Digit SIC Code	Percent
13	5.14	13	6.07
28	7.86	28	8.14
35	7.64	35	4.07
36	6.36	36	5.43
37	2.50	38	8.50
38	9.79	48	3.71
48	4.00	49	3.36
49	3.29	50	2.07
60	6.71	60	5.07
63	3.43	63	2.36
73	14.00	73	18.43
80	3.14	80	3.07
Others (<2%)	26.14	87	4.50
		Others (<2%)	25.22

Panel E. Univariate Test

	Low Inside Debt Ratio CEO_REL_INCENTIVE ≤ 2		High Inside Debt Ratio CEO_REL_INCENTIVE > 2		Difference
Variables	Mean	*N*	Mean	*N*	High – Low
VERTICAL CAR(−2, +2) (%)	0.711	555	−1.014	103	−1.725***
HORIZONTAL CAR(−2, +2) (%)	0.563	312	0.613	35	0.050
DIVERSIFYING CAR(−2, +2) (%)	0.066	289	0.667	58	0.601

We match the mergers from SDC data to the firm-years in ExecuComp with a lag, so that the data on CEO incentives is always measured at the fiscal year-end immediately prior to the acquisition announcement. We are interested in the volume of M&A activity in our sample and employ three metrics for the intensity of merger volume. The first is simply an indicator variable for whether there is a vertical, horizontal, or diversifying merger from the SDC data matched (with the lag described previously) to the firm-year from ExecuComp. As can be seen in Panel A of Table 1, 23.4% of the firm-years from ExecuComp are matched to a vertical merger announcement by the firm in the following year, 12.7% of the observations are matched to a horizontal merger, and 5.7% are matched to a diversifying merger. Our second measure is the sum of the deal values of all vertical, horizontal, or diversifying mergers conducted in a firm-year, divided by total assets (from Compustat) as of the end of the last fiscal year. If a firm does not participate in vertical, horizontal, or diversifying acquisitions in a given year, this continuous variable is set to 0. Further, our third measure is the sum of the deal values of all vertical, horizontal, or diversifying mergers conducted in a firm-year, scaled by the sum of the deal values of all mergers in that firm-year. This variable

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is only computed for years in which the firm conducts acquisitions (otherwise the denominator would be 0). On average, approximately 58% (31%) (by value) of the deals a firm does in a given year are vertical (horizontal) acquisitions. For these variables, we use all announced deals to construct the measures, regardless of whether the deals are completed.

Panel B of Table 1 presents summary statistics for the 1,405 *completed* M&As in our sample period (2007–2011) that have sufficient available data to measure our important variables. According to our definition described above (Section II.A), 49.3% of deals are classified as vertical mergers, 25.2% as horizontal mergers, and 25.5% as diversifying mergers. In 246 of the deals, the target is a publicly traded firm, while 44% of the merger deals in our sample are for private targets. As can be seen from the table, the average 5-day CAR for our acquirers is 0.39%, and the mean 1-week acquisition premiums are around 41%. These statistics are generally in line with previous studies.

Both CEO relative inside leverage measures have similar averages for the merger sample (Panel B of Table 1, matched so that the incentive measures are measured at the fiscal year-end immediately prior to the acquisition announcement) compared to the full sample of firm-years from ExecuComp (Panel A). We also conduct *t*-tests (Panel C) to check whether there are significant differences for the CEO incentive variables between the merger sample and the full sample. For the two CEO inside debt incentive variables, there are no significant differences between the merger sample and the full sample. The relative size of acquisitions in our sample is also consistent with the existing literature (approximately 13% of acquirer market value on average). In 45% of the deals in our sample, the acquirer pays the target 100% cash compensation for buying their shares, and almost all the deals we study are categorized by SDC as friendly. Panel D presents the industry distribution of acquirers and targets in our merger sample.

In Panel E of Table 1, we perform a univariate test to compare acquirer announcement returns in the three types of acquisitions between groups of deals with high versus low inside relative leverage ratios. We consider firms with a large inside debt bias (i.e., CEO_REL_INCENTIVE > 2) as the high inside debt ratio group, which contains around 14.5% of our sample of mergers.[12] The remaining mergers in our sample (CEO_REL_INCENTIVE ≤ 2) are classified as the low inside debt ratio group. We find that the high inside debt ratio group has a negative average 5-day CAR (-1.0%) for vertical mergers, suggesting that CEOs with high relative leverage destroy shareholder value in vertical acquisitions. In contrast, the average 5-day CAR associated with vertical deals in the low inside debt ratio group is positive (0.7%).[13] The difference between the two groups is -1.7%, statistically significantly different from 0 at the 1% level. On the other hand, for horizontal or diversifying transactions, there is no significant difference in average acquirer 5-day CAR between the high inside debt ratio group and the

[12]The mean value of CEO_REL_INCENTIVE in our entire sample is approximately 2.

[13]This univariate comparison also suggests that not all vertical mergers are necessarily bad for shareholders. Only some vertical mergers (those undertaken by CEOs with high inside debt ratio) destroy acquirer shareholder wealth. In general, shareholders could benefit from vertical mergers because such deals may reduce uncertainty in input costs, generate efficiencies along the supply chain, and so on.

low inside debt ratio group: In fact, all the aforementioned averages have positive point estimates. This univariate evidence provides preliminary proof that firms with CEOs that have greater inside debt make worse vertical acquisitions for their shareholders.

III. Empirical Results

A. Risk Reduction in Mergers

Our hypothesis in this paper is that risk-averse CEOs are more likely to pursue a strategy of undertaking acquisitions if such a strategy reduces firm risk, even if that reduction in risk is at the expense of shareholder wealth, thereby creating less (or destroying more) wealth for acquirer shareholders. Clearly, one key element of testing this hypothesis is obtaining a good proxy for the incentives of risk-averse CEOs, which we describe in Section II.B. Another necessary condition for this hypothesis to hold is establishing that certain types of mergers actually do reduce firm risk.

Corporate diversification (e.g., via a diversifying merger) is commonly viewed as a risk-reducing strategy (Amihud and Lev (1981), May (1995)). In addition, there is evidence in the extant literature that vertical mergers result in reduced risk at the firm level. Garfinkel and Hankins (2011), for example, show that firms that vertically integrate experience significant post-merger reductions in the volatility of operating income and cost of goods sold, where the latter reflects the reduction in the volatility of input costs.

In this section, we examine which types of mergers reduce firm risk and we use the volatility of stock returns as our risk measure. Specifically, we conduct two types of analyses. First, we compare total equity risk (the annualized variance of daily returns) and idiosyncratic equity risk (the annualized variance of the residuals from a market model) of acquisition firms (the treatment group) with those of a propensity-score-matched sample of firms from ExecuComp that are in our sample period and that have not conducted a merger (the control group). For the treatment group, we examine all three types of mergers (vertical, horizontal, and diversifying) separately. The propensity score matching (PSM) approach addresses a potential selection bias caused by the treatment group having non-random characteristics. The procedure is to match each observation in the treatment group with a control group observation based on the predicted probabilities, or propensity scores. There are several alternative techniques for PSM, such as nearest neighbor matching and kernel matching, and we employ both for robustness.

Panels A and B of Table 2 present the risk reduction results for the propensity-score-matched sample. Our matching criteria used in the first-stage regression include firm size, Tobin's Q, leverage, research and development (R&D)/sales, G-index, the volatility of firm stock returns over the preceding year, and industry and year dummies. All of these variables are defined in the Appendix. We then match firms in the control group (defined previously) with firms in the treatment group based on the predicted probability of conducting a specific type of merger.

For each of our risk measures (total and idiosyncratic return variances), we compute the mean change from $t-1$ (1 year prior to the merger) to $t+1$ (1 year

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TABLE 2
Risk Reduction Following Mergers

Table 2 presents the differences in firm risk measures between treatment firms and control firms based on propensity score matching (PSM). The sample is a propensity-score-matched sample of acquisition firms and non-acquisition firms from the ExecuComp database during our sample period. TOTAL_RISK is the annualized variance of daily firm stock returns over the year. IDIOSYNCRATIC_RISK is the annualized variance of the residuals from the market model. The treatment group includes firms that have conducted a vertical (horizontal and diversifying) merger in year t (successful mergers). The control group includes all ExecuComp firms (during the sample period) that have not gone through an acquisition and have similar propensity scores with the treatment group, and control-group firms are matched either by nearest neighbor PSM (Panel A) or by Gaussian Kernel PSM (Panel B). Matching variables are firm size, Tobin's Q, leverage, R&D/sales, G-index, the volatility of firm stock returns over the past year, and industry and year dummies. Panels A and B show the average treatment effect for vertical (V) (horizontal (H) and diversifying (D)) merger firms versus non-merger firms: For each risk measure, the mean change from 1 year before acquisition to 1 year after is computed as the difference between the changes in risk for treatment and control firms. t-statistics are shown below in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Differences-in-Differences Results (Nearest Neighbor PSM)

ATT (Treatment vs. Control)	Nearest Neighbor PSM			Difference Test	
$t+1$ minus $t-1$	Vertical	Horizontal	Diversifying	V = H	V = D
TOTAL_RISK	−0.0626**	0.0032	−0.0111	−0.0659**	−0.0515*
	(−2.48)	(0.13)	(−0.44)	(−2.00)	(−1.65)
IDIOSYNCRATIC_RISK	−0.0441**	−0.0012	−0.0041	−0.0429*	−0.0400**
	(−2.56)	(−0.06)	(−0.27)	(−1.81)	(−2.01)

Panel B. Differences-in-Differences Results (Gaussian Kernel PSM)

ATT (Treatment vs. Control)	Gaussian Kernel PSM			Difference Test	
$t+1$ minus $t-1$	Vertical	Horizontal	Diversifying	V = H	V = D
TOTAL_RISK	−0.0593***	0.0017	−0.0043	−0.0611*	−0.0550*
	(−2.67)	(0.06)	(−0.15)	(−1.90)	(−1.80)
IDIOSYNCRATIC_RISK	−0.0393***	−0.0027	−0.0019	−0.0366	−0.0374*
	(−2.79)	(−0.14)	(−0.10)	(−1.59)	(−1.93)

after the merger) for our treatment firms. For the control firms, we compute the mean change from 1 year prior to the matched firm-year (since the control firms have not undertaken a merger) to 1 year after the matched firm-year. We also calculate the difference between our treatment firms and control firms (differences-in-differences). Panels A and B of Table 2 present the results of the differences-in-differences estimation using two PSM methods: nearest neighbor and kernel, respectively. We find that firms completing vertical mergers experience a significantly larger post-merger reduction in total and idiosyncratic risk compared to matched (non-merger) control firms. Specifically, all of the mean differences-in-differences for vertical transactions are negative and statistically significant (at the 5% level for nearest neighbor matching and the 1% level for kernel matching). In contrast, we do not observe statistically significant declines in firm risk in either horizontal or diversifying mergers.

