

# Insider Share-Pledging and Firm Risk<sup>§</sup>

Ronald Anderson<sup>a</sup>

Michael Puleo<sup>a</sup>

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## ABSTRACT

We examine the relation between insider share pledging and firm risk using propensity-score matching and an exogenous shock to the supply of lending capital related to the 2008 financial crisis. Using manually collected pledging data from January 2007 through December 2011 for 500 randomly selected S&P 1500 firms, we document an economically and statistically significant positive relation between insider pledging and equity risk. Ours tests indicate insider pledging corresponds with a 9.5 (9.4) percent increase in firm (firm-specific) risk, and suggest a causal interpretation of the relation between pledging and risk. Overall, our findings indicate that corporate insiders appear to be extracting private benefits through pledging activity at the expense of outsider shareholders.

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<sup>a</sup> Both authors are from the Department of Finance at Temple University.

## **I. Introduction**

Managerial equity ownership constitutes a fundamental governance device in mitigating the conflict between executives and shareholders (Jensen and Meckling, 1976). Morck, Shleifer, and Vishny (1988) and McConnell and Servaes (1990) document that managerial ownership positively influences firm value when managers hold low-levels of equity, but firm performance deteriorates as ownership stakes become meaningfully larger. Core and Larcker (2002) find that excess returns in both accounting and stock performance increase following mandatory increases in executive stock ownership. More recently, Lilenfeld-Toal and Ruenzi (2014) show that CEO-ownership can reverse the negative effect of weak governance and significantly improves stock performance.

Yet, managers may wish to decouple portions of their wealth from the firm's future prospects. While outside shareholders bear only market risk, managers bear market and firm-specific risk. Executives and directors often have large, undiversified portions of personal wealth tied to the firm and therefore have considerable wealth sensitivities to stock prices (Hall and Lieberman, 1998). Insiders' entire wealth, both human and financial capital, depends on the performance of the firm (Holstrom and Costa, 1986). Empirical work by Bettis, Bizjak, and Lemmon (2001) evidences the efforts of managers to decouple their personal wealth from the firm, documenting insiders' use of derivative instruments to materially reduce effective ownership (hedging 25% of ownership, on average). Later work by Jagolinzer, Matsunaga, and Yeung (2007) and Bettis, Bizjak, and Kalpathy (2014) further documents managers' hedging of material ownership stakes, while finding evidence to suggest managerial opportunism in the timing of these hedges.

We consider an alternative and yet unexamined hedging device available to insiders, pledged shares. Pledging shares of equity against personal borrowings allows insiders to access

the value of their shares without foregoing the long-term wealth-creating benefits of equity ownership. This affords insiders with the opportunity to purchase investment assets and/or consumption goods with funds borrowed against their ownership stakes, and thus the potential to materially alter or diversify their exposure to firm risk. Extant research documents important relations between managerial ownership and firm risk (Amihud and Lev, 1981; May, 1995; Coles, Daniel, and Naveen, 2006; Panousi and Papanikolaou, 2012), suggesting a potential link between insider pledging and firm risk. Unlike the derivative instruments scrutinized in earlier literature on managerial hedging however, the role of share pledges in a diversifying or hedging capacity remains largely unexplored.

Share pledges involve executives or directors borrowing capital from lenders and providing personally owned shares of firm equity as collateral for the loan. The executive retains the title and voting rights to the shares and enjoys unrestricted use of the loan proceeds. The dollar amount of the proceeds depends upon a loan-to-value ratio assigned by the lender according to the riskiness and liquidity of the shares. Loan-to-value ratios generally range between 50 and 80 percent of the shares' market value as of the contract date. While the loans are generally non-recourse, the executive becomes subject to a margin call if the value of the shares should fall below the lender's minimum collateral requirement as indicated by the loan-to-value ratio. The lender, generally a bank or brokerage house, gains the right to liquidate the pledged shares if the borrower fails to promptly comply with a margin call or otherwise defaults on the loan.

The relation between pledging on corporate risk-taking remains unclear. On one hand, undiversified risk-averse inside shareholders can use pledging proceeds to purchase diversifying investments thus potentially reducing their exposure to firm-specific risk. Faccio et. al. (2011), for example, show that firms controlled by large, diversified shareholders undertake riskier

investments than do firms controlled by large, undiversified shareholders. On the other hand, a natural tension exists between the hedging or diversifying opportunities possible with pledging shares and the inherent leveraging component produced when collateralizing personally owned assets. Unlike derivative instruments that offer unrestricted protection against downside risk, share pledges only afford hedging against a percentage decrease in the stock price equal to or less than one minus the loan-to-value ratio applied by the lender.<sup>1</sup> Pledging actually *leverages* the borrower's exposure to further price declines beyond this point (see **Figure I**). In addition to the wealth destruction caused by the declining share price, the pledgor now bears the additional cost of complying with a likely margin call from the lender. Considerable wealth destruction can occur if the pledgor lacks sufficient liquid capital as to restore the lender's minimum collateral requirement. The borrower may be forced to sell additional shares at depressed prices, or risk the lender exercising its legal right to liquidate the full collateral at these prices to settle the loan. Further still, unintended signaling effects from the insider selling at depressed prices may exacerbate the wealth destruction.

Several ill-fated examples in the financial press illustrate the perils of insider pledging. Robert Stiller, founder of Green Mountain Coffee Roasters, Inc., held a sizeable pledge position in May 2012 when an unfavorable earnings report triggered a margin call forcing him to sell five million shares of common stock (about 3.2% of shares outstanding) worth an estimated \$125.5 million. The cost of the ordeal was not merely financial for Stiller, as he who was subsequently relieved of his role as Chairman of the board (but retained his role as CEO).

The Green Mountain Coffee Roasters example suggests a possible link between insider pledging and tail risk. The possibility of an ill-timed margin call, such as the one Robert Stiller

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<sup>1</sup> For example, if the loan-to-value ratio is 0.70, then pledging affords hedging up to a 30% decrease in the share price.

received in May 2012, arguably increases tail risk borne by outside investors. The prospect of an insider having to sell additional ownership stakes to cover a lender's margin call in the event of sharp decline in the stock price may exacerbate downside volatility, and thus stands to increase firm risk (or stock volatility). Alternatively, managers' personal portfolio decisions do not change any of the firm's fundamental characteristics, one may thus arguably expect no change in firm risk associated with insider pledging.

We examine the relation between insider pledging and firm risk using a novel dataset for insider pledges. To the best of our knowledge, ours is the first comprehensive empirical analysis of insider pledging in a large sample, robust setting with U.S. firms. We capitalize upon the Securities and Exchange Commission (SEC) disclosure requirements for insider pledges introduced in August 2006, mandating footnote disclosure in the firm's proxy statement of any outstanding pledges by directors or named executive officers.<sup>2</sup> We manually collect pledging data from 2007 through 2011 for a random sample of 500 firms drawn from the S&P 1500 index. Our tests examine firm risk in pledging firms compared with a propensity-score matched, counterfactual sample of non-pledging firms drawn from our initial 500 sample firms.

Pledging arguably yields a causal effect on firm risk, possibly by affecting managerial risk-taking incentives or by increasing tail risk borne by outside investors. It may instead be the case however, that pledging has no effect on risk but rather that insiders base their pledging decisions upon anticipated future risk and return characteristics of the firm (reverse causality/endogeneity). Jagolinzer, Matsunaga, and Yeung (2007) find evidence of such managerial opportunism in derivatives transactions, whereby insiders employ pre-paid variable forwards to exploit privileged information access in hedging future poor performance. To account for endogeneity concerns

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<sup>2</sup> The disclosure requirements also apply to director nominees, for whom we likewise collect pledging data wherever observed.

relating to the pledging decision, we exploit an exogenous shock in the supply of lending capital to examine whether insider pledging influences firm risk. We utilize the 2008 financial crisis as an exogenous shock to the supply of equity collateralized funding available. This allows us to use difference-in-differences models to separate between the effects of pledging on firm risk from insiders' demand for share pledges to exploit privileged information in their hedging decisions, and thus to infer causality in spite of the likely endogeneity concern.

Our analysis indicates a positive and significant relation between insider pledging and firm risk after controlling for an extensive set of firm characteristics and market conditions. We likewise document a positive and significant relation between pledging and the firm-specific component of risk, measured by the standard deviation of daily abnormal returns. The results further indicate that these effects on risk prove both economically and statistically significant. Coefficient estimates indicate the average treatment effect of pledging corresponds with a 9.5 (9.4) percent relative increase in the standard deviation of daily stock (abnormal) returns for firms with insiders engaged in pledging. The positive relation between pledging and risk (both total and firm-specific) proves robust to controlling for investment and financing policies, as well as for lead-year risk and return characteristics. This suggests insider pledging significantly affects firm risk even after accounting for changing managerial incentives and for potential opportunism or informed trading. Further still, we find statistically and economically significant results regarding the relation between insider pledging and the skewness and kurtosis of stock returns, suggesting that added tail risk plays an important role in the relation between pledging and risk.

Consistent with exacerbated downside volatility or tail risk, we document a significant negative effect of insider pledging on return skewness, coupled with a significant positive effect on kurtosis. Skewness measures the asymmetry of the return distribution around its mean, with

negative skewness suggesting a distribution with frequent small gains coupled with occasional extreme losses. Kurtosis measures the likelihood of observing an extreme positive or negative return relative to the firm's distribution of returns, with higher kurtosis indicating a greater chance of extreme returns. Our skewness and kurtosis results thus suggest that the effects of insider pledging on return distributions correspond with large negative returns occurring increasingly more frequently than large positive returns, and with an increased likelihood of observing extreme return values. These effects would again appear consistent with added tail risk, potentially related to margin calls on large insider pledges. Assessing the sampling robustness of our results, we document consistent statistical and economic significance of insider pledging in both our full 500-firm sample and our propensity-score matched sample, verifying our principal findings.

The data suggest pledging remains most prevalent among large, influential insiders. We find that the average pledging insider owns (and pledges) a considerable portion of the firm's equity. Insider blockholders (owning at least five percent of firm) represent a meaningful percentage of individuals engaged in pledging. Moreover, these individuals tend to hold powerful corporate appointments, comprising significantly greater proportions of CEOs, Chairmen, Chairmen-CEOs, and founders than do their non-pledging colleagues. The substantial ownership stakes and firm influence enjoyed by typical pledging insiders illustrates that, as in the case of Green Mountain Coffee Roasters, insider pledging behavior potentially affects firm risk.

Our study makes three important contributions to the finance literature. First, we provide, to the best of our knowledge, the first empirical investigation of insider pledging in a large sample, robust setting with U.S. firms. In doing so, we provide important new insights as to corporate insiders' use of share pledges and the typical individuals engaging in pledging. Second, we document clear evidence on previously ambiguous effects of insider pledging on firm risk, finding

an economically and statistically significant positive relation between pledging and both total and firm-specific equity risk. We further identify increased tail risk as an important channel through which insider pledging affects risk, documenting significant effects of pledging on the skewness and kurtosis of returns. Finally, we infer the impact of insider pledging on outside shareholders. Our analysis suggests that influential insiders extract these private benefits at the expense of outside shareholders through pledging, in that we observe an increase in equity risk coupled with unchanged firm fundamentals.

We argue that our findings may have important implications for corporate governance policy. Insider pledging has garnered increasing attention among market participants since the introduction of mandatory SEC disclosure requirements in 2006. While few firms initially formalized and disclosed corporate policies on insider pledging following these new SEC requirements, the introduction of such policies has gained considerable momentum in recent years. According to a recent study by Sullivan & Cromwell LLP, 107 firms had included an explicit pledging policy within their annual proxy statement by May 2013, up from just eight firms in the prior year. The evidence provided in this paper offers valuable insights to be considered in the determination of strong governance practices. We provide direct evidence as to the apparently detrimental impact of insider pledging on outside shareholders, documenting significantly increase total and firm-specific equity risk in light of unchanged firm fundamentals. Moreover, our tests indicate that an important component of this added risk relates to exacerbated downside volatility or tail risk. While pledging may provide valuable personal wealth benefits to large insiders, it would seem that extracting those benefits comes at the cost of foregone positive skewness, or upside potential. Though undiversified insiders may value considerably the potential for diversification benefits, outside investors who are more likely to hold diversified portfolios would



almost certainly prefer to preserve the potential for large gains. Moreover, as Larcker and Tayan (2010) discuss, many firms do not publicly disclose their corporate policies regarding insider pledging. Based on our analysis, boards of directors can improve governance policy through the transparent disclosure of firms' pledging policies.