We also run t-tests to check whether the risk-reduction estimates for vertical mergers are significantly different from those for horizontal or diversifying mergers in our differences-in-differences analyses. In the difference test for Panel A of Table 2, we find that all of the estimates for vertical mergers are statistically different (at the 10% level) from those for horizontal or diversifying mergers. In Panel B, we find statistically significant differences (at the 10% level) in three out of four cases.

Second, we compare total and idiosyncratic return variances for firms that complete vertical, horizontal, or diversifying mergers versus those that propose

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corresponding deals but fail to complete the transactions (Table 3). Similarly, we compute the mean change from $t-1$ to $t+1$ for completed merger firms, withdrawn merger firms, and the difference between firms completing mergers and firms that do not complete their deals (differences-in-differences). Using the differences-in-differences approach, the reduction in total and idiosyncratic equity risk for firms *completing* vertical mergers is statistically significantly (at the 5% level for total risk and the 1% level for idiosyncratic risk) larger than the risk reduction for firms failing to complete such transactions. For horizontal and diversifying mergers, however, there is no significant difference between the completed and withdrawn groups. Moreover, we find that almost all of the estimates for vertical mergers are significantly different from those for horizontal or diversifying mergers using difference tests.

In summary, both the extant literature and the results in Tables 2 and 3 strongly suggest that firm risk is substantially reduced following mergers that result in vertical integration. The issues we examine in this paper are whether CEOs with greater incentives to reduce risk are more likely to pursue a vertical integration strategy and whether vertical mergers reduce shareholder wealth via a suboptimal reduction in risk from the shareholders' perspective (or, potentially, overpayment in the acquisition).

TABLE 3

Successful Mergers versus Failed Mergers

Table 3 compares total and idiosyncratic risk for firms that complete vertical, horizontal, or diversifying mergers versus those that propose mergers of the similar type but fail to complete the transactions. TOTAL_RISK is the annualized variance of daily firm stock returns over the year. IDIOSYNCRATIC_RISK is the annualized variance of the residuals from the market model. *t*-statistics are shown below in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Complete vs. Withdrawn	Differences-in-Differences			Difference Test	
$t+1$ minus $t-1$	Vertical	Horizontal	Diversifying	V = H	V = D
TOTAL_RISK	−0.0659**	0.0182	−0.0330	−0.0836***	−0.0330
	(−2.51)	(0.79)	(−0.37)	(−2.89)	(−0.97)
IDIOSYNCRATIC_RISK	−0.0571***	0.0025	0.0020	−0.0598***	−0.0579**
	(−2.88)	(0.15)	(0.03)	(−2.91)	(−2.27)

B. CEO Inside Debt and Merger Decisions

We examine the relation between the CEO's inside debt holdings and the likelihood that the firm pursues a certain type of merger to provide evidence on how CEOs' personal incentives to reduce firm risk (driven by higher relative leverage) affect corporate policies. In these tests, we include all ExecuComp firms with relevant inside debt data during our sample period and we use all three merger intensity variables noted in the discussion of Panel A of Table 1. Our key explanatory variables are the two inside debt incentive measures (CEO_FIRM_DE_RATIO and CEO_REL_INCENTIVE).[14] To isolate the effect of inside debt, we also include vega and delta as controls in all regressions.

[14] While we only report results using ln(CEO_FIRM_DE_RATIO) as the key independent variable in Table 4, our results are robust to using ln(CEO_REL_INCENTIVE) as an independent variable.

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We choose the control variables based on the extant merger literature (e.g., Garfinkel and Hankins (2011)). Because we are interested in explaining merger activity as a reaction to increased uncertainty or risk, we control for the increased volatility of operating income before depreciation (OIBD). This is an income uncertainty measure, and we use data from the prior 20 fiscal quarters to calculate the volatility. Our results are similar when using a cost uncertainty measure (increased volatility of cost of goods sold (COGS)). In addition to these cash flow volatilities, we also create indicator variables to capture shocks (5% up or down) to OIBD or COGS. Following Harford (2005), we further construct an "Econ Shock Index" to control for economic shocks to the acquirer's industry. The index is computed as the first principal component from seven economic shock variables (measured as the median absolute change per industry-year): cash flow scaled by sales, asset turnover, R&D scaled by assets, capital expenditures scaled by assets, employee growth, ROA, and sales growth. Other control variables include firm size (natural log of total assets), leverage, Tobin's Q, CAPEX, R&D (scaled by sales), the G-index, and the level and volatility of the industry median buy-and-hold return over the past 3 years. Again, all variables are defined in the Appendix.

At any point in time, a firm can choose not to make an acquisition or to make a vertical, horizontal, or diversifying acquisition. Therefore, we employ a multinomial logit model to estimate the likelihood of a firm undertaking a specified type of merger (vs. not attempting one at all, the omitted choice), and the results are reported in Table 4. The coefficients in the multinomial logit regression can be interpreted as the effect on the likelihood of undertaking a particular type of merger, relative to not engaging in an acquisition at all. The sample is as described in Panel A of Table 1: all firm-years from ExecuComp with relevant inside debt data.

For both specifications in Table 4,[15] the coefficients on the CEO inside debt variable are positive and statistically significant for vertical mergers, while not significant for horizontal and diversifying mergers. This is consistent with the notion that CEOs with greater incentives to reduce risk are more likely to participate in vertical integrations, and the advantage of the multinomial logit model is that we can identify which type of acquisitions firms with high CEO-to-firm debt/equity ratios are more likely to undertake.[16] The effect of CEO inside debt incentives on merger decisions is economically significant.[17] Ceteris paribus, for a 1-standard-deviation increase in the CEO_FIRM_DE_RATIO from the unconditional mean, the relative probability of choosing to conduct a vertical merger rather than not engaging in a merger at all is 17.4% higher (column 4,

[15]Panel A of Table 4 reports the regressions without the G-index as an independent variable, while Panel B controls for the G-index.

[16]Based on the summary statistics in Table 1, we observe that vertical mergers, on average, have a lower completion rate. Taken together with the results in Table 4, this suggests that managers with high inside debt aggressively attempt vertical mergers to reduce firm risk despite the lower completion rate of such deals.

[17]Since the inside debt variable is natural log transformed, we can interpret the economic significance of the effect of inside debt ratio in the following way. Take two values of CEO_FIRM_DE_RATIO, $r1$ and $r2$, and hold the other variables constant. The expected mean difference in the natural log-odds is $\beta \times (\ln(r2) - \ln(r1)) = \beta \times \ln(r2/r1)$. This means that as long as the percentage increase in CEO_FIRM_DE_RATIO is fixed, we will see the same difference in the natural log-odds.

TABLE 4

The Effect of CEO Inside Debt on Merger Decisions

Table 4 reports the regression results for the effect of CEO inside debt on the likelihood of firms undertaking a specified type of merger. All variables are defined in the Appendix. We use multinomial logit model to estimate firms' acquisition choices. The dependent variable includes three types of mergers: vertical (V), horizontal (H), and diversifying (D). We classify an acquisition as a vertical merger if the vertical relatedness coefficient between the acquirer and target is larger than 1%. We classify an acquisition as a horizontal merger if the acquirer and target have the same 2-digit SIC industry and do not have vertical relation. We classify an acquisition as a diversifying merger if the deal is neither horizontal nor vertical. The base outcome is not undertaking any type of merger. Panel A reports the regressions without the G-index as an independent variable, while Panel B controls for the G-index. Heteroskedasticity-consistent standard errors clustered at the firm level are reported in square brackets. All regressions contain both year and industry fixed effects. The coefficient on the constant is suppressed for brevity. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Panel A. Without G-index			*Panel B. With G-index*		
Variables	V	H	D	V	H	D
ln(CEO_FIRM_DE_RATIO)	0.107**	−0.025	−0.019	0.101**	−0.092	−0.013
	[0.046]	[0.067]	[0.102]	[0.050]	[0.075]	[0.109]
ln(VEGA)	−0.006	0.083**	0.083	−0.003	0.109***	0.046
	[0.025]	[0.035]	[0.055]	[0.027]	[0.039]	[0.060]
ln(DELTA)	0.105***	0.108**	0.151**	0.066*	0.065	0.156**
	[0.032]	[0.048]	[0.068]	[0.037]	[0.055]	[0.075]
INCREASED_OIBD_VOLATILITY	−0.066	−0.148	−0.430**	−0.031	−0.144	−0.453**
	[0.074]	[0.106]	[0.194]	[0.080]	[0.115]	[0.208]
SHOCK_5%_INCREASE	−0.131*	−0.204**	−0.235	−0.083	−0.164	−0.076
	[0.074]	[0.101]	[0.175]	[0.081]	[0.108]	[0.186]
SHOCK_5%_DECREASE	−0.316***	−0.425***	−0.415**	−0.326***	−0.380***	−0.420**
	[0.078]	[0.105]	[0.182]	[0.086]	[0.114]	[0.199]
ECON_SHOCK_INDEX	−0.146	−0.634	0.508	−0.439	−0.609	1.061
	[0.353]	[0.528]	[0.869]	[0.376]	[0.557]	[0.931]
ln(ASSETS)	0.196***	0.085*	0.073	0.207***	0.058	0.082
	[0.032]	[0.051]	[0.063]	[0.036]	[0.057]	[0.064]
LEVERAGE	−0.808***	−1.076***	−1.103**	−0.547**	−0.753*	−0.958
	[0.223]	[0.337]	[0.551]	[0.255]	[0.389]	[0.633]
Q	0.134***	0.184***	0.081	0.147**	0.217***	0.019
	[0.050]	[0.067]	[0.110]	[0.060]	[0.077]	[0.140]
CAPEX	−2.143*	−1.437	−3.092	−2.442*	−1.680	−3.358
	[1.249]	[1.435]	[2.245]	[1.443]	[1.607]	[2.606]
RD_SALES	0.615	−0.139	−1.010	0.277	−0.721	−0.180
	[0.675]	[0.922]	[1.535]	[0.834]	[1.041]	[1.675]
3_YR_RET	0.168	0.582*	−0.607	0.367	0.717*	−0.553
	[0.252]	[0.354]	[0.552]	[0.263]	[0.390]	[0.610]
3_YR_RET_VOLATILITY	−3.939	6.517	−3.575	−4.460	6.480	−6.165
	[2.640]	[4.087]	[6.206]	[2.937]	[4.589]	[6.656]
G_INDEX				−0.044**	0.014	−0.013
				[0.018]	[0.027]	[0.041]
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.		6,735			5,463	
Pseudo-R^2		0.141			0.150	
	ln(CEO_FIRM_DE_RATIO)			ln(CEO_FIRM_DE_RATIO)		
Coefficient difference test		V = H	V = D		V = H	V = D
p-value		0.0388**	0.2145		0.0065***	0.2991

$\exp[0.101 \times \ln(1+10.241/2.641)] = 4.88^{0.101} = 1.174$). For the control variables, their effects on acquisitions are mostly consistent with existing literature.[18]

[18] Interestingly, in Table 4, we also find a positive sign on vega for horizontal mergers, suggesting that firms with higher CEO vega incentives are more likely to engage in horizontal acquisitions. This finding reaffirms a connection between vega and firm risk and, thus, adds to the literature on whether vega affects managerial risk taking. Early studies show a strong positive relationship between vega and risk taking (e.g., Guay (1999), Coles et al. (2006)), whereas recent studies show mixed results

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Larger firms and firms with higher growth opportunities tend to undertake more acquisitions.

We also test the equality of the coefficients on the CEO inside debt variables between vertical mergers and horizontal mergers (or diversifying mergers). We find that the coefficients on the CEO inside debt variables in vertical mergers are significantly different from those in horizontal mergers (but not significantly different from the coefficients on the CEO inside debt variables in diversifying mergers). Therefore, in terms of acquisition choices, firms with high CEO inside debt incentives are at least more likely to choose vertical mergers over horizontal mergers.

In untabulated robustness tests, we use the value of vertical, horizontal, or diversifying mergers scaled by total assets as the dependent variable and run tobit regressions (because the dependent variable is censored at 0). The control variables are the same as in Table 4. We find that CEOs with greater incentives to reduce risk (i.e., those with greater inside debt) are more likely to conduct vertical acquisitions, and there is no significant relationship between CEO inside debt incentives and non-vertical (horizontal or diversifying) M&As. In addition, we run similar regressions using as the dependent variable the value of vertical, horizontal, or diversifying mergers scaled by total M&A deal value for the firm in a given year (i.e., fraction of deal value represented by a particular type of acquisition). For this robustness test, the sample is restricted to firm-years that have at least one completed M&A deal; otherwise, the denominator could not be measured (as described in Panel A of Table 1). Again, we find that CEOs with higher relative inside leverage are more likely to attempt vertical deals, but there is no association between inside leverage and other deal types.[19]

Phan (2014) documents a positive relationship between CEO inside debt and the propensity to conduct what he defines as diversifying acquisitions. It is worth noting that "diversifying" acquisitions in Phan's paper may well involve acquirers and targets that are vertically related, which could contaminate the estimate of the propensity to undertake a diversifying acquisition. Our paper, however, provides a more comprehensive definition of the three types of acquisitions. To enable comparisons with Phan's paper, we test whether the CEO's inside debt holdings are associated with *non-vertical* mergers generally, and non-vertical

(e.g., Hayes, Lemmon, and Qiu (2012)). Hayes et al. (2012) exploit a change in accounting rules in 2005 (FAS 123R; ASC 718) to examine compensation convexity and firm risk. They find that stock awards have dramatically displaced option grants since the adoption of FAS 123R, but find little support for the contention that the decline in option usage is associated with corresponding reductions in firm risk. Another paper by Bettis, Bizjak, Coles, and Kalpathy (2013) adopts a new methodology (performance-vesting provisions) to measure the value and incentives of stock and options. Bettis et al. (2013) find that although firms dramatically reduce their option usage after 2005, compensation convexity has not fallen as much as previously thought, which might explain the lack of decline in firm risk after 2005.

[19]In robustness tests, we include additional firm and CEO characteristic control variables in our merger decision models. These control variables include firm tangibility, age, degree of product market competition (Herfindahl-Hirschman index (HHI)), excess cash and cash flow volatility, CEO equity ownership, CEO age, and tenure. The coefficient on CEO relative leverage remains positive and significant for vertical mergers after including these control variables and insignificant for the other types of mergers.

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diversifying mergers specifically. The results reported in Table 4 suggest that they are not.

Taken together, our results demonstrate that CEOs with greater inside debt incentives are more likely to attempt vertical mergers. The effect of CEO inside debt incentives on vertical acquisition decisions is robust when we use the fraction of vertical integrations relative to total acquisitions as the proxy for the extent of vertical acquisition intensity.

C. CEO Inside Debt and Acquisition Announcement Returns

Having established that CEOs with greater inside debt incentives are more likely to undertake vertical acquisitions, we now focus on the wealth effects of these deals. Specifically, risk-averse managers might reduce firm-specific risk via vertical integration to levels conflicting with shareholder value maximization, because managers, unlike shareholders, have undiversified exposure to the firm.[20] Agency theory suggests that the risk reduction (via a vertical acquisition, for example) optimal for an undiversified, risk-averse CEO may be at the expense of shareholder value. Under this hypothesis, we expect our measures of managerial inside debt incentives (derived from the debt/equity mix in compensation contracts) to be negatively associated with cumulative acquisition announcement returns for acquirer shareholders.

We use the merger sample from 2007–2011 (Panel B of Table 1) to test this issue. The dependent variable is the acquirer's 5-day CAR(−2, +2). The independent variable of interest is ln(CEO_FIRM_DE_RATIO).[21] We control for firm size, ROA, Tobin's Q, leverage, acquirer stock return runup, relative size, target ownership status, payment method, deal type, and year and industry fixed effects in all specifications. The results from ordinary least squares (OLS) regressions are presented in Table 5. The sample includes all three types of mergers: vertical, horizontal, and diversifying.

In column 1 of Table 5, we test the effect of CEO inside debt on merger announcement returns regardless of the types of mergers. The coefficient on CEO inside debt is negative but insignificant, implying a weak relationship between CEO relative leverage and acquirer returns for the entire merger sample. In column 2 of Table 5, we modify the regression model to allow for the relation between acquirer announcement CARs and CEO inside debt to vary with the different types of mergers included in our study. We find that the coefficient on the interaction term between inside debt and the vertical merger indicator is negative and statistically significant (at the 5% level), while the estimate of the coefficient on the interaction term for horizontal and diversifying mergers is insignificant. This indicates that CEOs with higher relative leverage make vertical acquisitions that are

[20] Vertical integration could also be related to managers' desire to "enjoy the quiet life" (Bertrand and Mullainathan (2003)). The ultimate motive of pursuing vertical integration could be to reduce firm risk and gain greater control over the supply chain through vertical integration, which may enable managers to enjoy a quiet(er) life.

[21] While we only report results using ln(CEO_FIRM_DE_RATIO) as the independent variable of interest in Tables 5–8, our results are robust to using the CEO relative incentive ratio (ln(CEO_REL_INCENTIVE)) as an independent variable.