The remainder of the paper proceeds as follows. Section II describes our data and propensity-score matching procedure, as well as our variables measurement and descriptive statistics. Section III presents our multivariate analysis and empirical results. Section IV assesses robustness. Section V concludes.

## **II. Data and Descriptive Statistics**

### ***A. Sample***

For our empirical analysis, we begin with the firms in the S&P 1500 index as of January 1, 2007. We exclude public utilities (SIC codes 4812, 4813, and 4911 through 4991), financial firms (SIC codes 6020 through 6799), and foreign firms because government regulation may affect firm equity ownership structure. These exclusions leave 1,061 firms from which we randomly draw 500 firms as our base sample. To avoid survivorship bias, we do not adjust the sample for changes in the S&P 1500 index composition but rather track our initial 500 sample firms regardless of subsequent exit or re-entry to the index. Our full sample consists of 2,452 firm-year observations from 2007 through 2011.

We manually collect pledging data from footnotes to statements of beneficial ownership provided in annual proxy statements (form DEF 14A) filed by our sample firms between January 1, 2007 and December 31, 2011. In August 2006, the SEC amended Item 403(b) of Regulation S-K and Item 403(b) of Regulation S-B to require footnote disclosure of the number of shares pledged as security by named executive officers, directors, and director nominees. Prior to the amended regulation, firms' disclosure of pledging information was strictly voluntary, with few

firms reporting any pledging for officers or directors. We collect pledging data (i.e., the number of shares pledged) for each officer and director from firms' annual proxy statements from 2007 through 2011. To capture the fraction of shares pledged, we use RiskMetrics and Execucomp to determine the total number of shares by held corporate insiders.

#### *A.i. Propensity-Score Matching*

Our study focuses on estimating the treatment effects of insider pledging on firm risk and return characteristics. Because insider pledging data arises from an insider's decision of whether and how many shares to pledge rather than from random assignment, simply regressing firm risk and stock performance on insider pledging introduces an endogeneity concern. Potentially confounding factors may affect both the pledging decision and our dependent variables simultaneously. The statistical bias in estimating the effects of pledging decreases however when comparing otherwise similar firms that differ with respect to insider pledging. Although we control for a variety of firm-specific characteristics, we further control for potential endogeneity by comparing firms as similar as possible. Because we document pledging in only 16.4 percent of firm-year observations, using a matched counterfactual sample should provide a more meaningful evaluation of the effects of pledging with respect to unobserved heterogeneity (endogeneity).

Using a logit model with a pledging indicator as the dependent variable, we match non-pledging to pledging firm-years on firm size, leverage, voting premium, dividend yield, book to market ratio, return on assets, board size, institutional ownership, insider ownership, trading volume, analyst coverage, and board independence. We use one-to-one nearest neighbor matching

and impose common support.<sup>3</sup> The matching process yields a matched sample of 712 firm-year observations consisting of 356 pledging and 356 counterfactual, non-pledging observations. We utilize this propensity-score matched sample for our primary empirical investigation of pledging and firm risk.

### ***B. Primary Variables Measurement***

Our analysis centers around the effects of insider equity pledging on firm risk. We measure firm risk as the standard deviation of daily stock returns during the fiscal year. To compute the standard deviation of daily stock returns, we extract daily share prices from CRSP and calculate the corresponding daily returns. Next, we compute the standard deviation of daily returns during the fiscal year assuming a 252 trading-day year and calculating the standard deviation of daily stock returns over the trailing 251 days preceding the reported fiscal year-end date.<sup>4</sup> See **Table I** for descriptions of these and all other variables used in our analysis.

To construct our annual measure of insider pledging, we aggregate the number of shares pledged by all officers and directors by firm-year and divide by the aggregate number of shares owned by those individuals to determine the aggregate insider pledging ratio by firm-year. This annual aggregate pledging ratio provides our continuous variable measure of insider pledging. We then designate an indicator variable equal to one if the aggregate pledge ratio is greater than zero (i.e., if any of the firm's insiders pledge one or more shares of stock) and zero otherwise. We document pledging in 399 (16.4 percent) of the total 2,452 firm-year observations in our sample.

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<sup>3</sup> We explore alternative matching procedures in unreported robustness testing, including two-to-one matching and matching on a narrower range of explanatory variables. These robustness tests indicate that our results are not sensitive to the matching process and do not depend upon the matching procedure applied in our primary tests. Our results remain largely unchanged by the choice of matching procedure, and our difference-in-differences estimation using alternative matched sample support our primary findings.

<sup>4</sup> CRSP provides year-end standard deviation values for daily stock returns. We rerun our analysis using these data instead of our computed standard deviation and the results remain robust to this check. However, the CRSP values correspond exclusively to calendar year-end, while many firms in the sample report fiscal-year ends at differing times during the year. Thus, we use our computed measure as the primary dependent variable in our analysis of firm risk.

### ***C. Control Variable Measurement***

The goal of our analysis is to isolate the effect of insider pledging on firm risk, holding constant other factors potentially confounding the relation between pledging and risk. Because insiders choose whether and how much of their ownership stakes to pledge, the same underlying influences may simultaneously affect the outcomes of insider pledging and stock volatility. We therefore control for a broad set of likely pledging determinants and factors affecting stock volatility in our empirical tests. Together with propensity-score matching, including these controls helps to further eliminate any potential statistical bias underlying our empirical investigation.

Existing academic research on insider pledging remains scarce and, to the best of our knowledge, limited to studies of Taiwanese firms (for which readily available insider pledging data exists). Summing this work on Taiwanese firms, pledging may relate to corporate governance risk, firm transparency, and the retention of corporate control.<sup>5</sup> We control for transparency using firm size (measured as the natural logarithm of total book assets) and analyst coverage (measured by the number of analysts submitting earnings estimates for the firm in the I/B/E/S database). Board independence proxies for governance quality and is measured as the number of independent directors divided by total board size, using board information from the Risk Metrics Directors database. Because pledging allow insiders to access the value of their shares while retaining voting rights to pledged shares, we construct an index based on the voting-relating components of the G-index (Gompers, Ishii and Metrick, 2003) to measure the relative control benefits of holding common stock.<sup>6</sup> This voting premium index measures the preferential voting rights enjoyed by

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<sup>5</sup> Lee and Yeh, (2004) instrument for corporate governance risk using director pledging, and find insider pledging inversely relates to the number of independent directors on the board; Chiang and He (2010) observe greater insider pledging in more opaque firms; and Chan et. al., (2013) find firms with insiders engaged in pledging prove more likely to repurchase shares following a decline in the share price.

<sup>6</sup>Following from the original G-Index, we include *Bylaws*, *Charter*, *Cumulative voting*, *Secret ballot*, *Supermajority*, and *Unequal voting* in our voting index variable. We additionally include *Dual class* and *Majority vote requirement* provisions in our measure. See Variable Definitions provided in Table I for further details. Definitions for the provisions in our voting index can be found in Gompers, Ishii and Metrick (2003) and/or in the Risk Metrics database.

insiders, and should thus correlate negatively with insider pledging as these provisions may substitute for the control benefits of retaining large equity stakes.<sup>7</sup>

Extant literature on managerial hedging suggests additional relevant controls of insider ownership and firm age (Bettis et al., (2001)). Because managerial hedging (or pledging) incentives increase with ownership and thus wealth exposure to the share price, we control for the aggregate number of shares beneficially owned by all directors and named executive officers as a percentage of common shares outstanding. We also consider ownership dispersion (the ratio of common ordinary shareholders to common shares outstanding) as a general proxy for the effects of ownership structure. Firm age relates inversely to both firm risk and consequently to managerial hedging in that younger firms typically have riskier prospects. We measure firm age using the natural logarithm of the difference between the fiscal year and the year the firm was founded.

Jagolinzer, Matsunaga, and Yeung (2007) find strong evidence to suggest informed trading in the use of pre-paid variable forward contracts by corporate insiders. We control for informed trading incentives related to abnormal stock performance using short sales as a percentage of shares outstanding. To control for abnormal accounting performance, we proxy for unexpected earnings shocks (Anderson, Reeb, and Zhao, 2012) and compute EPS shocks as the differential between actual reported earnings and consensus estimates from one period prior.<sup>9</sup> We also control for profitability using return on assets (net income divided by total assets), following the Jagolinzer, Matsunaga, and Yeung (2007) finding that insider hedging tends to follow strong accounting performance.

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<sup>7</sup> The voting premium also serves as an useful control in the estimation of firm risk, as John, Litov, and Yeung (2008) document a negative relation between managerial entrenchment and corporate risk-taking.

<sup>9</sup>Consensus estimates given by the mean of analyst estimates listed in the I/B/E/S database. The unexpected earnings shock for firm  $j$  in year  $t$  is given by the equation,  $EPS\ Shock_{jt} = EPS_{jt} - E_{t-1}[EPS_{jt}]$ , where  $E_{t-1}[EPS_{jt}]$  reflects the mean of analyst estimates from the I/B/E/S database. Note that EPS shocks also proxy for managers' earnings smoothing incentive, which John, Litov, and Yeung (2008) show relates significantly to firm risk.

Larcker and Tayan (2010) and Bettis, Bizjak, and Kalpathy (2014) suggest that insiders may be more likely to pledge or hedge rather than sell shares outright to avoid realizing taxable gains and/or liquidating at depressed prices. More generally, pledging allows individuals to access the value of their equity investments without foregoing the long-term, wealth-creating benefits of equity ownership. This may be more valuable in firms with better growth opportunities. We control for firm growth opportunities using book-to-market ratio, given by the ratio of total book value of shareholder's equity to the total market capitalization as of the fiscal year-end date.

Firm leverage serves as an important control in estimating risk, and may also influence the pledging decision. Malmendier, Tate, and Yan (2011) document a significant positive relation between corporate financing policies and managers' personal characteristics. We control for financial leverage using the ratio of total liabilities to total assets. In additional tests, we further control for R&D, acquisitions, and capital expenditures intensity (each scaled by total assets) as well as changes in debt ratios to account for potential effects of corporate investment and financing policies.<sup>10</sup>

To control for pledged-share characteristics, we include dividend yield, trading volume, and the risk-free interest rate. Pledge contracts frequently permit the pledgor to retain any cash flow rights including dividends, yet the borrower may opt to pass on dividend payments to the lender in exchange for more favorable financing terms. Lenders often incorporate trading volume when determining an appropriate loan-to-value ratio; suggesting that firms' stock liquidity likely influences insiders' pledging decisions. The market risk-free rate of interest serves as a proxy for the cost of borrowing.

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<sup>10</sup> R&D intensity also proxies for innovation however, and thus may capture the effects of agency problems relating to contracting imperfections typically associated with greater innovation (Holstrom, 1989). Francis and Smith (1995) find that such agency problems decrease with ownership concentration, further motivating our inclusion of ownership dispersion in our tests.

Following John, Litov, and Yeung (2008), we control for the effects of sales growth and large shareholder ownership on firm risk. Sales growth measures the firm's percentage change in total revenues from the prior year. For large shareholder ownership, we designate a Blockholder indicator equal to one if any individual insider holds  $\geq 5$  percent of shares outstanding. We also control for market volatility using the Chicago Board Options Exchange Market Volatility Index (VIX) to capture systematic factors affecting firm risk. Finally, we control for time and industry fixed effects using two-digit SIC code and fiscal year dummies, respectively.<sup>11</sup>

#### ***D. Descriptive Statistics***

Our sample includes 738 share pledges corresponding to 271 unique individuals in 130 different firms (26.0 percent of our 500 sample firms). The mean (median) of these pledges represents 33.3 (35.4) percent of the insider's total equity stake. By comparison, Larcker and Tayan (2010) report that based on their corporate executive survey,<sup>12</sup> 982 directors or executive officers reported a pledge between 2006 and 2009 with an average magnitude of 44 percent of the individual's ownership stake. Bettis, Bizjak, and Kalpathy (2014) investigate insider hedging with derivatives and report average levels of ownership hedged with zero-cost collars, pre-paid variable forwards, and equity swaps of 31, 28, and 33 percent respectively. Jagolinzer, Matsunaga, and Yeung (2007) similarly report average insider hedging using pre-paid variable forwards of approximately 30 percent of firm-related wealth. Based on these findings, it would appear that insider pledging follows a similar pattern to other observed hedging mechanisms.