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TABLE 5

The Effect of CEO Inside Debt on Acquisition Announcement Returns

Table 5 reports the results of OLS regressions of the effect of CEO inside debt on acquisition acquirer announcement returns. VERTICAL, HORIZONTAL, and DIVERSIFYING are indicator variables for the different types of mergers. The dependent variable is acquirer's 5-day CAR(−2,+2). All variables are defined in the Appendix. Heteroskedasticity-consistent standard errors clustered at the acquirer level are reported in square brackets. All regressions contain both year and industry fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent Variable: CAR(−2, +2)		
Variables	1	2	3
ln(CEO_FIRM_DE_RATIO)	−0.237 [0.238]		
ln(CEO_FIRM_DE_RATIO) × VERTICAL		−0.652** [0.266]	−0.608** [0.267]
ln(CEO_FIRM_DE_RATIO) × HORIZONTAL		−0.442 [0.424]	−0.269 [0.433]
ln(CEO_FIRM_DE_RATIO) × DIVERSIFYING		0.315 [0.452]	0.541 [0.460]
ln(VEGA)	0.032 [0.126]		
ln(VEGA) × VERTICAL			0.268* [0.151]
ln(VEGA) × HORIZONTAL			0.079 [0.214]
ln(VEGA) × DIVERSIFYING			−0.443** [0.215]
ln(DELTA)	0.314** [0.149]		0.302** [0.149]
ln(ASSETS)	−0.478*** [0.148]	−0.282** [0.128]	−0.513*** [0.146]
ROA	3.963 [3.533]	4.345 [3.543]	4.324 [3.492]
Q	−0.380 [0.314]	−0.189 [0.302]	−0.423 [0.306]
LEVERAGE	1.371 [1.412]	1.183 [1.402]	1.613 [1.402]
STOCK_RUNUP	−1.891** [0.770]	−1.811** [0.777]	−1.882** [0.771]
RELATIVE_SIZE	0.308 [1.547]	0.297 [1.532]	0.314 [1.546]
PRIVATE_TARGET_DUMMY	−0.252 [0.374]	−0.241 [0.372]	−0.256 [0.376]
PUBLIC_TARGET_DUMMY	−3.204*** [0.586]	−3.201*** [0.589]	−3.122*** [0.587]
ALL_CASH_DEAL	0.777** [0.363]	0.760** [0.363]	0.683* [0.365]
FRIENDLY_DEAL	0.226 [1.922]	0.201 [1.948]	0.557 [1.895]
TENDER_OFFER	1.792** [0.847]	1.747** [0.853]	1.873** [0.854]
VERTICAL	−0.181 [0.456]	0.007 [0.589]	−0.674 [1.068]
DIVERSIFYING	−0.703 [0.514]	−1.086 [0.675]	0.969 [1.391]
CONSTANT	11.915*** [2.405]	12.549*** [2.405]	12.800*** [2.409]
Year fixed effects Industry fixed effects	Yes Yes	Yes Yes	Yes Yes
No. of obs. Adj. R^2	1,400 0.0554	1,400 0.0554	1,400 0.0636
Coefficient difference test *p*-value		V = H 0.7011	V = H 0.5356
Coefficient difference test *p*-value		V = D 0.0299**	V = D 0.0100***

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significantly worse for their shareholders, consistent with the univariate evidence in Panel E of Table 1.[22]

In column 3 of Table 5, we include controls for CEO equity incentives (vega and delta) and also include the interaction terms between vega and merger-type indicators.[23] After controlling for these additional interactions, we continue to find a significantly negative coefficient on the interaction between CEO inside debt and the vertical merger indicator. The effect of relative leverage on acquisition announcement returns is also economically significant. Ceteris paribus, as our CEO_FIRM_DE_RATIO increases by 1 standard deviation from the unconditional mean, the acquirer's 5-day CAR decreases by 93 bps ($0.608 \times \ln(1+9.97/2.769)$) for vertical mergers: This is a large effect relative to the in-sample average CAR of around 40 bps.

The effects of the control variables on acquisition announcement returns are largely consistent with existing literature. For example, we find that acquirer pre-announcement stock price runup has a significantly negative effect on acquirer announcement returns. We also find that acquisitions of public targets are associated with lower acquirer returns, while acquisitions financed purely with cash are associated with higher acquirer returns.

Moreover, we test whether the coefficients on the three interaction terms (ln(CEO_FIRM_DE_RATIO) and merger type) in Table 5 are statistically different. We find that the coefficients on the vertical interaction term are statistically different from those for the diversifying interaction term, but not statistically different from those for the horizontal interaction term.

Phan (2014) also investigates the relation between inside debt and the wealth effects associated with M&A announcements and finds that CEO relative leverage has a negative effect (marginally significant) on acquisition announcement returns for all types of deals. We argue that our results are more persuasive than his because we show that this negative effect is concentrated in vertical merger deals.[24] The results show that CEO relative leverage has, in fact, no effect on acquirer CARs in non-vertical M&As, but a very strong effect on acquirer returns in vertical M&A announcements.

D. Factors Strengthening the Effect of CEO Inside Debt on Vertical Acquisition Announcement Returns

The results in Table 5 show that shareholders should be concerned about vertical integration conducted by CEOs with higher relative leverage, because these acquisitions create less (or destroy more) shareholder value. In this section,

[22] We test the robustness of our results using CEO_DE_RATIO (the ratio of CEO inside debt holdings to equity holdings) instead of CEO_FIRM_DE_RATIO and find that the coefficient on CEO inside debt for vertical mergers is still negative and statistically significant.

[23] The use of vega and delta as controls is important. For example, vega and inside debt may be correlated because a firm that wished the CEO to implement some risky policy is likely to offset the risk-reducing incentive of inside debt with convexity (vega) in compensation. In robustness tests, we also add the interaction terms between delta and the merger-type indicators. The results are quantitatively similar to those presented in column 3 of Table 5.

[24] According to our estimates based on a sample of deals from a similar time period, approximately 14%–15% of the acquisitions that would be classified as diversifying in Phan (2014) are actually vertical deals.

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we explore factors that influence the relation between CEO inside debt incentives and vertical acquisition announcement returns. First, holding CEO inside debt constant, firm informational opacity might lower the marginal cost to the CEOs of engaging in moral hazard activities for their personal benefit. Therefore, we expect that the agency problem of CEO inside debt should be particularly strong for firms with higher informational opacity. We use a measure of earnings management from the accounting literature (e.g., Dechow, Ge, and Schrand (2010)) to proxy for information opacity.

Firms that engage in greater earnings management tend to have lower quality of reported earnings, and investors will find these firms' financial performance less informative (i.e., more opaque). The use of accruals to temporarily manipulate (boost or reduce) reported earnings is one important mechanism for earnings management.[25] We use a modified version of the Jones (1991) model (Dechow, Sloan, and Sweeney (1995)) to estimate abnormal accruals as our accruals-based earnings management measure. The Appendix provides a detailed description of how we construct this measure.

Table 6 reports our results. In Panel A, we split the sample based on whether the acquirer's absolute value of modified-Jones-model discretionary accruals is above or below the sample median.[26] We find that CEO relative leverage has a significantly negative effect on acquirer abnormal returns only for vertical M&A transactions in the high earnings management subsample. Consistent with our conjecture, the effect of CEO inside debt on vertical acquisition abnormal returns is more prominent for firms with higher degrees of informational opacity.

Next, we check whether the relation between CEO inside debt incentives and vertical acquisition abnormal returns is affected by proxies for corporate governance. The idea is that the negative effect of CEO relative leverage on acquisition abnormal returns should be more pronounced for firms with weaker corporate governance, since these firms face higher agency cost of equity (allowing managers more freedom to pursue their own interests). We use institutional ownership and product market competition to proxy for a firm's corporate governance. Their definitions are included in the Appendix.

We first reestimate our acquirer return regression using subsamples formed based on whether the acquirer's institutional ownership is above or below the sample median. The results are presented in Panel B of Table 6. We find that the coefficient on the interaction term between CEO inside debt incentives and vertical mergers enters negatively and significantly only in the low institutional ownership subsample. On the other hand, the coefficient on the interaction between CEO inside debt and vertical mergers is not statistically significant in the high institutional ownership subsample.

We also consider product market competition as a governance factor and partition our sample based on whether the acquirer industry's HHI is above or below the sample median (Panel C of Table 6). Hart (1983) argues that product

[25]The majority of the extant literature argues that accrual "manipulation" is likely harmful to (or misleading for) investors. For a different perspective, however, see Linck, Netter, and Shu (2013). Those authors argue that the use of discretionary accruals increases investment efficiency for firms that have valuable projects but face binding financial constraints.

[26]Our results are robust to, instead, using the Jones (1991) model to estimate discretionary accruals.

TABLE 6

The Effect of CEO Inside Debt on Acquisition Announcement Returns: Firm Opacity and Corporate Governance