**Table II** presents descriptive statistics and mean comparisons for the personal characteristics of pledgors compared with non-pledging insiders within the same firm-year. The

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<sup>11</sup> We also consider Fama-French industry classifications and four-digit SIC codes for alternative measure of industry fixed effects and document common findings irrespective of the chosen industry definitions.

<sup>12</sup>Corporate Secretary Magazine and the Rock Center for Corporate Governance at Stanford University, "2010 Executive Hedging and Pledging Survey," (forthcoming).

data suggest that insiders who pledge shares appear to be large, influential shareholders. Relative to their non-pledging colleagues within the firm, pledging insiders tend to hold more powerful corporate appointments, larger ownership stakes, and longer tenure with the firm. Pledging insiders consist of significantly greater proportions of executive-directors (42.0 percent of pledgors), CEO's (23.4 percent of pledgors), Chairmen of the board of directors (22.5 percent of pledgors), and Chairman-CEO's (14.6 percent of pledgors) than non-pledging insiders. The average pledging insider owns 3.3 percent of the firm's equity, compared to an average ownership stake of 0.4 percent among non-pledging insiders. Insider blockholders (owning at least five percent of the firm) represent 22.8 percent of pledging insiders, compared with only 1.7 percent of non-pledging insiders. Pledging insiders average also longer firm tenure (15.04 years) than non-pledging insiders (8.19 years), and include a significantly greater proportion of founders and co-founders (1.5 percent of pledgors compared with 0.1 percent of non-pledgors). The considerable level of firm ownership and influence retained by typical pledging insiders attests to the feasibility of these pledges having a causal effect on firm risk.

**Table III** provides annual summary statistics for our propensity-score matched sample (*Panel A*) as well as for our full sample (*Panel B*) from January 2007 through December 2011. We calculate these statistics by aggregating firm characteristics (winsorized at the 1<sup>st</sup> and 99<sup>th</sup> percentiles) for 356 pledging and 356 non-pledging observations in the matched sample, and 399 pledging and 2,031 non-pledging observations in the full sample. To characterize our matched sample, which we use in our primary empirical analysis, we compare key firm characteristics in the sample with their corresponding average values for all S&P 1500 firms as of our sampling date. Specifically, we run difference of means tests on total assets, trading volume, leverage ratios, book-to-market ratios, dividend yields, and market capitalization for our matched sample versus



the S&P 1500 constituents. Unreported results indicate that our matched sample consists of firms statistically indistinct from the overall index with respect to all of these key characteristics, with the exception of trading volume. Firms in our matched sample display significantly higher trading volume compared with the S&P 1500 overall. We control for trading volume in all of our empirical tests however, making any meaningful sampling bias unlikely. Furthermore, we re-estimate our primary empirical tests on our full sample as a robustness test and find our results unchanged by the choice of sample.

**Table IV** presents difference of means tests for pledging versus non-pledging observations in our propensity-score matched (*Panel A*) and full (*Panel B*) samples. In the matched sample, we observe significantly lower stock returns, kurtosis of returns, EPS shocks, R&D intensity, acquisitions, and sales growth among pledging firms. Pledging firms however exhibit a greater incidence of insider blockholders and a ratio of capital expenditures to total assets. All other measures are comparable between pledging and non-pledging firms, suggesting that our matching process was effective in eliminating much of the variation between these groups. In addition to the differences emerging between pledging and non-pledging firms in the matched sample, we find much more variation between these groups in our full sample.

In the full sample, we observe significantly lower firm risk, both total and firm-specific, in pledging firms. Pledging also appears more frequent in larger firms, more liquid firms (those with higher trading volume), and firms with greater analyst coverage, consistent with a positive relation between insider pledging and firm transparency as suggested by Bizjak, Bettis, and Lemmon (2001). Short sales as a percentage of common shares outstanding remain significantly lower in pledging firms, suggesting less informed trading (though pledging may plausibly substitute for short selling by insiders). We document significantly lower book-to-market ratios associated with

pledging, suggesting that insiders time pledging transactions when the share price is high to maximize the dollar value of pledging proceeds. Jagolinzer, Matsunaga, and Yeung (2007) and Bettis, Bizjak, and Kalpathy (2014) document similar relations between stock price and insider derivatives use. Pledging firms also display significantly greater return on assets, dividend yields, and leverage ratios, suggesting that pledging remains more frequent among insiders of more mature or stable firms. Finally, pledging firms exhibit significantly lower R&D intensity, suggesting a possible link between pledging and innovativeness or operational volatility.

### **III. Multivariate Analysis**

#### ***A. Empirical Design and Exogenous Shock***

Our multivariate analysis implements a natural experiment using difference-in-differences models controlling for covariates in our propensity-score matched sample to estimate the effect of insider pledging on firm risk and stock performance. We match our pledging and counterfactual, non-pledging samples using one-to-one nearest neighbor matching on a host of firm characteristics as described in the data section. Similar to work by Chava and Purnanandam (2011) using the 1998 Russian financial crisis as an exogenous shock to the supply of lending capital, our primary empirical tests employ the 2008 financial crisis as an exogenous shock to the supply of lending capital available to fund insider pledging. This exogenous shock allows us to separate the effects of insider pledging on firm risk from insiders' demand for share pledges to exploit inside information in opportunistic hedging. Together with propensity-score matching, this provides a strong setting to infer causality between firm risk and pledging.

Cornett et. al. (2011) present the intuition underlying the financial crisis as an exogenous shock to the supply of lending capital, and provide robust empirical evidence to corroborate the effect of the crisis on the supply of credit in the market. Regarding share pledge loans, sharply declining asset prices in October 2008 triggered a wave of unexpected margin calls on outstanding

share pledges, forcing pledgors to return large amounts of borrowed capital to lenders. Moreover, because lenders assign loan-to-value ratios inversely related to the riskiness of the pledged shares, the supply of financing available for new pledges tightened as the crisis amplified volatility in the equity market. Consistent with our exogenous shock, Brunnermeier and Pedersen (2009) present a theoretical model demonstrating the link between market volatility and the supply of lending capital, demonstrating conditions under which liquidity spirals like that of the 2008 financial crisis may arise.

### ***B. Insider Pledging and Firm Risk***

We estimate the following difference-in-differences model on our propensity-score matched sample of pledging and counterfactual, non-pledging firm-year observations to investigate the effect of insider pledging on firm risk,

$$Firm\ Risk_{jt} = \alpha + \beta_1 Pledge_{jt} + \beta_2 Post\ Crisis_{jt} + \beta_3 (Pledge_{jt} \times Post\ Crisis_{jt}) + \delta X_{jt} + \theta_j + \phi_t + \varepsilon_{jt} \quad (1)$$

where  $X_{jt}$  represents a vector of time varying firm characteristics;  $Pledge_{jt}$  equals one if firm  $j$  reports at least one insider pledge in fiscal year  $t$ ; and  $Post\ Crisis_t$  equals one if the fiscal year-end date occurs after September 30, 2008.  $\theta_j$  and  $\phi_t$  represent time and industry fixed effects given by fiscal year and two-digit SIC dummies, respectively.<sup>13</sup> Firm risk refers to the standard deviation of daily stock returns during the fiscal year. The interaction term  $Pledge_{jt} \times Post\ Crisis_{jt}$  reflects our variable of interest, where coefficient  $\beta_3$  measures the treatment effect associated with insider pledging. We interpret the coefficient estimate for  $\beta_3$  as the effect of insider pledging on firm risk. We winsorize all regression variables at the 1<sup>st</sup> and 99<sup>th</sup> percentiles to account for potentially influential observations and estimate robust standard errors clustered at the

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<sup>13</sup> For robustness, we also re-estimate our results using Fama French industry classifications in place of SIC codes for our industry fixed effects. Our findings remain unchanged.

firm level to account for any unobserved heterogeneity between firms (Bertrand, Duflo and Mullainathan, 2002).

Our primary tests do not restrict the duration of the follow-up (or post-financial-crisis) period;  $Post\ Crisis_{jt}$  equals one for all firm-year observations occurring after September 2008. We later refine this condition however, to reflect the case in which the effects of the exogenous shock have a limited duration after which the relation between pledging and risk returns to pre-crisis conditions. In these tests, we consider several alternative specifications of our difference-in-differences model, including restricting the crisis period to a) the nine-month period from October 1, 2008 through June 30, 2009, and b) the five-month period from October 1, 2008 through February 28, 2009. In each case we exclude all observations corresponding to fiscal year-end dates after the given crisis period. Despite considerably reducing the number of sample observations, our findings remain highly robust to these alternative model parameters.

**Table V** presents the results of estimating the difference-in-differences model specification in (1) on our propensity-score matched sample of pledging and counterfactual, non-pledging observations. The results indicate a significant positive relation between insider pledging and firm risk across all model specifications. The coefficient estimates for the interaction term (*Insider Pledging*  $\times$  *Post Crisis*) imply an average treatment effect on treated firms (ATT) of 9.5 percent.<sup>14</sup> This suggests that insider pledging corresponds with a 9.5 percent relative increase in the standard deviation of returns for firms with insiders engaged in pledging compared to these firms' initial, pre-crisis average standard deviation of returns. Our empirical evidence thus indicates both a

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<sup>14</sup> We report and interpret the effects of insider pledging using the average treatment effect on treated firms (ATT), which represents the effect of pledging on pledging firms. We also however compute corresponding average treatment effects (ATE). We compute the ATT as the difference-in-differences coefficient estimated by the model, divided by the baseline (pre-crisis) mean of the dependent variable among the pledging firms in our matched sample. We accordingly compute the ATT as the estimated difference-in-differences coefficient divided by the unconditional baseline (pre-crisis) mean for our matched sample.

economically and statistically significant positive relation between insider pledging and firm risk.<sup>15</sup>

We observe a significant negative coefficient estimate for the stand-alone *Insider Pledging* indicator in several model specifications (the effect remains negative but loses significance in other specifications). This suggests that outside investors view pledging firms as less risky than their non-pledging counterpart firms. The magnitude of the positive coefficient estimates for the interaction term (*Insider Pledging*  $\times$  *Post Crisis*) outweighs those of the stand-alone pledging indicator however, implying a positive net effect of insider pledging. Wald tests of the null hypothesis that both the *Insider Pledging* and the *Post Crisis*  $\times$  *Insider Pledging* terms are jointly insignificant ( $\beta_1 = \beta_3 = 0$ ) confirm the significance of this finding ( $F_{2,270} = 3.33$ ;  $p = 0.0385$ ). Intuitively, this suggests that while pledging firms tend to be initially less risky, these firms actually become *more* risky than their non-pledging counterparts are after the effects of insider pledging. Moreover, adjusted  $R^2$  coefficients indicate that our difference-in-differences model explains upwards of 80 percent of the variation in firm risk.

### ***C. Equity Ownership of Pledgors***

Arguably, the relation between insider pledging and firm risk likely depends on which of a firm's insiders engage in pledging. Pledging by large and influential insiders, such as Robert Stiller in the Green Mountain Coffee Roasters Inc. example, should have a more meaningful impact on firm risk than would pledging by a more junior insider with a trivial equity stake. We therefore test the prediction that the effect of pledging on firm risk is increasing in the equity ownership of the insiders engaged in pledging. To do so, we re-estimate equation (1) on subsamples of the

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<sup>15</sup> The actual magnitude of these average treatment effects (ATE and ATT) depend on the model specification. We report and interpret treatment effects of pledging for the model specification best fitting the data according to Akaike's (AIC) and Schwarz's Bayesian information criterion (BIC) statistics.

propensity-score matched sample segmented by the percentage equity ownership of the firm's largest insider engaged in pledging. We determine the subsamples according to four ownership benchmarks, including the median percentage ownership of all insiders engaged in pledging (equal to 0.55 percent ownership)<sup>17</sup> and one, two, and three percent of shares outstanding, respectively. We form two subsamples for each of these benchmarks. The first subsample consists of all counterfactual observations and all pledging observations for which the largest pledging insider holds at least the benchmark level of equity ownership; the second consists of all counterfactual observations and pledging observations for which the largest pledging insider owns less than the benchmark level of equity.<sup>18</sup>

We report summary results in Table VI for regression estimates by subsample for each of the four benchmarks. Specifically, we re-estimate specification (6) in Table V, our fully controlled model of the standard deviation of daily returns including time and industry fixed effects and specifying robust standard errors clustered by firm. Table VII lists the  $\beta_3$  coefficient and t-stat for the difference-in-differences interaction term (Insider Pledging  $\times$  Post Crisis), as well as the corresponding economic and statistical significance, given by the magnitude and p-value of the treatment effect (ATT). Consistent with our expectations, we find that the statistical and economic significance of the relation between insider pledging and firm risk increases (almost non-monotonically) with the equity ownership of the insiders engaged in pledging.

#### ***D. Firm-Specific Risk***

Delineating total risk into individual components of systematic risk and firm-specific risk potentially provide further insights and a strong robustness check of the effect of insider pledging on firm risk.. Insider pledging reflects a firm- rather than market-level factor. If the documented

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<sup>17</sup> This refers to the median of all 738 insider-firm-year observations pledging observations in our data.

<sup>18</sup> We include the full set of counterfactual observations in both subsamples.

positive relation to firm risk indeed measures the effect of insider pledging, we would then expect a similar relation to emerge when considering the firm-specific component of risk. To test this prediction, we define firm-specific risk as the volatility of the residuals of daily abnormal returns. We compute daily abnormal returns using a cross-sectional four-factor model of excess returns over the risk-free rate,<sup>19</sup>

$$r_{js}-r_s^f=\alpha+\beta_1\cdot MRP_i+\beta_2\cdot SMB_i+\beta_3\cdot HML_i+\beta_4\cdot UMD_i+\varepsilon_{ji} \quad (2)$$

We define the abnormal return for firm  $j$  on date  $s$  as the excess residual return from the cross-sectional four-factor model,

$$Abnormal\ Return_{js}=\varepsilon_{js}=(r_{js}-r_s^f)-(\alpha+\beta_1\cdot MRP_i+\beta_2\cdot SMB_i+\beta_3\cdot HML_i+\beta_4\cdot UMD_i) \quad (3)$$

Next, we calculate the annual standard deviation of daily abnormal returns for firm  $j$  during fiscal year  $t$  to determine our firm-specific risk measure. We again assume a 252-trading-day year and compute the annual standard deviation of daily abnormal returns using the trailing 251 daily abnormal return observations leading up to the fiscal year-end date.

$$Firm\ Specific\ Risk_{jt}=\sqrt{\frac{1}{250}\sum_{n=1}^{251}\left(Abnormal\ Return_{jst}-\frac{1}{250}\sum_{n=1}^{250}Abnormal\ Return_{jst}\right)^2} \quad (4)$$

We re-estimate our difference-in-differences model in equation (1) on the propensity-score matched sample, now using firm-specific risk as the dependent variable. **Table VII** presents these results, which indicate a positive effect of pledging on firm-specific risk. The  $\beta_3$  coefficient for the most conservative point estimate indicates that insider pledging corresponds with an increase of 9.4 percent in the standard deviation of daily abnormal returns, mirroring the results on the standard deviation of daily raw returns. This supports our principal findings regarding insider

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<sup>19</sup> Risk-free rate given by one-month UST bill yields.

pledging and firm risk, and suggests a similarly economically and statistically significant effect on the firm-specific component of equity risk.

### ***E. Skewness and Kurtosis of Returns***

The skewness and kurtosis of returns can offer further insight as to the nature of the positive relation between insider pledging and firm risk. If pledging indeed increases tail risk as suggested by the risk of an ill-timed margin call exacerbating downside volatility, we would then expect to see a significant negative relation between pledging and skewness of returns. We would in turn expect a significant positive relation between pledging and the kurtosis of returns. Intuitively, a negative effect on skewness would indicate that pledging corresponds with left-skewed returns, wherein large negative returns are more common than large positive returns. A positive effect on kurtosis would in turn suggest an increased probability of observing extreme returns. Together, these effects would arguably coincide with the risk of an ill-timed margin call threatening exacerbated downside volatility.

We test these predictions using our difference-in-differences model estimated on our original propensity-score matched sample. We reference the existing empirical literature to determine the appropriate regressors in our estimation of skewness. Mitton and Vorkink (2007) document a negative relation between large shareholder diversification and return skewness, motivating our inclusion of large inside shareholder ownership in our skewness model. The authors also report a significant relation between observed skewness and the apparent mean-variance inefficiency of underdiversified investors, prompting our inclusion of both contemporaneous and lagged values of stock returns and stock volatility (or standard deviations of returns). Following Boyer, Mitton, and Vorkink (2010), we also control for firm size, book-to-market ratio, momentum (measured by current and lagged values of cumulative abnormal returns from a three-factor Fama-French model), trading volume, and annualized measures of the four-



factor model regressors (Carhart, 1997). We employ the same specifications in our estimation of the kurtosis of returns, though we include the skewness of returns as an added regressor in our kurtosis model.

The results, presented in **Table VIII**, indicate a significant negative relation between insider pledging and the skewness of stock returns, and a significant positive relation between pledging and the kurtosis of returns. The effects on both skewness and kurtosis would thus appear consistent with added tail risk corresponding from insider pledging. These results therefore corroborate our principal findings regarding the effect of insider pledging on firm risk, and indicate tail risk as an important channel through which pledging may affect risk.

Moreover, the negative relation between insider pledging and return skewness may offer further meaningful insights as to the impact on outsider shareholders. Mitton and Vorkink (2007) document that the portfolio returns of underdiversified investors are substantially more positively skewed than those of diversified investors, and that the apparent mean-variance inefficiency of underdiversified investors can be largely explained by these investors' sacrificing mean-variance efficiency for greater skewness exposure. Consistent with this link between underdiversification and positive skewness, we observe a significantly positive coefficient for the stand-alone insider pledging indicator in our model estimates. This suggests that, before the effects of treatment, firms with insiders engaged in pledging exhibit significantly greater return skewness than do their non-pledging counterparts. The magnitude and sign of the coefficient estimates for the interaction term however, indicate that the negative effect of pledging offsets (and slightly outweighs) the initially greater positive skewness. Given that pledging insiders are free to purchase investment assets with the loan proceeds from pledging, these results arguably suggest that large insiders utilize share pledges to achieve diversification benefits with respect to their personal portfolios. While these

diversification benefits likely provide considerable value to large undiversified insiders however, outside shareholders are more likely to hold already diversified portfolios and would thus prefer to retain the positive skewness exposure. This suggests that influential insiders can utilize share pledges to extract private benefits. Furthermore, given the documented increase in firm risk despite unchanged firm fundamentals, it would appear that influential insiders extracting private benefits from pledging do so at the direct expense of outside shareholders.

#### **IV. Robustness**

##### ***A. Sampling Robustness***

Our primary empirical tests match pledging observations to a counterfactual sample of non-pledging observations in the difference-in-difference model. We verify the robustness of our sampling procedure by re-estimating our empirical tests on our full data sample. **Table IX** presents the results obtained by estimating the models on our full sample. The indicated effects of insider pledging on both firm risk and firm-specific risk remain positive and significant, verifying our principal findings. The magnitudes of the  $\beta_3$  coefficients for full sample estimation indicate average treatment effects of insider pledging (ATT) on firms with insiders engaged in pledging correspond to 4.0 and 4.5 percent relative increases in firm risk and firm-specific risk, respectively. These results corroborate our primary findings regarding insider pledging and firm risk, and likewise imply economic as well as statistical significance. Unreported robustness testing likewise indicates that our findings on insider pledging and the skewness and kurtosis of returns hold for our full sample as well. Overall, these robustness tests indicate that our findings are not sensitive to the choice of sample data.

##### ***B. Lead-Year Risk and Return Characteristics***

Our analysis proposes a causal relation between insider pledging and firm risk, whereby insider pledging effectively increases the firm's equity risk. It may instead be the case however, that

insiders base their pledging decision upon future risk and return expectations. Jagolinzer, Matsunaga, and Yeung (2007) document strong evidence of this opportunism in insiders' use of pre-paid variable forward contracts, whereby managers utilize these hedges to exploit privileged information about declining future performance and/or increasing volatility. Our difference-in-differences approach addresses this potential endogeneity by separating insiders' demand for pledging (the opportunistic hedging influence) from the causal effect of pledging on risk. As a further test of robustness however, we control for lead-year risk and return characteristics in our firm risk model to ensure that our results indeed support a causal interpretation of the relation between pledging and risk. Similarly, based on findings by Jagolinzer, Matsunaga, and Yeung (2007) and Bettis, Bizjak, and Kalpathy (2014) evidencing insider hedging following periods of strong stock performance, we also consider specifications controlling for lagged and contemporaneous stock returns.

The results, presented in **Table X**, indicate the relation between insider pledging and risk remains robust when controlling for lead- and lag-year, as well as contemporaneous, risk and return characteristics. These results coincide with our primary findings, both in terms of the significance and the magnitude of the reported effects of insider pledging on risk. The implied average treatment effect (ATT) controlling for lead and lag risk and return characteristics suggests that, for firms with insider engaged in pledging, insider pledging corresponds with a 9.4 percent relative increase in the standard deviation of returns. Again, this essentially mirrors the magnitude and significance of effect indicated in our primary estimation of firm risk. Regarding the firm-specific component or risk, the results reiterate the statistical significance of our primary findings, yet suggest that our main tests may understate the economic significance of the treatment effect.

When controlling for the full set of lead, lag, and contemporaneous risk and return characteristics, the implied treatment effect (ATT) increases to 21.1 percent and remains highly significant.

The coefficient estimates for lead risk and lead return however suggest that insiders' expectations of future performance may play an important role in the pledging decision. Lead-year risk (firm-specific) and return (abnormal return) prove to be significantly and positively related to current risk. Further investigation as to the determinants of insider pledging may yield interesting findings with respect to opportunism or informed trading in relation to insiders' pledging decisions.

### ***C. Corporate Investment and Financing Decisions***

While the results seem to indicate a causal effect of insider pledging on firm risk, the underlying driver of the effect on risk remains unclear. The increase in risk may relate to changes in managerial decision making consistent with an incentives-based view of insider pledging, or may reflect added tail risk borne by outside investors. To differentiate between these two possible explanations, we include additional controls to capture any changes in the firm's investment and/or financing policies as these represent important channels through which managers can potentially influence firm risk. In particular, we control for acquisitions, R&D investment, capital expenditures, and changes in debt ratios. We scale acquisitions, R&D, and capital expenditures by total assets to adjust for firm size; changes in debt ratios measure the difference in the ratio of total debt to assets from the prior year.

**Table XI** reports the estimation results for firm risk and firm-specific risk controlling for investment and financing decisions. These indicate strongly that, even controlling for managerial decisions proxying for the prospective incentive effects of pledging, a significant positive relation persists between insider pledging and firm risk. The mean treatment effect (ATT) indicated by the coefficient estimates from these specifications suggests that pledging corresponds with a 7.5 (8.2)

percent relative increase in the standard deviation of daily stock (abnormal) returns for firm with pledging insiders. These results support of primary findings, and appear consistent with the added tail risk argument in that pledging corresponds with significantly increased firm risk even after accounting for prospective changes in managerial incentives. Furthermore, the economic significance of the effect remains considerable when incorporating these controls.

#### ***D. Corporate Anti-Pledging Policies***

Despite important similarities, one distinction between insider pledging and hedging with derivative instruments pertains to insider trading policies. Corporate policies forbidding executives from hedging their ownership interests with derivative instruments remain far more common than policies forbidding pledging. Larcker and Tayan (2010) conduct a survey of corporate executives and report that, of the respondent firms that allow either hedging or pledging by their executives, 79% allow pledging compared with only 29% that allow hedging with derivatives. To account for possible selection bias related to corporate policies restricting insiders from pledging, we record an indicator variable equal to one if the firm states an anti-pledging policy in its proxy filing. We observe very few of these policies in our sample period. Only nine of our firms stipulate an explicit policy on insider pledging. By comparison, an executive-compensation attorney at Sullivan & Cromwell LLP reports that only eight firms report anti-pledging policies in 2012 SEC filings, compared with 107 firms just one year later. While firms may have had anti-pledging policies in place without explicitly disclosing these, the establishment of corporate policies on insider pledging (and importantly, the disclosure thereof) would seemingly constitute a matter of growing importance in recent years. We argue that the increasing attention paid to insider pledging by market participants and corporate governance committees only stands to highlight the significance of our findings. Empirical investigation however suggests that the potentially unobserved corporate pledging policies should not threaten the validity of our findings.

While not included in our matched sample, difference in means tests suggest that the firms prohibiting pledging in our sample are statistically indistinct from those comprising our matched sample. Unreported propensity-score tests estimating a probit model of the conditional likelihood of observing an anti-pledging policy in place (i.e. propensity-score matching using our pledging policy indicator as the dependent variable) indicate that the full set of regressors considered in our analysis prove jointly insignificant to the pledging policy ( $\chi^2=16.2, p = .369$ ).