Table 6 reports OLS regression results of the effect of CEO inside debt on acquisition acquirer announcement returns. VERTICAL, HORIZONTAL and DIVERSIFYING are indicator variables for the different types of mergers. In Panel A, the subsamples are formed based on whether the acquirer's absolute value of discretionary accrual measure is above or below the sample median. The discretionary accruals are estimated by a cross-sectional version of the modified Jones model (Dechow et al. (1995)). In Panel B, the subsamples are formed based on whether the acquirer's institutional ownership is above or below the sample median. In Panel C, the subsamples are formed based on whether the acquirer's Herfindahl–Hirschman index (HHI) is above or below the sample median. In Panel D, the subsamples are formed based on whether the acquirer's excess cash is above or below the sample median. Excess cash is the residual from a regression of the acquirer's cash holdings at the fiscal year end immediately prior to the acquisition announcement on firm size (natural log of total assets), leverage, market-to-book, ROA, net working capital/assets, cash flow volatility, R&D/sales, capital expenditures/assets, acquisitions/assets, and industry and year fixed effects. The dependent variable is the acquirer's 5-day CAR(−2,+2). All variables are defined in the Appendix. Heteroskedasticity-consistent standard errors clustered at the acquirer level are reported in square brackets. All regressions contain both year and industry fixed effects. The coefficient on the constant is suppressed for brevity. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent Variable: CAR(−2, +2)							
	Panel A. DA_MODIFIED_JONES		*Panel B. INSTITUTIONAL_OWNERSHIP*		*Panel C. HHI*		*Panel D. EXCESS_CASH*	
	High	Low	High	Low	High	Low	High	Low
Variables	1	2	3	4	5	6	7	8
ln(CEO_FIRM_DE_RATIO) × VERTICAL	−0.877*** [0.335]	0.515 [0.468]	−0.240 [0.408]	−1.247*** [0.458]	−0.978** [0.424]	−0.245 [0.323]	−1.177*** [0.400]	−0.010 [0.437]
ln(CEO_FIRM_DE_RATIO) × HORIZONTAL	−0.597 [0.506]	0.095 [0.626]	−0.117 [0.589]	−0.357 [0.547]	−1.409** [0.610]	0.696 [0.491]	−0.222 [0.758]	−0.687 [0.562]
ln(CEO_FIRM_DE_RATIO) × DIVERSIFYING	1.274 [0.920]	−0.107 [0.457]	1.478* [0.875]	0.132 [0.447]	−0.194 [0.427]	1.194 [0.968]	0.794 [0.555]	0.814 [1.092]
ln(VEGA) × VERTICAL	0.006 [0.240]	0.200 [0.231]	0.443* [0.233]	0.376* [0.227]	0.504*** [0.192]	−0.198 [0.242]	0.230 [0.321]	−0.024 [0.229]
ln(VEGA) × HORIZONTAL	−0.091 [0.322]	0.239 [0.299]	−0.090 [0.301]	0.440 [0.347]	0.345 [0.361]	−0.258 [0.284]	0.077 [0.336]	0.253 [0.380]
ln(VEGA) × DIVERSIFYING	−1.169*** [0.433]	0.124 [0.290]	0.044 [0.247]	−0.643** [0.315]	−0.244 [0.256]	−0.745** [0.360]	−0.815 [0.497]	0.033 [0.266]
ln(DELTA)	0.688** [0.267]	0.051 [0.240]	0.213 [0.240]	0.272 [0.217]	0.072 [0.205]	0.736*** [0.230]	0.070 [0.281]	0.242 [0.297]
Acquirer characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Deal characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	585	598	646	680	797	603	524	598
Adj. R^2	0.127	0.0460	0.0812	0.0868	0.0706	0.0897	0.109	0.0578
Test "High" = "Low" (p-value)	0.0094***		0.0721*		0.1546		0.0386**	

market competition plays a disciplinary role on managerial behavior, and Shleifer and Vishny (1997) suggest that product market competition is one of the most powerful mechanisms to reduce managerial inefficiency or agency costs. As expected from this literature, we find that the coefficient on CEO inside debt in the acquirer CAR regression is significant and negative only in the subsample of vertical acquisitions, where the acquirer is in a more concentrated industry: Industry competition appears to drive out this particular form of agency cost.

Prior studies suggest that self-interested managers with substantial free cash flow can waste the firm's cash on inefficient activities, particularly acquisitions (Jensen (1986)). It is, therefore, interesting to examine whether acquirer excess cash aggravates the agency conflicts between managers and shareholders that we have identified here. Following Harford, Mansi, and Maxwell (2008), we construct an excess cash measure by regressing the acquirer's cash holdings at the

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fiscal year end immediately prior to the acquisition announcement on firm size (natural log of total assets), leverage, market-to-book, ROA, net working capital/assets, cash flow volatility, R&D/sales, capital expenditures/assets, acquisitions/assets, and industry and year fixed effects. The residual from the above cash holdings model is called excess cash. We then split the sample based on whether the acquirer's excess cash is above or below the sample median and report the results in the last two columns of Table 6 (Panel D). Consistent with the agency cost of free cash flow hypothesis, we find that CEO relative leverage has a significantly negative effect on vertical acquisition abnormal returns only in the cash-rich acquirer group. Furthermore, the coefficients on the interactions between horizontal or diversifying mergers and CEO inside debt are not significant in either excess cash subsample.

In the bottom of Table 6, we also test the equality of the coefficients on the interaction terms (ln(CEO_FIRM_DE_RATIO) × VERTICAL) between the two subsamples, relying on a Wald test. In three out of four cases, the null hypotheses of equality between "high" and "low" subsamples are rejected at the 90% confidence level.

Overall, our results show that acquirer shareholders earn lower announcement abnormal returns from vertical acquisitions made by CEOs with incentives from inside debt that likely make them more risk averse. In particular, the effect of CEO inside debt incentives on vertical acquisition returns for acquirer shareholders is more pronounced when the acquirer has higher levels of informational opacity, weaker corporate governance, and excess cash holdings. These results are consistent with the agency cost hypothesis: Under-diversified CEOs with greater inside leverage than the firm's external leverage have incentives to take actions (vertical acquisitions in this case) that reduce risk below the level considered optimal by outside shareholders, and those acquisitions appear to destroy shareholder wealth. The lack of effective corporate governance and adequate informational transparency (and the availability of ample cash) appears to exacerbate this effect. In Section III.G, we examine one particular channel through which risk-averse CEOs may be destroying wealth for their shareholders.

E. Change Regressions, Instrumental Variables, and Heckman Regressions

One concern about our results is the issue of endogeneity. It is possible that some unobservable firm characteristic could be responsible for both the CEO compensation contracts (including inside debt) and the returns from acquisitions. While it is plausible, this issue is less likely to be a problem in our context because our dependent variable is based on a short-term market-price-based measure (i.e., acquirer's 5-day abnormal returns). In this section, we attempt to address any residual concerns about endogeneity using three empirical approaches.

First, we estimate change regressions, examining the effect of changes in CEOs' relative leverage on changes in acquirer returns. Using this method, we can account for certain stationary unobservable or omitted firm characteristics that might affect both the compensation structure and acquirer returns, because such time-invariant factors will be eliminated in a change regression. In order to construct the sample for change regressions, we require that each

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acquirer–CEO pair has at least two acquisitions of the same type (vertical, horizontal, or diversifying) during our sample period. The change in the acquirer's 5-day CAR is measured as the difference in CARs for consecutive acquisitions of the same type by the same acquirer. To begin, differences of all other variables, including the CEO relative leverage measures and control variables, are measured over the same time interval as the change in abnormal announcement returns.

The results of the change regressions are presented in Panel A of Table 7. The dependent variable is the acquirer-specific change in the 5-day merger announcement CAR, and the key independent variable is the CEO-specific change in relative leverage. Following Graham, Li, and Qiu (2008), we use median regressions to estimate the effect of the change in CEO relative leverage on the change in acquirer abnormal returns.[27] The results are consistent with previous findings. Specifically, announcement returns are lower for an acquirer's *next* vertical acquisition if the CEO's relative leverage has increased since the prior vertical acquisition. In untabulated analyses, we do not find any significant results in similar change regressions for horizontal or diversifying acquisitions.

Second, we employ an instrumental variables approach to address the concern about endogeneity. We select four instrumental variables for the CEO's relative inside debt ratio. The first instrument we use is the industry-year mean CEO relative inside debt ratio (IND_YR_AVG_ln(CEO_REL_INCENTIVE)). According to the recent literature (e.g., Lin et al. (2011)), a firm's CEO compensation structure might be related to the compensation contracts offered by industry peers, because firms in the industry compete for a small pool of managerial talent in the labor market. In addition, industry-level compensation structure would not directly affect firm-level acquisition returns; therefore, the industry-year mean CEO relative leverage satisfies the conditions for a valid instrument.

We also use three tax-related variables as instruments (Anantharaman et al. (2013)). Pensions and deferred compensation are important tax planning tools for corporate executives. Through them, CEOs can defer their income to a later period when their marginal tax rate might be lower. Therefore, CEOs subject to higher marginal tax rates on income have greater incentives to defer current income to later periods through the use of deferred compensation schemes and/or pensions. We expect CEO relative inside debt ratios to be positively associated with individual tax rates, but these tax rates are unlikely to be correlated with firm-level acquisition returns (again satisfying the conditions for valid instruments).

Based on the above argument, we choose three individual tax rates as instrumental variables: the maximum tax rate for wage income (TAX_RATE_WAGES), the maximum tax rate for long-term capital gains (TAX_RATE_LTGAINS), and the maximum tax rate on mortgage deductions (TAX_RATE_MORTGAGE) in the state where a firm is headquartered.[28] We use maximum tax rates because most of our sample firms are relatively large and, thus, their CEOs are more likely to

[27] Median regressions are more robust to the effect of outliers, which is important given our sample size.

[28] These tax rates are calculated using the TAXSIM model (Feenberg and Coutts (1993)). We obtain these rates from http://www.nber.org/~taxsim/state-rates/. We use the sum of state and federal individual tax rates as our instruments. We assume a CEO is taxed by the state where her firm is headquartered.