## **V. Conclusion**

We examine the relation between insider pledging and firm risk using a hand-collected pledging dataset spanning from January 2007 through December 2011 for 500 randomly selected S&P 1500 firms. Our analysis indicates a significant positive relation between insider pledging and firm risk, measured by the standard deviation of stock returns. Using the 2008 financial crisis as an exogenous shock to the supply of lending capital, and propensity-score matching to account for endogeneity relating to the pledging decision, difference-in-difference tests suggest a causal relation between insider pledging and both the total and firm-specific components of stock volatility. Coefficient estimates from our empirical specifications indicate the average treatment effect of pledging (ATT) on firms with insiders engaged in pledging corresponds to a 9.5 percent relative increase in firm risk, and a 9.4 percent relative increase in the firm-specific component of stock volatility. Our findings thus exhibit economical as well as statistical significance.

At least three potential explanations exist for the observed relation between pledging and firm risk. First, pledging may alter managerial risk-taking incentives, and thus affect risk through channels related to corporate risk-taking decisions such as investment and financing policies. Second, insiders' pledging decisions may be endogenously determined with respect to managers' informed expectations regarding future risk and return outcomes. Jagolinzer, Matsunaga, and

Yeung (2007) document such a relation between insiders' use of pre-paid variable forwards and future accounting and stock performance. Third, the increased stock volatility may relate to added tail risk borne by outside investors of firms with insiders engaged in pledging.

Our analysis would appear to support the tail risk argument. The relation between insider pledging and firm risk (both total and firm-specific) proves robust to controlling for changes in investment and financing decisions as well as for lead- and lag-year risk and return characteristics. These controls proxy for the influences related to changing managerial risk-taking incentives and to opportunistic hedging based on privileged information access, respectively. The robustness tests indicate that a significant positive relation remains between insider pledging and stock volatility after accounting for the effects of managerial incentives and opportunism or informed trading. We argue this remaining effect on firm risk ought to be attributable to added tail risk introduced by insider pledging and the corresponding risk of ill-timed margin calls on large pledged positions exacerbating downside volatility. Further supporting this tail risk argument, we find that insider pledging relates significantly to the skewness and kurtosis of returns. Consistent with the predictions implied by added tail risk, difference-in-differences estimation indicates that insider pledging corresponds with negatively skewed returns and with increased kurtosis. Together, these results indicate that insider pledging corresponds with a greater incidence of large negative returns relative to large positive returns, and with an increased probability of observed extreme return values. Both these results appear economically as well as statistically significant, and persist in both the full and propensity-score matched samples.

We make three important contributions to the finance literature with this analysis. First, we provide the first comprehensive empirical analysis of insider pledging within U.S. firms. Using a five-year panel of 500 randomly selected S&P 1500 firms, we provide important new insights

on corporate insiders' use of share pledges and the typical individuals who use them. We characterize the prevalence and magnitude of insider pledges, and offer evidence to suggest that share pledges provide large, concentrated insiders with a valuable diversification mechanism. Second, we provide clear and robust evidence on the otherwise ambiguous relation between insider pledging on firm risk, finding an economically and statistically significant positive relation between pledging and equity risk. This positive relation to risk holds both with respect to overall risk and to the firm-specific component of risk. We further identify tail risk as an important channel through which insider pledging affects risk, evidencing significant and informative effects on the skewness and kurtosis of returns. Finally, we infer the impact of insider pledging on outside shareholders. Documenting evidence of increased firm risk coupled with unchanged firm fundamentals, our analysis suggests that influential insiders have hurt outside shareholders by pledging.

Our findings would seem to hold meaningful implications for corporate governance policy, particularly given the considerable increase in corporate pledging policy initiations in recent years. The evidence shown in this paper offers valuable insights to be considered in the determination of strong governance practices, specifically with regard to the impact of insider pledging on outside shareholders and the channel through which pledging may affect shareholder wealth. We show that, without changing firm fundamentals, insider pledging corresponds with increased equity risk. More specifically, we identify added tail risk as significant component of the observed increase in risk. While large, undiversified insiders may be willing to forego positive skewness or upside potential in favor of diversification opportunities, outside investors who hold diversified portfolios are unlikely to share this view. Publicly disclosed corporate policies publicly addressing insider pledging practices may thus improve governance quality.



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**Table I.** Variable Definitions

Post Crisis	Indicator variable equal to one if the fiscal year-end date occurs after September 30, 2008
Insider Pledging	Indicator variable equal to one if at least one director or named executive officer reports a share pledge in the proxy statement
Blockholder	Indicator variable equal to one if an insider owns 5% or more of the firm's common stock
Voting Premium	Aggregate of the six voting-related provision included in the G-Index, ( <i>Bylaws, Charter, Cumulative voting, Secret ballot, Supermajority, and Unequal voting</i> ) and two additional voting provisions, <i>Dual class</i> and <i>Majority vote requirement</i> . <sup>1</sup> Following the G-Index construction, we include the <i>absence</i> of three governance-enhancing provisions in computing the aggregate voting score ( <i>Cumulative Voting, Secret Ballot, and Majority vote requirement</i> ). <sup>2</sup>
	$\text{Voting Premium} = D_{\text{Bylaws}} + D_{\text{Charter}} + D_{\text{Supermaj}} + D_{\text{Uneq vote}} + D_{\text{Dual class}} + (1 - D_{\text{Cum vote}}) + (1 - D_{\text{Sec bal}}) + (1 - D_{\text{Maj vote}})$
Market Volatility	Chicago Board Options Exchange Market Volatility Index
Short Interest	Shares held short as of the fiscal year-end date divided by common shares outstanding
EPS Shock	Differential between actual year-end earnings reported and consensus estimates (given by the mean of analyst estimates in the I/B/E/S database) from one year prior;
	$\text{EPS Shock}_{jt} = \text{EPS}_{jt} - E_{t-1}[\text{EPS}_{jt}]$
Stock Return	Return without dividends for the firm's common stock for the fiscal year
Dividend Yield	Dividends per share divided by share price at fiscal year end
Firm Risk	Standard deviation of daily stock returns during the fiscal year
B / M Ratio	Book value of total equity divided by market capitalization
Leverage	Total Liabilities divided by Total Assets
Firm Size	Natural logarithm of Total Assets
Trading Volume	Total trading volume of stock during the fiscal year (in millions)
Board Independence	Number of independent directors divided by the total number of directors
Risk-Free Rate	One-year Constant Maturity Treasury rate
Insider Ownership	Total number of shares beneficially owned by all directors and named executive officers divided by common shares outstanding
Beta	Annual beta values from CRSP (computed using Scholes-Williams method)
Ownership Dispersion	Number of common ordinary shareholders divided by common shares outstanding
Analyst Coverage	Number of analysts providing earnings estimate for the firm on I/B/E/S
Firm Age	Natural logarithm of firm age in years (fiscal year minus the year firm was founded)
R&D Intensity	Annual R&D expense divided by total assets
ROA	Net income divided by total assets
Firm-Specific Risk	Standard deviation of daily abnormal returns during the fiscal year
Acquisitions	Acquisitions divided by total assets
Capex Ratio	Capital Expenditures divided by total assets
Change in Debt Ratio	Change in the ratio of total debt to total assets from the prior year
HML	Cumulative HML factor for the trailing 12 months from fiscal year-end
Risk Premium	Cumulative MRP factor for the trailing 12 months from fiscal year-en,
Sales Growth	Percent change in total revenues from the prior year
SMB	Cumulative SMB factor for the trailing 12 months from fiscal year-end
UMD	Cumulative UMD factor for the trailing 12 months from fiscal year-end
Industry Fixed Effects	Two-digit SIC code dummies
Time Fixed Effects	Fiscal year dummies

<sup>1</sup>See Gompers, Ishii and Metrick (2003).<sup>2</sup> *Majority vote requirement* is not included in the original G-index, though we consider this a governance-enhancing provision according to widely held perceptions of this provision strengthening shareholder rights.

**Table II. Pledgor Characteristics**

This table provides annual summary statistics for personal-professional characteristics of pledging insiders (*Panel A*) and compares these characteristics with those of the pledging insiders' non-pledging colleagues within the same firm and fiscal year using difference in means tests (*Panel B*). We compute the summary statistics presented in section A by aggregating all 738 insider-firm-year observations from January 2007 through December 2011 in which the given individual reports an outstanding share pledge at fiscal year-end. These 738 pledging observations correspond to 271 unique individual insiders, and to 399 firm-year observations in our data. In section B, we aggregate these personal-professional characteristics for all 4,527 non-pledging, insider-firm-year observations among the 399 firm-years in which at least one insider engages in pledging. We then compute difference in means tests on the total 5,265 insider-firm-year observations (738 pledging and 4,527 non-pledging) for each of the given characteristics. All variables are measured as of fiscal-year end. Pledge Ratio is the number of shares pledged by the insider divided by the number of shares beneficially owned by that individual. Director, Executive, Executive-Director, Chairman, CEO, and Chairman-CEO are respective dummy variables indicating the insiders' role in the firm. Equity Ownership measures the number of shares beneficially owned by the insider, divided by the number of common shares outstanding. Tenure indicates the number of years the insider has held an active professional role in the firm, either as an employee and/or as a board member. Founder is a dummy variable equal to one if the insider is listed as a founder or co-founder of the firm; Female is a dummy variable equal to one if the insider is a woman. Age measures the insider's age in years.

Insider Characteristic	Panel A. Descriptive Statistics						Panel B. Mean Tests					
	Obs.	Mean	Median	Std. Dev.	Min.	Max.	Pledging (1)		Non-Pledging (2)		Difference (1) – (2)	
							Obs.	Mean	Obs.	Mean	t-stat	p-value
Pledge Ratio	738	0.333	0.354	0.192	0.000	0.528	.	.	.	.	.	.
Director <sup>‡</sup>	738	0.802	1.000	0.399	0.000	1.000	738	0.802	4,527	0.708	5.33	0.000
Executive <sup>‡</sup>	738	0.560	1.000	0.497	0.000	1.000	738	0.560	4,527	0.398	8.28	0.000
Executive-Director <sup>‡</sup>	738	0.420	0.000	0.494	0.000	1.000	738	0.420	4,527	0.114	22.16	0.000
Chairman <sup>‡</sup>	738	0.225	0.000	0.418	0.000	1.000	738	0.225	4,527	0.068	14.10	0.000
CEO <sup>‡</sup>	738	0.234	0.000	0.424	0.000	1.000	738	0.234	4,527	0.101	10.44	0.000
Chairman-CEO <sup>‡</sup>	738	0.146	0.000	0.354	0.000	1.000	738	0.146	4,527	0.047	10.52	0.000
Equity Ownership	738	0.033	0.005	0.061	0.000	0.482	738	0.033	4,527	0.004	22.84	0.000
Blockholder <sup>‡</sup>	738	0.228	0.000	0.420	0.000	1.000	738	0.228	4,527	0.017	13.56	0.000
Tenure	633	15.039	14.000	10.974	0.000	53.000	633	15.039	3,924	8.191	18.54	0.000
Founder <sup>‡</sup>	738	0.015	0.000	0.121	0.000	1.000	738	0.015	4,527	0.001	6.05	0.000
Female <sup>‡</sup>	738	0.087	0.000	0.282	0.000	1.000	738	0.087	4,527	0.140	-3.98	0.000
Age	732	59.523	59.000	9.380	38.000	89.000	732	59.523	4,526	58.999	1.44	0.151

<sup>‡</sup>Indicates a binary variable.

**Table III.** Descriptive Statistics

This table provides annual summary statistics for our propensity-score matched sample (*Panel A*) and our full 500-firm sample (*Panel B*) from January 2007 through December 2011. We calculate these statistics by aggregating firm-year observations for 356 pledging and 356 non-pledging firm-years for the matched sample in *Panel A* ( $356 + 356 = 712$  matched observations), and for 399 pledging and 2,053 non-pledging firm-years for the full sample in *Panel B* ( $399 + 2,053 = 2,452$  total observations). All variables are winsorized at the 1<sup>st</sup> and 99<sup>th</sup> percentile to control for possible influential observations in the data; the summary statistics presented in this table correspond to the winsorized values of the given variables. All variables reflect annual data measured at fiscal year-end.

Variable	Panel A. Propensity-Score Matched Sample						Panel B. Full Sample					
	Obs.	Mean	Median	SD	Min.	Max.	Obs.	Mean	Median	SD	Min.	Max.
Firm Risk	712	0.027	0.024	0.012	0.010	0.078	2,438	0.029	0.026	0.013	0.010	0.078
Firm-Specific Risk	712	0.021	0.019	0.009	0.009	0.067	2,443	0.023	0.021	0.011	0.009	0.067
Skewness	712	0.150	0.120	0.762	-2.781	3.346	2,444	0.128	0.105	0.870	-2.781	3.346
Kurtosis	712	7.190	5.436	5.630	3.164	41.117	2,438	7.922	5.748	6.307	3.164	41.117
Pledging Indicator	712	0.500	0.500	0.500	0.000	1.000	2,452	0.162	0.000	0.369	0.000	1.000
Aggregate Pledge Ratio	712	0.084	0.000	0.169	0.000	0.715	2,452	0.027	0.000	0.102	0.000	0.715
Total Pledging (%)	712	0.084	0.000	0.169	0.000	0.715	2,452	0.027	0.000	0.102	0.000	0.715
No. of Pledging Insiders	712	0.949	0.500	1.765	0.000	14.000	2,452	0.225	0.000	0.922	0.000	14.000
Return	712	0.090	0.033	0.496	-0.798	2.019	2,442	0.058	0.010	0.469	-0.798	2.019
Blockholder	712	0.354	0.000	0.479	0.000	1.000	2,452	0.226	0.000	0.418	0.000	1.000
Voting Premium	712	2.690	3.000	1.251	0.000	5.000	2,252	2.637	3.000	1.209	0.000	5.000
EPS Shock	709	1.868	1.770	2.821	-10.308	9.363	2,406	1.479	1.502	2.734	-10.308	9.363
Short Interest	676	0.054	0.039	0.051	0.001	0.301	2,358	0.063	0.045	0.056	0.001	0.301
Board Independence	712	0.807	0.833	0.102	0.000	1.000	2,438	0.774	0.833	0.199	0.000	1.000
Beta	712	1.166	1.129	0.485	0.207	2.718	2,365	1.180	1.136	0.503	0.207	2.718
Ownership Dispersion	712	0.119	0.032	0.217	0.001	1.082	2,447	0.122	0.035	0.210	0.001	1.082
Analyst Coverage	712	15.586	15.000	7.554	1.000	37.000	2,452	12.896	11.000	8.009	1.000	37.000
Trading Volume	712	793.212	421.130	1,173.509	14.045	7,478.506	2,452	649.057	219.337	1,140.304	14.045	7,478.506
Dividend Yield	712	0.013	0.009	0.017	0.000	0.090	2,435	0.011	0.003	0.016	0.000	0.090
Book-to-Market Ratio	712	0.508	0.413	0.380	-0.050	2.298	2,449	0.563	0.453	0.421	-0.050	2.298
Firm Size	712	8.363	8.382	1.361	4.746	11.926	2,452	7.747	7.565	1.514	4.746	11.926
Leverage	712	0.560	0.571	0.187	0.105	1.017	2,439	0.504	0.501	0.203	0.105	1.017
Risk-Free Rate	712	0.001	0.000	0.001	0.000	0.004	2,452	0.001	0.000	0.001	0.000	0.004
Insider Ownership	712	0.053	0.012	0.092	0.000	0.385	2,452	0.026	0.005	0.062	0.000	0.385
Sales Growth	712	0.075	0.006	0.117	0.000	0.668	2,452	0.068	0.000	0.118	0.000	0.668
ROA	712	0.061	0.065	0.076	-0.446	0.268	2,432	0.046	0.058	0.103	-0.446	0.268
Firm Age	705	63.233	51.000	45.049	8.000	189.000	2,443	59.173	43.000	42.357	8.000	189.000
R&D Intensity	712	0.017	0.000	0.031	0.000	0.211	2,452	0.023	0.000	0.045	0.000	0.250
Acquisition	661	0.021	0.001	0.047	0.000	0.302	2,302	0.027	0.002	0.056	0.000	0.302
Capex	712	0.053	0.037	0.049	0.003	0.230	2,452	0.047	0.032	0.045	0.003	0.230
Δ Debt Ratio	709	0.002	0.000	0.063	-0.173	0.260	2,416	0.003	0.000	0.065	-0.173	0.260

**Table IV. Difference in Means**

This table provides differences in means test for our propensity-score matched sample (*Panel A*) and our full 500-firm sample (*Panel B*) from January 2007 through December 2011. We calculate these statistics by aggregating firm-year observations for 356 pledging and 356 non-pledging firm-years for the matched sample in *Panel A* ( $356 + 356 = 712$  matched observations), and for 399 pledging and 2,053 non-pledging firm-years for the full sample in *Panel B* ( $399 + 2,053 = 2,452$  total observations). All variables are winsorized at the 1<sup>st</sup> and 99<sup>th</sup> percentile to control for possible influential observations in the data; the summary statistics presented in this table correspond to the winsorized values of the given variables. All variables reflect annual data measured at fiscal year-end. We compute the difference in means tests for pledging minus non-pledging sample means and report the two-sample test-statistics assuming unequal variances. Inference asterisks indicate significance at the 10%, 5% and 1% levels, respectively.

*Panel A. Matched Sample*

Variable	Obs.	Pledging (1)			Non-Pledging (2)				Difference in Means (1) – (2)	
		Mean	Median	Std. Dev.	Obs.	Mean	Median	Std. Dev.	<i>t-stat</i>	<i>p-value</i>
Firm Risk	356	0.028	0.025	0.012	356	0.026	0.024	0.011	1.49	0.137
Firm-Specific Risk	356	0.021	0.019	0.009	356	0.020	0.019	0.008	1.50	0.135
Skewness	356	0.137	0.098	0.737	356	0.163	0.141	0.788	-0.46	0.646
Kurtosis	356	6.817	5.291	5.316	356	7.564	5.556	5.911	-1.77	0.077 *
<i>Pledging Indicator</i>	356	1.000	1.000	0.000	.	.	.	.	.	.
<i>Aggregate Pledge Ratio</i>	356	0.168	0.080	0.207	.	.	.	.	.	.
<i>No. of Pledging Insiders</i>	356	1.899	1.000	2.105	.	.	.	.	.	.
Return	356	0.048	0.025	0.451	356	0.131	0.049	0.534	-2.25	0.025 **
Blockholder	356	0.393	0.000	0.489	356	0.315	0.000	0.465	2.20	0.028 **
Voting Premium	356	2.646	3.000	1.255	356	2.733	3.000	1.247	-0.93	0.353
EPS Shock	354	1.664	1.578	2.784	355	2.071	1.944	2.846	-1.93	0.054 *
Short Interest	342	0.054	0.037	0.048	334	0.055	0.041	0.053	-0.35	0.725
Board Independence	356	0.801	0.800	0.088	356	0.813	0.833	0.115	-1.63	0.103
Beta	356	1.169	1.145	0.486	356	1.162	1.110	0.483	0.19	0.853
Ownership Dispersion	356	0.123	0.032	0.229	356	0.115	0.033	0.204	0.47	0.638
Analyst Coverage	356	15.708	15.000	7.129	356	15.463	15.000	7.965	0.43	0.666
Trading Volume	356	839.446	452.558	1,252.891	356	746.978	372.176	1,088.164	1.05	0.293
Dividend Yield	356	0.014	0.009	0.018	356	0.013	0.009	0.016	0.92	0.360
Book-to-Market Ratio	356	0.515	0.430	0.375	356	0.500	0.403	0.386	0.55	0.584
Firm Size	356	8.369	8.457	1.352	356	8.358	8.293	1.373	0.10	0.920
Leverage	356	0.561	0.572	0.194	356	0.559	0.570	0.179	0.11	0.913
Risk-Free Rate	356	0.001	0.000	0.001	356	0.001	0.000	0.002	-1.35	0.179
Insider Ownership	356	0.058	0.018	0.094	356	0.047	0.009	0.090	1.57	0.117
Sales Growth	356	0.066	0.000	0.105	356	0.084	0.012	0.128	-1.98	0.048 **
ROA	356	0.059	0.066	0.079	356	0.063	0.064	0.072	-0.69	0.493
Firm Age	355	63.155	50.000	45.429	350	63.311	52.000	44.725	-0.05	0.963
R&D Intensity	356	0.013	0.000	0.026	356	0.021	0.003	0.036	-3.08	0.002 ***
Acquisitions	326	0.018	0.000	0.038	335	0.024	0.003	0.055	-1.67	0.095 *
Capex	356	0.056	0.038	0.051	356	0.050	0.037	0.046	1.68	0.093 *
$\Delta$ Debt Ratio	356	0.004	0.000	0.062	353	0.001	0.000	0.065	0.63	0.530

Table IV continued...

## Panel B. Full Sample

Variable	Obs.	Pledging (1)			Non-Pledging (2)				Difference in Means (1) – (2)		
		Mean	Median	Std. Dev.	Obs.	Mean	Median	Std. Dev.	t-stat	p-value	
Firm Risk	393	0.028	0.025	0.012	2,040	0.029	0.026	0.013	-2.69	0.007	***
Firm-Specific Risk	393	0.022	0.019	0.010	2,050	0.023	0.021	0.011	-3.18	0.002	***
Skewness	393	0.126	0.118	0.777	2,051	0.129	0.103	0.887	-0.08	0.939	
Kurtosis	392	7.095	5.377	5.712	2,046	8.080	5.856	6.404	-3.07	0.002	***
Pledging Indicator	399	1.000	1.000	0.000	.	.	.	.	.	.	.
Aggregate Pledge Ratio	399	0.166	0.079	0.203	.	.	.	.	.	.	.
No. of Pledging Insiders	399	1.840	1.000	2.001	.	.	.	.	.	.	.
Return	398	0.049	0.034	0.450	2,039	0.059	0.007	0.474	-0.39	0.697	
Blockholder	401	0.404	0.000	0.491	2,053	0.191	0.000	0.393	8.17	0.000	***
Voting Premium	375	2.648	3.000	1.264	1,872	2.636	3.000	1.198	0.17	0.868	
EPS Shock	389	1.658	1.627	2.859	2,012	1.438	1.476	2.708	1.40	0.161	
Short Interest	383	0.053	0.038	0.048	1,970	0.065	0.046	0.057	-4.17	0.000	***
Board Independence	398	0.787	0.800	0.134	2,034	0.772	0.833	0.208	1.90	0.057	*
Beta	380	1.162	1.142	0.493	1,980	1.185	1.135	0.504	-0.85	0.394	
Ownership Dispersion	398	0.125	0.035	0.229	2,044	0.122	0.035	0.206	0.30	0.761	
Analyst Coverage	394	15.777	15.000	7.258	2,042	12.878	11.000	8.007	7.14	0.000	***
Trading Volume	399	808.465	442.881	1,207.068	2,048	613.570	193.707	1,120.382	2.98	0.003	***
Dividend Yield	399	0.014	0.008	0.018	2,031	0.011	0.001	0.016	3.30	0.001	***
Book-to-Market Ratio	399	0.524	0.429	0.392	2,045	0.571	0.459	0.426	-2.20	0.028	**
Firm Size	399	8.318	8.409	1.377	2,048	7.629	7.444	1.508	9.01	0.000	***
Leverage	397	0.559	0.574	0.188	2,037	0.493	0.487	0.204	6.32	0.000	***
Risk-Free Rate	399	0.001	0.000	0.002	2,048	0.001	0.000	0.002	-0.82	0.413	
Insider Ownership	401	0.057	0.019	0.091	2,053	0.030	0.009	0.063	5.72	0.000	***
Sales Growth	399	0.065	0.000	0.106	2,048	0.069	0.000	0.120	-0.65	0.518	
ROA	396	0.057	0.064	0.088	2,031	0.044	0.057	0.106	2.51	0.012	**
Firm Age	398	62.090	49.000	44.317	2,039	58.482	42.000	41.902	1.50	0.134	
R&D Intensity	401	0.014	0.000	0.028	2,072	0.034	0.010	0.052	-11.21	0.000	***
Acquisitions	366	0.019	0.000	0.041	1,936	0.029	0.002	0.059	-3.86	0.000	***
Capex	399	0.056	0.039	0.052	2,053	0.045	0.031	0.043	3.90	0.000	***
$\Delta$ Debt Ratio	393	0.004	0.000	0.061	2,023	0.003	0.000	0.066	0.22	0.827	

**Table V. Insider Pledging and Firm Risk**

In this table we present firm-year difference-in-differences OLS regressions (accounting for covariates) of firm risk on insider pledging using a propensity-score matched sample of pledging and counterfactual non-pledging observations using annual data from 2007 to 2011. The dependent variable is the standard deviation of daily stock returns during the fiscal year. We implement one-to-one nearest neighbor matching on firm size, leverage, voting premium, dividend yield, book to market ratio, return on assets, board size, institutional ownership, insider ownership, trading volume, analyst coverage, and board independence using a logit model of insider pledging on common support. This yields a matched sample of 712 firm-year observations (356 pledging and 356 counterfactual observations). *Post Crisis* equals one if the fiscal year-end date occurs after September 30, 2008. *Insider Pledging* equals one if any of the firm's insiders reports a share pledge at fiscal year-end. The interaction term *Post Crisis*  $\times$  *Insider Pledging* reflects our variable of interest and measures the treatment effect of insider pledging on firm risk. See Table I for definitions of control variables. The economic significance of the treatment effect of insider pledging is indicated (in bold) below each model specification. This number measures the average treatment effect on treated (ATT), equal to the diff-in-diff coefficient divided by the baseline (pre-crisis) mean of the dependent variable for firms with insiders engaged in pledging. This reflects the percentage change in the dependent variable associated with pledging for firms with insiders engaged in pledging. All regression variables are winsorized at the 1<sup>st</sup> and 99<sup>th</sup> percentiles, and correspond to annual data measured at fiscal year-end. All regressions include time and industry fixed effects given by fiscal year and two-digit SIC dummies, respectively. *p-values* corresponding to robust standard errors clustered at the firm level are reported in parentheses; \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% levels, respectively.