TABLE 7

The Effect of CEO Inside Debt on Acquisition Announcement Returns: Endogeneity Concerns

Table 7 uses three empirical approaches to address endogeneity concerns. Panel A presents the results of a median regression of changes in CEO inside debt between successive acquisitions by the same firm–CEO pair on changes in acquisition acquirer announcement returns between successive acquisitions by the same firm–CEO pair. The dependent variable is the acquirer's 5-day ΔCAR(−2,+2). Panel B presents the coefficients from the second stage of a 2-stage least squares (2SLS) regression of instruments for CEO inside debt on acquisition acquirer announcement returns. The inside debt measures are instrumented with fitted values from a first-stage regression of the CEO inside debt measures on the corresponding industry-year (based on 3-digit SIC codes) average inside debt measure, the maximum tax rate for wage income, the maximum tax rate for long-term capital gains, the maximum mortgage subsidy rate in the state where a firm is headquartered, and control variables. The dependent variable in the second-stage regression presented in the table is the acquirer's 5-day CAR(−2,+2). In Panel C, we use a 2-stage Heckman (1979) model to address selection bias. The dependent variable in the second-stage regression presented in the table is the acquirer's 5-day CAR(−2,+2). All variables are defined in the Appendix. Heteroskedasticity-consistent standard errors are reported in square brackets. The coefficient on the constant is suppressed for brevity. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Change Regressions

	Dependent Variable: ΔCAR(−2,+2)	
Vertical Mergers	1	2
ΔIn(CEO_FIRM_DE_RATIO)	−1.698**	
	[0.843]	
ΔIn(CEO_REL_INCENTIVE)		−2.133**
		[0.922]
ΔIn(VEGA)	−0.018	0.042
	[0.498]	[0.561]
ΔIn(DELTA)	−0.542	−0.383
	[0.666]	[0.840]
ΔIn(ASSETS)	0.103	0.787
	[2.815]	[3.276]
ΔROA	12.927	11.032
	[20.278]	[25.032]
ΔQ	−0.081	−0.413
	[1.243]	[1.552]
ΔLEVERAGE	9.866	0.369
	[13.372]	[17.076]
ΔSTOCK_RUNUP	−4.447***	−4.588***
	[1.516]	[1.574]
ΔRELATIVE_SIZE	−1.627	−0.926
	[4.403]	[5.665]
No. of obs.	267	249
Adj. R^2	0.0448	0.0408

Panel B. Instrumental Variable Regressions

	Dependent Variable: CAR(−2,+2)					
Variables	Vertical	Horizontal	Diversifying	Vertical	Horizontal	Diversifying
PREDICTED_ ln(CEO_FIRM_DE_RATIO)	−0.908*	−0.488	2.004			
	[0.526]	[1.320]	[1.229]			
PREDICTED_ ln(CEO_REL_INCENTIVE)				−1.255**	−0.534	2.416*
				[0.605]	[1.453]	[1.315]
ln(VEGA)	0.208	0.453*	−0.568**	0.275	0.385	−0.608**
	[0.188]	[0.233]	[0.242]	[0.195]	[0.257]	[0.282]
ln(DELTA)	0.372	0.176	0.586	0.319	0.209	0.632
	[0.238]	[0.309]	[0.394]	[0.240]	[0.310]	[0.389]
ln(ASSETS)	−0.323	−0.794**	−0.944***	−0.379*	−0.782**	−0.901***
	[0.209]	[0.388]	[0.348]	[0.211]	[0.390]	[0.344]
ROA	1.471	12.513*	2.778	−0.356	11.061	2.289
	[5.272]	[7.398]	[7.384]	[5.170]	[7.436]	[7.420]
Q	−0.102	−1.161**	−0.345	0.047	−1.037*	−0.300
	[0.418]	[0.549]	[0.826]	[0.419]	[0.567]	[0.868]
LEVERAGE	0.842	1.788	4.244	−0.485	1.831	4.328
	[2.420]	[2.917]	[3.386]	[2.428]	[2.995]	[3.309]

(continued on next page)

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TABLE 7 (continued)

The Effect of CEO Inside Debt on Acquisition Announcement Returns: Endogeneity Concerns

Panel B. Instrumental Variable Regressions

	Dependent Variable: CAR(−2,+2)					
Variables	Vertical	Horizontal	Diversifying	Vertical	Horizontal	Diversifying
STOCK_RUNUP	−2.706**	−1.217	0.294	−2.732**	−1.534	0.384
	[1.082]	[1.375]	[1.727]	[1.108]	[1.466]	[1.755]
RELATIVE_SIZE	2.282	1.651	−4.149	2.865	1.686	−3.844
	[1.885]	[2.694]	[3.255]	[2.032]	[2.816]	[3.352]
PRIVATE_TARGET_DUMMY	−0.646	−0.019	0.378	−0.705	−0.020	0.605
	[0.532]	[0.730]	[0.772]	[0.554]	[0.741]	[0.822]
PUBLIC_TARGET_DUMMY	−4.246***	−2.274*	−1.546*	−4.649***	−2.004	−1.710*
	[0.855]	[1.177]	[0.843]	[0.884]	[1.227]	[0.880]
ALL_CASH_DEAL	1.361**	0.022	−0.499	1.196**	−0.080	−0.608
	[0.534]	[0.605]	[0.755]	[0.540]	[0.608]	[0.776]
FRIENDLY_DEAL	−1.944	2.421		−1.935	2.575	
	[1.496]	[2.694]		[1.534]	[2.795]	
TENDER_OFFER	1.943	1.124	1.676	2.132	1.014	1.906
	[1.318]	[1.837]	[1.438]	[1.362]	[1.867]	[1.465]
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
First-stage Shea's partial R^2	0.211	0.155	0.133	0.224	0.165	0.156
First-stage *F*-stat.	12.50	6.76	6.12	12.19	6.51	6.94
First-stage *F*-test (*p*-value)	0.000	0.000	0.000	0.000	0.000	0.000
Cragg–Donald Wald *F*-stat.	42.42	14.06	11.69	43.37	14.79	13.62
Stock–Yogo critical values (10%)	10.27	10.27	10.27	10.27	10.27	10.27
No. of obs.	690	353	356	657	346	345
Second-stage adj. R^2	0.0922	0.0233	0.0150	0.0930	0.0149	0.00341
Hansen *J*-stat.	0.241	1.733	5.306	0.272	1.799	6.118
Hansen *J*-test (*p*-value)	0.9707	0.6297	0.1507	0.9651	0.6152	0.1060
Wu–Hausman *F*-stat.	0.210	0.144	1.497	0.603	0.139	2.541
Wu–Hausman *F*-test (*p*-value)	0.6467	0.7044	0.2221	0.4379	0.7091	0.1120

Panel C. Heckman Regressions

	Dependent Variable: CAR(−2,+2)	
Variables	1	2
ln(CEO_FIRM_DE_RATIO) × VERTICAL	−0.790***	
	[0.286]	
ln(CEO_FIRM_DE_RATIO) × HORIZONTAL	−0.114	
	[0.398]	
ln(CEO_FIRM_DE_RATIO) × DIVERSIFYING	0.453	
	[0.472]	
ln(CEO_REL_INCENTIVE) × VERTICAL		−0.919***
		[0.325]
ln(CEO_REL_INCENTIVE) × HORIZONTAL		−0.081
		[0.454]
ln(CEO_REL_INCENTIVE) × DIVERSIFYING		0.459
		[0.572]
INVERSE_MILLS_RATIO	3.533*	3.501*
	[1.931]	[1.993]
CEO incentive controls	Yes	Yes
Acquirer characteristics	Yes	Yes
Deal characteristics	Yes	Yes
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
No. of obs.	1,325	1,277
Second-stage adj. R^2	0.0542	0.0537

be subject to the maximum tax rates. We expect CEO relative leverage to be positively correlated with the individual tax rates for wage income and capital gains, since CEOs who face higher marginal tax rates on current income are more willing

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to defer their compensation. On the other hand, we expect CEO relative leverage to be negatively correlated with the maximum mortgage subsidy rate, as mortgage deductions alleviate the CEO's tax burden.

Panel B of Table 7 reports the coefficients from the second stage of the 2-stage least squares (2SLS) regression for the subsample of vertical mergers, horizontal mergers, and diversifying mergers, respectively. In the (untabulated) first-stage regressions, we find that CEO relative leverage is significantly positively associated with industry-year average relative inside leverage and negatively associated with the combined federal and state tax rate on mortgage deductions, consistent with the arguments above. We then include the fitted value from these first-stage regressions in the acquirer announcement return (second-stage) regressions documented in the table. We see that the coefficient on CEO inside debt variable in the second-stage regression is negative and significant only in the subsample of vertical mergers, consistent with the coefficient estimates from the OLS regressions documented in prior tables. Panel B reports the 2SLS results using two inside debt incentive measures.[29] The coefficients on ln(CEO_FIRM_DE_RATIO) and ln(CEO_REL_INCENTIVE) in the vertical merger subsample are statistically significant at the 10% and 5% levels, respectively. We also tabulate Shea's (1997) partial R^2 and F-statistics for the first-stage regression.[30] In the vertical merger subsample, the F-statistics (F-test of the joint significance of the excluded instruments) is 12.50 and its p-value is 0.000. All these tests suggest that our instruments satisfy the relevance condition.

Moreover, since we have four instruments and only one endogenous regressor, we run Hansen's over-identification test and report the results in Panel B of Table 7 for each subsample. For example, in column 1 (the vertical merger subsample), the p-value of the Hansen J-test is 0.97, which means that we cannot reject the null hypothesis that the IVs are exogenous. In general, Hansen's over-identification J-statistics suggest that our instruments are valid. Finally, we also conduct a Wu–Hausman test to compare the OLS and 2SLS-IV estimates and determine whether the OLS and IV coefficients are significantly different. We report the Hausman statistics and p-value in the bottom of Panel B. Basically, the large p-values indicate that there is no endogeneity bias in the OLS estimates (i.e., OLS should be consistent). From the Hausman test, it appears that endogeneity is not a particularly big issue in our acquirer CAR regressions.

In addition, we consider another control in the instrumental variables approach, following Anantharaman et al. (2013). Specifically, we control for the percentage of wealthy individuals in the state, using IRS tax data. Firms located in states with a high proportion of wealthy people are likely to face a

[29] In Panel B of Table 7, the right-hand-side variables of interest are the predicted values of ln(inside debt ratio) from the first-stage regression.

[30] We also report the Cragg–Donald Wald F-statistic and Stock–Yogo critical values to test the weak instrument problem. The Cragg–Donald Wald F-statistic is distributed as χ^2 with $(L1 - K1 + 1)$ degrees of freedom (L1 is the number of excluded instruments, and K1 is the number of endogenous regressors). The Stock–Yogo critical values depend on the maximum IV relative bias. For our case, we have one endogenous variable and four instruments, so the critical value is 10.27 if we set the maximum acceptable bias to 10% (i.e., we tolerate a bias of 10% relative to OLS). Based on the Stock–Yogo critical values, our instruments are not considered weak because the Cragg–Donald F-statistic is larger than the critical value (10% maximum IV relative bias) across all the specifications.