	<i>Dependent Variable: Standard Deviation of Daily Returns</i>					
	(1)	(2)	(3)	(4)	(5)	(6)
Post Crisis	0.00417 (0.180)	0.00411 (0.186)	0.00296 (0.338)	0.00293 (0.345)	0.00342 (0.219)	0.00428 (0.113)
Insider Pledging	-0.00242*** (0.008)	-0.00245*** (0.008)	-0.00241*** (0.009)	-0.00244*** (0.008)	-0.00200** (0.028)	-0.00187** (0.037)
Post Crisis $\times$ Insider Pledging	0.00287*** (0.004)	0.00287*** (0.004)	0.00288*** (0.004)	0.00288*** (0.004)	0.00252** (0.012)	0.00252** (0.011)
Voting Premium	Yes	Yes	Yes	Yes	Yes	Yes
Blockholder	Yes	Yes	Yes	Yes	Yes	Yes
EPS Shock	Yes	Yes	Yes	Yes	Yes	Yes
Short Interest	Yes	Yes	Yes	Yes	Yes	Yes
Board Independence	Yes	Yes	Yes	Yes	Yes	Yes
Beta	Yes	Yes	Yes	Yes	Yes	Yes
Ownership Dispersion	Yes	Yes	Yes	Yes	Yes	Yes
Analyst Coverage	Yes	Yes	Yes	Yes	Yes	Yes
Trading Volume	Yes	Yes	Yes	Yes	Yes	Yes
Dividend Yield	Yes	Yes	Yes	Yes	Yes	Yes
B/M Ratio	Yes	Yes	Yes	Yes	Yes	Yes
Firm Size	Yes	Yes	Yes	Yes	Yes	Yes
Leverage	Yes	Yes	Yes	Yes	Yes	Yes
Risk-Free Rate	Yes	Yes	Yes	Yes	Yes	Yes
Inside Ownership	Yes	Yes	Yes	Yes	Yes	Yes
Firm Age	Yes	Yes	Yes	Yes	Yes	Yes
R&D Intensity		Yes		Yes	Yes	Yes
Market Volatility			Yes	Yes	Yes	Yes
ROA					Yes	Yes
Sales Growth						Yes
Time & Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.0259*** (0.000)	0.0264*** (0.000)	0.0232*** (0.000)	0.0238*** (0.000)	0.0286*** (0.000)	0.0267*** (0.000)
<b>Treatment Effect (%)</b>	<b>12.3</b>	<b>12.0</b>	<b>13.8</b>	<b>13.5</b>	<b>9.5</b>	<b>10.1</b>
Observations	666	666	666	666	666	666
Adjusted $R^2$	0.816	0.816	0.817	0.817	0.821	0.825



**Table VI.** Insider Pledging, Firm Risk, and Equity Ownership of Pledgors

This table summarizes the results of firm-year differences-in-differences OLS regressions of firm risk on insider pledging (specifically, model (6) in Table VI) estimated on subsamples of our propensity-score matched sample using annual data from 2007 through 2011. The dependent variable is the standard deviation of daily stock returns during the fiscal year. The subsamples correspond to the equity ownership of the firm's largest insider engaged in pledging and are determined based on the ownership benchmarks indicated in the leftmost column below. "Median" refers to the median percentage equity ownership of all 738 insider-firm-year observations in our sample corresponding to insider pledges, and is equal to 0.55% ownership. "1%," "2%," and "3%" indicate respective percentages of common shares outstanding. For each of these benchmarks, we group pledging observations by ownership of the largest pledging insider above (1) or below (2) the benchmark level. For each of the summary parameters, column (1) corresponds to regressions estimated on the subsample consisting of all counterfactual observations and all matched pledging observations in the matched sample for which the largest pledgor holds the benchmark level of equity ownership or greater. Column (2) corresponds to regressions estimated on the subsample consisting of all counterfactual observations and all matched pledging observations in the matched sample for which the largest pledgor holds less than the benchmark level of equity ownership.  $\beta$  indicates the  $\beta_3$  coefficient from model (6) in Table VI, corresponding to the *Post Crisis*  $\times$  *Insider Pledging* interaction term measuring the treatment effect of pledging on firm risk. *t*-stat indicates the test statistic of the  $\beta_3$  coefficient. Treatment Effect (%) indicates the average treatment effect on treated (ATT) implied by the coefficient estimate. *p*-value indicates the statistical significance of the treatment effect. All regression variables are winsorized at the 1st and 99th percentiles, and correspond to annual data measured at fiscal year-end. All regressions include our full set of firm controls as well as time and industry fixed effects given by fiscal year and two-digit SIC dummies, respectively. *p*-values corresponding to robust standard errors clustered at the firm level are reported in parentheses; \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% levels, respectively.

Equity Stake of Largest Pledgor	$\beta$		<i>t</i> -stat		Treatment Effect (%)		<i>p</i> -value		Obs.		Adj. $R^2$	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Median (0.55%)	0.00233**	0.00206*	2.16	1.85	5.3	5.4	0.032	0.066	577	478	0.818	0.822
1%	0.00242**	0.00159	2.20	1.51	6.5	4.3	0.029	0.133	548	507	0.815	0.826
2%	0.00291**	0.00116	2.53	1.12	6.2	5.0	0.012	0.263	510	545	0.816	0.825
3%	0.00283**	0.00121	2.34	1.20	7.3	4.2	0.020	0.233	493	562	0.816	0.826

**Figure 1.** Share Pledges and Hedging versus Leveraging Risk

This figure illustrates the offsetting hedging and leveraging features inherent in share pledge mechanics. For small decreases in the stock price, those for which the total collateral value of the pledged shares remains in excess of the Loan-to-Value ratio benchmark, the pledgor's wealth is insulated against adverse fluctuations in the share price. For large price decreases, however, the pledgor's wealth exposure to the stock price will be amplified by the cost of complying with a likely margin call from the lender.

**Table VII. Insider Pledging and Firm-Specific Risk**

In this table we present firm-year difference-in-differences OLS regressions (accounting for covariates) of firm risk on insider pledging using a propensity-score matched sample of pledging and counterfactual non-pledging observations using annual data from 2007 to 2011. The dependent variable is the standard deviation of daily abnormal returns during the fiscal year. We compute abnormal returns as the difference between actual and expected returns predicted using a four-factor cross-sectional model. We implement one-to-one nearest neighbor matching on firm size, leverage, voting premium, dividend yield, book to market ratio, return on assets, board size, institutional ownership, insider ownership, trading volume, analyst coverage, and board independence using a logit model of insider pledging on common support. This yields a matched sample of 712 firm-year observations (356 pledging and 356 counterfactual observations). *Post Crisis* equals one if the fiscal year-end date occurs after September 30, 2008. *Insider Pledging* equals one if any of the firm's insiders reports a share pledge at fiscal year-end. The interaction term *Post Crisis* × *Insider Pledging* reflects our variable of interest and measures the treatment effect of insider pledging on firm risk. See Table I for definitions of control variables. The economic significance of the treatment effect of insider pledging is indicated (in bold) below each model specification. This number measures the average treatment effect on treated (ATT), equal to the diff-in-diff coefficient divided by the baseline (pre-crisis) mean of the dependent variable for firms with insiders engaged in pledging. This reflects the percentage change in the dependent variable associated with pledging for firms with insiders engaged in pledging. All regression variables are winsorized at the 1<sup>st</sup> and 99<sup>th</sup> percentiles, and correspond to annual data measured at fiscal year-end. All regressions include time and industry fixed effects given by fiscal year and two-digit SIC dummies, respectively. *p-values* corresponding to robust standard errors clustered at the firm level are reported in parentheses; \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% levels, respectively.

	<i>Dependent Variable: Standard Deviation of Daily Abnormal Returns</i>					
	(1)	(2)	(3)	(4)	(5)	(6)
Post Crisis	0.00168 (0.566)	0.00172 (0.559)	0.000815 (0.777)	0.000842 (0.771)	0.00126 (0.621)	0.00223 (0.350)
Insider Pledging	-0.00268*** (0.003)	-0.00267*** (0.003)	-0.00268*** (0.003)	-0.00266*** (0.003)	-0.00228*** (0.009)	-0.00214** (0.013)
Post Crisis × Insider Pledging	0.00274*** (0.005)	0.00274*** (0.005)	0.00274*** (0.005)	0.00275*** (0.005)	0.00245** (0.013)	0.00244** (0.012)
Voting Premium	Yes	Yes	Yes	Yes	Yes	Yes
Blockholder	Yes	Yes	Yes	Yes	Yes	Yes
EPS Shock	Yes	Yes	Yes	Yes	Yes	Yes
Short Interest	Yes	Yes	Yes	Yes	Yes	Yes
Board Independence	Yes	Yes	Yes	Yes	Yes	Yes
Beta	Yes	Yes	Yes	Yes	Yes	Yes
Ownership Dispersion	Yes	Yes	Yes	Yes	Yes	Yes
Analyst Coverage	Yes	Yes	Yes	Yes	Yes	Yes
Trading Volume	Yes	Yes	Yes	Yes	Yes	Yes
Dividend Yield	Yes	Yes	Yes	Yes	Yes	Yes
B/M Ratio	Yes	Yes	Yes	Yes	Yes	Yes
Firm Size	Yes	Yes	Yes	Yes	Yes	Yes
Leverage	Yes	Yes	Yes	Yes	Yes	Yes
Risk-Free Rate	Yes	Yes	Yes	Yes	Yes	Yes
Inside Ownership	Yes	Yes	Yes	Yes	Yes	Yes
Firm Age	Yes	Yes	Yes	Yes	Yes	Yes
R&D Intensity		Yes		Yes	Yes	Yes
Market Volatility			Yes	Yes	Yes	Yes
ROA					Yes	Yes
Sales Growth						Yes
Time & Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.0248*** (0.000)	0.0244*** (0.000)	0.0247*** (0.000)	0.0243*** (0.000)	0.0284*** (0.000)	0.0263*** (0.000)
<b>Treatment Effect (%)</b>	<b>12.4</b>	<b>12.6</b>	<b>12.5</b>	<b>12.7</b>	<b>9.4</b>	<b>10.1</b>
Observations	666	666	666	666	666	666
Adjusted <i>R</i> <sup>2</sup>	0.681	0.681	0.682	0.681	0.687	0.695

**Table VIII. Insider Pledging and the Skewness and Kurtosis of Returns**

In this table we present firm-year difference-in-differences OLS regressions (accounting for covariates) of skewness and kurtosis of returns on insider pledging using a propensity-score matched sample of pledging and counterfactual non-pledging observations using annual data from 2007 to 2011. The dependent variable in *Panel A* is the skewness of daily stock returns during the fiscal year. The dependent variable in *Panel B* is the kurtosis of daily stock returns during the fiscal year. We implement one-to-one nearest neighbor matching on firm size, leverage, voting premium, dividend yield, book to market ratio, return on assets, board size, institutional ownership, insider ownership, trading volume, analyst coverage, and board independence using a logit model of insider pledging on common support. This yields a matched sample of 712 firm-year observations (356 pledging and 356 counterfactual observations). *Post Crisis* equals one if the fiscal year-end date occurs after September 30, 2008. *Insider Pledging* equals one if any of the firm's insiders reports a share pledge at fiscal year-end. The interaction term *Post Crisis*  $\times$  *Insider Pledging* reflects our variable of interest and measures the treatment effect of insider pledging on firm risk. See Table I for definitions of control variables. All regression variables are winsorized at the 1<sup>st</sup> and 99<sup>th</sup> percentiles, and correspond to annual data measured at fiscal year-end. All regressions include time and industry fixed effects given by fiscal year and two-digit SIC dummies, respectively. *p-values* corresponding to robust standard errors clustered at the firm level are reported in parentheses; \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% levels, respectively.