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relatively lower cost of equity, since they have a large local pool of potential equity investors. The lower cost of equity is associated with lower firm leverage, which could lead to a higher relative leverage ratio. Meanwhile, if these states (with more wealthy people) also have higher personal tax rates, we may find a positive relation between personal tax rates and CEO relative leverage, which is unrelated to the CEO's inside debt incentive to defer current compensation. To address this concern, we add the percentage of wealthy individuals in the first-stage regression, which is measured using the number of individual returns with adjusted gross income of $200,000 or more divided by the total number of individual returns (state-year level). The instrumental variable results (untabulated) are similar after controlling for the local proportion of wealthy people.

Third, we employ a 2-stage Heckman (1979) model to address concerns about selection bias, because only firms that decide to pursue a merger are included in our tests of acquisition returns. Therefore, in the first stage, we run a probit model where the dependent variable is equal to 1 if the firm engaged in a merger in a given year, and 0 otherwise. We use the control variables in Table 4 to examine firms' merger decisions in the probit model and then calculate an inverse Mill's ratio based on the fitted value from the probit model. After including the inverse Mill's ratio in the acquirer return regression (Panel C of Table 7), we find that the coefficient on the interaction term between CEO inside debt incentives and vertical mergers remains unchanged.

F. Robustness Tests

To check the robustness of our results, we first perform additional tests based on an alternative definition of a vertical merger. Specifically, we categorize an acquisition as "vertical" if the vertical relatedness coefficient is greater than 5% (instead of 1% used in most of this paper). This is a tighter definition of vertical relatedness, which implies a closer vertical relationship between the acquirer and target firms. Naturally, imposing a tighter definition of the key construct in the paper reduces the sample size (by more than 50%). Under the 5% cutoff, we only have approximately 330 vertical merger observations during our sample period for use in the regressions (depending on data constraints imposed by other variables), compared to almost 700 with the 1% cutoff.

We reestimate the acquirer CAR regressions based on this tighter cutoff, and we continue to find that CEO relative inside leverage is negatively correlated with the acquirer's announcement returns in vertical acquisitions.

After confirming that our results are robust to an alternative definition of vertical mergers, we include a series of acquirer governance and CEO characteristic controls in our model as further robustness checks. First, we consider proxy variables for managerial incentives. Equity ownership and well-designed compensation contracts could help alleviate the conflicts of interest between CEOs and shareholders. Lewellen, Claudia, and Rosenfeld (1985) find that acquirer management's stock ownership is positively related to acquirer abnormal announcement returns. Therefore, we control for CEO equity ownership to capture this potential incentive alignment effect.

Masulis et al. (2007) find evidence that acquirers with more antitakeover provisions experience significantly lower acquisition announcement returns. We,

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therefore, add the G-index (Gompers, Ishii, and Metrick (2003)) to the regressions as an additional corporate governance control. In addition, institutional investors also play a significant governance role. Shleifer and Vishny (1997) indicate that institutional investors have stronger incentive to collect information and monitor the management. Thus, higher institutional ownership could reduce agency problems and make external governance more effective. We use the acquirer's stock ownership by institutional investors to account for this governance effect.

Finally, we include CEO age and tenure in the acquirer return regressions, since these CEO characteristics might be associated with both acquisition returns and CEO relative inside leverage. Including all these new variables in our regressions does not qualitatively affect the relation between CEO relative leverage and acquirer announcement returns in vertical mergers.

G. CEO Inside Debt and Acquisition Premiums

To further understand why CEOs with incentives from inside debt that likely make them more inclined to reduce risk create less (or destroy more) shareholder wealth in vertical acquisitions, we now explore the effect of CEO inside debt incentives on acquisition premiums paid to target shareholders. The dependent variable is PREMIUM_1WEEK (measured by the SDC). By definition, this acquisition premium measure is only available when the target firm is publicly traded, resulting in a significant drop in our sample size (to around 240 observations). The explanatory variables are the same as in Table 5, except we obviously exclude the target public status indicator variable. Since the targets are all public companies, we are able to collect some firm-level information for these firms. Therefore, we also include target characteristics in the regression, such as ROA, Tobin's Q, leverage, and stock price runup.

Table 8 presents the regression results. We find that the estimated coefficients on the interaction term (ln(CEO_FIRM_DE_RATIO) × VERTICAL) are positive and statistically significant, implying that CEOs who are more risk averse tend to pay higher premiums to acquire their targets in vertical acquisitions relative to other types of deals.[31] More specifically, ceteris paribus, a 1-standard-deviation increase in our CEO relative inside debt measures from their unconditional means is associated with higher vertical acquisition premiums of a magnitude of approximately 16 percentage points. This finding suggests that the tendency of more risk-averse CEOs paying higher premiums to their targets in vertical acquisitions might be one cause of lower value creation for shareholders noted in previous sections.[32]

[31] In robustness tests, we include acquirer-firm financial constraint measures (Kaplan–Zingales index, Whited–Wu index) in our acquisition premium regressions. We find that CEO relative leverage ratios are still positively associated with the acquisition premiums in vertical mergers after including the financial constraint measures.

[32] In the premium regression, we also test whether the coefficients on the three interaction terms in Table 8 are statistically different. We find that the coefficients on the vertical product are statistically different from the coefficients on the horizontal product, but not statistically different from those for the diversifying product.

TABLE 8

The Effect of CEO Inside Debt on Acquisition Premiums

Table 8 reports the results of OLS regressions where the dependent variable is the acquisition premium (1-week) for publicly traded targets. VERTICAL, HORIZONTAL, and DIVERSIFYING are indicator variables for the different types of mergers. All variables are defined in the Appendix. Heteroskedasticity-consistent standard errors clustered at the acquirer level are reported in square brackets. All regressions contain both year and industry fixed effects. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent Variable: PREMIUM_1WEEK		
Variables	1	2	3
ln(CEO_FIRM_DE_RATIO)	5.527*		
	[3.237]		
ln(CEO_FIRM_DE_RATIO) × VERTICAL		11.276**	10.495**
		[4.578]	[4.468]
ln(CEO_FIRM_DE_RATIO) × HORIZONTAL		−3.504	−4.826
		[7.735]	[7.737]
ln(CEO_FIRM_DE_RATIO) × DIVERSIFYING		2.430	0.770
		[4.409]	[4.033]
ln(VEGA)	−1.070		
	[1.684]		
ln(VEGA) × VERTICAL			−3.034
			[2.178]
ln(VEGA) × HORIZONTAL			−2.061
			[3.089]
ln(VEGA) × DIVERSIFYING			3.279
			[2.842]
ln(DELTA)	−2.514		−2.485
	[2.600]		[2.579]
VERTICAL	−5.064	−13.993	−10.739
	[9.964]	[9.507]	[19.765]
DIVERSIFYING	−2.361	−5.760	−30.820
	[9.811]	[9.054]	[20.731]
CONSTANT	48.743	86.166***	49.832
	[29.564]	[27.644]	[33.761]
Acquirer characteristics	Yes	Yes	Yes
Deal characteristics	Yes	Yes	Yes
Target characteristics	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
No. of obs.	241	241	241
Adj. R^2	0.167	0.175	0.179
Coefficient difference test		V = H	V = H
p-value		0.0761*	0.0666*
Coefficient difference test		V = D	V = D
p-value		0.2085	0.1678

IV. Conclusion

In this paper, we provide a new explanation for vertical integration based on managerial risk preferences. A recent study by Garfinkel and Hankins (2011) highlights that risk management plays an important role in vertical mergers and also contributes to the start of merger waves. Motived by this new finding, we expect that the reason why firms decide to vertically integrate may be associated with their CEOs' risk preferences, since CEOs likely consider their *personal* exposure when making decisions that reduce *firm* risk.

Given the prevalent use of inside debt as a form of executive compensation and the substantial magnitude of CEO inside debt holdings, we use CEO relative leverage (defined as the ratio of the CEO's inside leverage to firm leverage) to proxy for the incentives of risk-averse managers. We then examine the

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effect of this proxy on firms' acquisition decisions and outcomes for shareholders. Using a sample of three types of acquisitions from 2007 to 2011, we find that CEOs with higher relative inside leverage are more likely to engage in vertical mergers. However, vertical acquisitions made by CEOs with greater incentives to reduce risk (i.e., those with greater inside debt) generate lower abnormal announcement returns. In particular, the negative effect of CEO inside debt incentives on acquisition outcomes (acquirer CARs) is more pronounced when the acquirer has higher information opacity, weaker corporate governance, and excess cash holdings. These results are consistent with CEO debt-like compensation affecting managers' risk-taking behavior, which, in turn, has a large impact on shareholder wealth. Further analyses show that overpayment may be one channel through which CEOs with higher levels of risk aversion are more likely to consummate value-decreasing vertical acquisitions.

Our study shows that in addition to the potential agency-related benefits (e.g., lower costs of debt financing and fewer restrictive covenants), inside debt has costs.[33] In the paper, we identify some costs associated with reduced firm risk arising from vertical takeovers and manifested in lower CARs. Moreover, our empirical findings have important implications for the design of incentive compensation contracts and the firm's governance structure.

Appendix. Variable Definitions

CEO_INS_DEBT_HOLDINGS: Sum of accumulated pension benefits and deferred compensation.

CEO_EQUITY_HOLDINGS: Sum of the values of stock and stock-option holdings.

CEO_DE_RATIO: The ratio of CEO inside debt holdings to equity holdings.

FIRM_DE_RATIO: The ratio of total debt (dlc + dltt) to the market value of equity (csho × prcc_f).

CEO_FIRM_DE_RATIO: CEO's debt/equity ratio scaled by the firm's debt/equity ratio. We sum the present value of accumulated pension benefits and deferred compensation as reported in ExecuComp. For CEO equity holdings, we take the sum of the values of stock and stock-option holdings. We calculate CEO stock ownership value by multiplying the number of shares held by the stock price at the firm's fiscal year end. We value stock-option portfolios by applying the Black–Scholes (1973) formula (with volatilities calculated using daily stock price data over the prior year) to each individual tranche of options held by the CEO and then summing the tranche values to obtain a grand total. The firm's debt-to-equity ratio is measured as the ratio of the book value of total debt to the market value of equity.

CEO_REL_INCENTIVE: The marginal change in the CEO's inside debt over the marginal change in his inside equity holdings, given a unit change in the firm value, scaled by the ratio of the marginal change in the firm's external debt over the marginal change

[33] We thank the anonymous referee for suggesting how to interpret these results. On one hand, inside debt potentially represents a method of reducing agency conflicts (risk-shifting investment distortions and debt overhang problems) between managers and creditors in a levered firm. On the other hand, inside debt holdings might create the agency problems of outside equity: If a manager's incentive structure has too much inside debt, managers may make financing and investment decisions too conservatively. In this paper, we do not attempt to measure *both* the costs and benefits (i.e., the net agency benefits/costs) of inside debt; instead, we focus on how inside debt affects managerial incentives in M&A decisions.

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in its external equity, given the same unit change in the firm value:

$$\text{CEO_REL_INCENTIVE} = \frac{\Delta\text{CEO_INS_DEBT_HOLDINGS}/\Delta\text{CEO_EQUITY_HOLDINGS}}{\Delta\text{FIRM_DEBT}/\Delta\text{FIRM_EQUITY}}.$$

As in Wei and Yermack ((2011), p. 3826), ΔCEO_EQUITY_HOLDINGS can be estimated using the CEO's total delta from their equity exposure to the firm. Specifically, it can be computed as $S + \sum_i N_i(\Delta N_i)$, where S is the number of shares held in the firm (and we assume the delta on shares held is 1) and $\sum_i N_i(\Delta N_i)$ is the CEO's total option delta (N_i is the number of options in tranche i and ΔN_i is the option delta for tranche i). In order to calculate the firm delta, ΔFIRM_EQUITY in equation (2), we follow a similar approach except that there is not complete data on all of the outstanding option tranches issued by the firm. We use the total number of employee stock options outstanding, the average exercise price of outstanding options, and an assumed remaining life of 4 years for all options as the inputs to the Black–Scholes formula. As in Wei and Yermack ((2011), p. 3827), we use the simplifying assumption that ΔCEO_INS_DEBT_HOLDINGS and ΔFIRM_DEBT are set equal to CEO inside debt holding and firm debt, respectively.

VERTICAL: We classify an acquisition as a vertical merger if the vertical relatedness coefficient between the acquirer and target is larger than 1%.

HORIZONTAL: We classify an acquisition as a horizontal merger if the acquirer and target have the same 2-digit SIC industry and do not have vertical relation.

DIVERSIFYING: We classify an acquisition as a diversifying merger if the deal is neither horizontal nor vertical.

MERGER_INDICATOR: An indicator variable for whether there is an announced vertical, horizontal, or diversifying merger from the SDC data matched to the firm-year from ExecuComp.

MERGER_VALUE_TOTAL_ASSETS: The sum of the deal values of all mergers of a specific type conducted by the firm divided by total assets (from Compustat) as of the end of the last fiscal year.

MERGER_VALUE_DEAL_VALUE: The sum of the deal values of all mergers of a specific type conducted by the firm scaled by the sum of the deal values of all mergers conducted by the firm.

CAR(−2, +2): The 5-day cumulative abnormal returns (CARs) estimated using the market model over the period [−210, −11], where event day 0 is the acquisition announcement date.

ln(ASSETS): The natural log of book value of total assets.

ROA: The ratio of EBITDA to total assets.

Q: Market value of total assets (at-ceq + csho × prcc_f) divided by book value of total assets.

LEVERAGE: The ratio of total debt (dlc + dltt) to total assets.

RD_SALES: The ratio of R&D to sales.

CAPEX: Net capital expenditures scaled by total assets.

COGS_VOLATILITY: The standard deviation of cost of goods sold (COGS) scaled by total assets over the prior 20 fiscal quarters.

OIBD_VOLATILITY: The standard deviation of operating income before depreciation (OIBD) scaled by total assets over the prior 20 fiscal quarters.

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INCREASED_OIBD_VOLATILITY: A dummy variable equal to 1 if the current quarter's OIBD volatility is at least 10% higher than the previous fiscal year's (same quarter) value.

SHOCK_5%_INCREASE: A dummy variable equal to 1 if this year's OIBD/TA or COGS/TA is 5% higher than last year's measure.

SHOCK_5%_DECREASE: A dummy variable equal to 1 if this year's OIBD/TA or COGS/TA is 5% lower than last year's measure.

ECON_SHOCK_INDEX: The first principal component from seven economic shock variables. Following Harford (2005), the economic shock variables are cash flow scaled by sales, asset turnover, R&D scaled by assets, capital expenditures scaled by assets, employee growth, ROA, and sales growth. Each variable is measured as the median absolute change per industry-year.

CASH_FLOW_VOLATILITY: The standard deviation of cash flow from operations scaled by total assets over the prior 20 fiscal quarters.

3_YR_RET: The industry median buy-and-hold return over the past 3 years.

3_YR_RET_VOLATILITY: The standard deviation of the industry median buy-and-hold return over the past 3 years.

STOCK_RUNUP: Acquirer's buy-and-hold return during the $[-210, -11]$ window minus the CRSP value-weighted buy-and-hold return over the same period.

RELATIVE_SIZE: The ratio of SDC deal value to the acquirer's market value of equity measured on the 11th trading day prior to the announcement date.

PRIVATE_TARGET_DUMMY: An indicator variable equal to 1 if the target is a private firm.

PUBLIC_TARGET_DUMMY: An indicator variable equal to 1 if the target is a public firm.

ALL_CASH_DEAL: An indicator variable equal to 1 if the deal is purely financed by cash.

FRIENDLY_DEAL: An indicator variable equal to 1 if the deal is friendly.

TENDER_OFFER: An indicator variable equal to 1 if the deal is a tender offer.

PREMIUM_1WEEK: ((Offer price/Target stock price 1 week before announcement) $-$ 1) $\times$ 100.

CEO_EQUITY_OWNERSHIP: Acquirer CEO's ownership of the firm, including both stock and stock options.

ln(DELTA): The natural log of the change in the dollar value of the CEO's stock and option portfolio for a 1-percentage-point change in stock price.

ln(VEGA): The natural log of the change in the dollar value of the CEO's option portfolio for a 0.01 change in the annualized standard deviation of stock returns.

CEO_AGE: The age of the CEO.

CEO_TENURE: The number of years being CEO.

G_INDEX: Taken from Gompers et al. (2003), based on 24 antitakeover provisions.

INSTITUTIONAL_OWNERSHIP: Fraction of acquirer's common stock held by institutional investors.

HHI: The acquirer's Herfindahl–Hirschman index, computed as the sum of squared market shares.

DA_JONES: Residuals estimated from the annual cross-sectional industry regression model (the Jones model).

DA_MODIFIED_JONES: Residuals estimated from the annual cross-sectional industry regression model (the modified Jones model). To estimate the abnormal accrual models, we begin with all firm-year observations from the Compustat database over the period

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2006–2010. We define total accruals (TA) as the change in current assets minus the change in cash holdings, minus the change in current liabilities excluding the current portion of long-term debt, minus depreciation and amortization expense of the firm, and scaled by lagged total assets. Then we estimate the following model for each year and industry (2-digit SIC code) combination:

$$TA_{it} = \beta_0 + \beta_1(1/A_{it-1}) + \beta_2(\Delta REV_{it} - \Delta REC_{it}) + \beta_3(PPE_{it}) + \varepsilon_{it},$$

where A refers to total assets, ΔREV is change in sales scaled by lagged total assets, ΔREC is change in receivables scaled by lagged total assets, and PPE is gross property, plant, and equipment scaled by lagged total assets. The residuals from the annual cross-sectional regression (equation above) are the modified-Jones-model discretionary accruals. We take the absolute value of discretional accruals as our earnings management measure, because earnings manipulation involves both positive and negative abnormal accruals and managers have incentives to manage earnings in both directions.

EXCESS_CASH: Residual cash holdings, obtained from a regression of a firm's cash holdings on a series of firm-specific characteristics. Following Harford et al. (2008), the dependent variable is ln(cash and short-term investments/sales) and the independent variables are the natural log of total assets, leverage, market-to-book, ROA, net working capital/assets, cash flow volatility, R&D/sales, capital expenditures/assets, acquisitions/assets, and industry and year fixed effects.

TOTAL_RISK: The annualized variance of daily firm stock returns over the year.

IDIOSYNCRATIC_RISK: The annualized variance of the residuals from the market model.

IND_YR_AVG_ln(CEO_REL_INCENTIVE): The industry-year (based on 3-digit SIC codes) average ln(CEO_REL_INCENTIVE).

TAX_RATE_WAGES: The maximum tax rate for wage income in the state where a firm is headquartered.

TAX_RATE_LTGAINS: The maximum tax rate for long-term capital gains in the state where a firm is headquartered.

TAX_RATE_MORTGAGE: The maximum tax rate on mortgage deductions in the state where a firm is headquartered.

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