	<i>Panel A. Skewness of Daily Returns</i>				<i>Panel B. Kurtosis of Daily Returns</i>			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post-Crisis	1.008*** (0.004)	1.132*** (0.002)	1.093*** (0.002)	1.209*** (0.001)	-8.964** (0.022)	-9.213** (0.023)	-8.292** (0.024)	-7.125** (0.050)
Insider Pledging	0.970*** (0.003)	1.020*** (0.002)	1.004*** (0.002)	0.985*** (0.002)	-6.928** (0.029)	-6.840** (0.033)	-6.516** (0.032)	-6.614** (0.030)
Post Crisis $\times$ Insider Pledging	-0.979*** (0.003)	-1.021*** (0.003)	-1.011*** (0.002)	-0.990*** (0.003)	6.459** (0.041)	6.480** (0.042)	6.218** (0.039)	6.192** (0.039)
Cumulative Abnormal Returns	Yes		Yes	Yes	Yes		Yes	Yes
Trading Volume	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
B/M Ratio	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Size	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Risk $t_{-1}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Risk	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cumulative Abnormal Returns $t_{-1}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Beta	Yes	Yes	Yes		Yes	Yes	Yes	
Market Volatility	Yes	Yes	Yes		Yes	Yes	Yes	
Blockholder	Yes	Yes	Yes		Yes	Yes	Yes	
Stock Return		Yes	Yes			Yes	Yes	
Stock Return $t_{-1}$		Yes	Yes			Yes	Yes	
Analyst Coverage			Yes				Yes	
Insider Ownership			Yes				Yes	
Risk Premium				Yes				Yes
SMB				Yes				Yes
HML				Yes				Yes
UMD				Yes				Yes
Return Skewness					Yes	Yes	Yes	Yes
Time & Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.558 (0.277)	0.183 (0.725)	0.563 (0.264)	-0.567 (0.192)	14.58*** (0.000)	22.42*** (0.000)	17.22*** (0.000)	15.09*** (0.000)
Observations	572	577	572	572	572	577	572	572
Adjusted $R^2$	0.224	0.225	0.229	0.234	0.196	0.194	0.218	0.185

**Table IX. Full Sample Estimation of Insider Pledging and Risk**

In this table we present firm-year difference-in-differences OLS regressions (accounting for covariates) of risk on insider pledging using full sample data from 2007 to 2011. The full sample consists of 399 pledging and 2,053 non-pledging firm years observations (399 + 2,053 = 2,452 total observations). The dependent variable in *Panel A* is the standard deviation of daily stock returns during the fiscal year. The dependent variable in *Panel B* is the standard deviation of daily abnormal returns during the fiscal year. We compute abnormal returns as the difference between actual and expected returns predicted using a four-factor cross-sectional model. *Post Crisis* equals one if the fiscal year-end date occurs after September 30, 2008. *Insider Pledging* equals one if any of the firm's insiders reports a share pledge at fiscal year-end. The interaction term *Post Crisis* × *Insider Pledging* reflects our variable of interest and measures the treatment effect of insider pledging on firm risk. See Table I for definitions of control variables. The economic significance of the treatment effect of insider pledging is indicated (in bold) below each model specification. This number measures the average treatment effect on treated (ATT), equal to the diff-in-diff coefficient divided by the baseline (pre-crisis) mean of the dependent variable for firms with insiders engaged in pledging. This reflects the percentage change in the dependent variable associated with pledging for firms with insiders engaged in pledging. All regression variables are winsorized at the 1<sup>st</sup> and 99<sup>th</sup> percentiles, and correspond to annual data measured at fiscal year-end. All regressions include time and industry fixed effects given by fiscal year and two-digit SIC dummies, respectively. *p-values* corresponding to robust standard errors clustered at the firm level are reported in parentheses; \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% levels, respectively.

	<i>Panel A. Firm Risk</i>				<i>Panel A. Firm-Specific Risk</i>			
	(1)	(3)	(3)	(4)	(5)	(6)	(7)	(8)
Post Crisis	0.00571*** (0.000)	0.00520*** (0.000)	0.00510*** (0.000)	0.00512*** (0.000)	0.00323*** (0.007)	0.00321** (0.010)	0.00310** (0.012)	0.00313** (0.011)
Insider Pledging	-0.00112* (0.084)	-0.00109* (0.096)	-0.00101 (0.107)	-0.000967 (0.124)	-0.000972 (0.123)	-0.000949 (0.138)	-0.000920 (0.132)	-0.000827 (0.178)
Post Crisis × Insider Pledging	0.00161** (0.016)	0.00161** (0.017)	0.00159** (0.018)	0.00156** (0.020)	0.00139** (0.030)	0.00140** (0.031)	0.00143** (0.027)	0.00136** (0.036)
Voting Premium	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Blockholder	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EPS Shock	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Short Interest	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Board Independence	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Beta	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ownership Dispersion	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Analyst Coverage	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Trading Volume	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dividend Yield	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
B/M Ratio	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Size	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Leverage	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Risk-Free Rate	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Inside Ownership	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Age	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R&D Intensity		Yes	Yes	Yes		Yes	Yes	Yes
Market Volatility		Yes	Yes	Yes		Yes	Yes	Yes
ROA			Yes	Yes			Yes	Yes
Sales Growth				Yes				Yes
Time & Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.0415*** (0.000)	0.0400*** (0.000)	0.0411*** (0.000)	0.0409*** (0.000)	0.0321*** (0.000)	0.0318*** (0.000)	0.0328*** (0.000)	0.0322*** (0.000)
<b>Treatment Effects (%)</b>	<b>4.0</b>	<b>4.0</b>	<b>4.1</b>	<b>4.0</b>	<b>3.9</b>	<b>4.7</b>	<b>4.4</b>	<b>4.5</b>
Observations	2091	2091	2076	2076	2091	2091	2076	2076
Adjusted R <sup>2</sup>	0.796	0.797	0.802	0.802	0.716	0.717	0.724	0.725

**Table X. Controlling for Lead- and Lag-Year Risk and Return Characteristics**

In this table we present firm-year difference-in-differences OLS regressions (accounting for covariates) of risk on insider pledging controlling for lead- and lag- year risk and return characteristics using a propensity-score matched sample of pledging and counterfactual non-pledging observations using annual data from 2007 to 2011. The dependent variable in *Panel A* is the standard deviation of daily stock returns during the fiscal year. The dependent variable in *Panel B* is the standard deviation of daily abnormal returns during the fiscal year. We compute abnormal returns as the difference between actual and expected returns predicted using a four-factor cross-sectional model. We implement one-to-one nearest neighbor matching on firm size, leverage, voting premium, dividend yield, book to market ratio, return on assets, board size, institutional ownership, insider ownership, trading volume, analyst coverage, and board independence using a logit model of insider pledging on common support. This yields a matched sample of 712 firm-year observations (356 pledging and 356 counterfactual observations). *Post Crisis* equals one if the fiscal year-end date occurs after September 30, 2008. *Insider Pledging* equals one if any of the firm's insiders reports a share pledge at fiscal year-end. The interaction term *Post Crisis*  $\times$  *Insider Pledging* reflects our variable of interest and measures the treatment effect of insider pledging on firm risk. See Table I for definitions of control variables. The economic significance of the treatment effect of insider pledging is indicated (in bold) below each model specification. This number measures the average treatment effect on treated (ATT), equal to the diff-in-diff coefficient divided by the baseline (pre-crisis) mean of the dependent variable for firms with insiders engaged in pledging. This reflects the percentage change in the dependent variable associated with pledging for firms with insiders engaged in pledging. All regression variables are winsorized at the 1<sup>st</sup> and 99<sup>th</sup> percentiles, and correspond to annual data measured at fiscal year-end. All regressions include time and industry fixed effects given by fiscal year and two-digit SIC dummies, respectively. *p-values* corresponding to robust standard errors clustered at the firm level are reported in parentheses; \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% levels, respectively.

	<i>Panel A. Firm Risk</i>					<i>Panel B. Firm-Specific Risk</i>				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Post Crisis	0.00830*** (0.000)	0.00800*** (0.000)	0.00765*** (0.001)	0.00765*** (0.001)	0.00772*** (0.001)	0.00508** (0.011)	0.00535*** (0.005)	0.00544*** (0.004)	0.00547*** (0.004)	0.00402** (0.033)
Insider Pledging	-0.00147 (0.116)	-0.00198** (0.029)	-0.00194** (0.030)	-0.00194** (0.030)	-0.00191** (0.036)	-0.00191** (0.036)	-0.00250*** (0.004)	-0.00251*** (0.004)	-0.00250*** (0.004)	-0.00245*** (0.008)
Post Crisis $\times$ Insider Pledging	0.00226** (0.027)	0.00262** (0.011)	0.00241** (0.017)	0.00242** (0.017)	0.00239** (0.021)	0.00222** (0.027)	0.00255** (0.011)	0.00249** (0.012)	0.00250** (0.012)	0.00276*** (0.008)
Firm Risk $t_{+1}$	Yes	Yes	Yes	Yes	Yes					
Firm Risk $t_{-1}$		Yes	Yes	Yes	Yes					
Stock Return $t_{+1}$			Yes	Yes	Yes					
Stock Return $t_{-1}$				Yes	Yes					
Firm-Specific Risk $t_{+1}$						Yes	Yes	Yes	Yes	Yes
Firm-Specific Risk $t_{-1}$							Yes	Yes	Yes	Yes
CAR $t_{+1}$								Yes	Yes	Yes
CAR $t_{-1}$									Yes	Yes
All Firm & Market Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time & Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.0164*** (0.000)	0.0268*** (0.002)	0.0136*** (0.003)	0.0139*** (0.003)	0.0274*** (0.001)	0.0145*** (0.001)	0.0140* (0.070)	0.0134* (0.071)	0.0138* (0.068)	0.0155*** (0.000)
<b>Treatment Effect (%)</b>	<b>15.1</b>	<b>10.5</b>	<b>20.8</b>	<b>20.3</b>	<b>9.4</b>	<b>17.6</b>	<b>22.2</b>	<b>22.8</b>	<b>22.2</b>	<b>21.1</b>
Observations	663	646	644	644	643	663	647	641	641	636
Adjusted $R^2$	0.836	0.840	0.842	0.842	0.841	0.723	0.750	0.753	0.753	0.737

**Table XI. Controlling for Investment and Financing Policies**

In this table we present firm-year difference-in-differences OLS regressions (accounting for covariates) of risk on insider pledging controlling investment and financing policies using a propensity-score matched sample of pledging and counterfactual non-pledging observations using annual data from 2007 to 2011. The dependent variable in *Panel A* is the standard deviation of daily stock returns during the fiscal year. The dependent variable in *Panel B* is the standard deviation of daily abnormal returns during the fiscal year. We compute abnormal returns as the difference between actual and expected returns predicted using a four-factor cross-sectional model. We implement one-to-one nearest neighbor matching on firm size, leverage, voting premium, dividend yield, book to market ratio, return on assets, board size, institutional ownership, insider ownership, trading volume, analyst coverage, and board independence using a logit model of insider pledging on common support. This yields a matched sample of 712 firm-year observations (356 pledging and 356 counterfactual observations). *Post Crisis* equals one if the fiscal year-end date occurs after September 30, 2008. *Insider Pledging* equals one if any of the firm's insiders reports a share pledge at fiscal year-end. The interaction term *Post Crisis* × *Insider Pledging* reflects our variable of interest and measures the treatment effect of insider pledging on firm risk. See Table I for definitions of control variables. The economic significance of the treatment effect of insider pledging is indicated (in bold) below each model specification. This number measures the average treatment effect on treated (ATT), equal to the diff-in-diff coefficient divided by the baseline (pre-crisis) mean of the dependent variable for firms with insiders engaged in pledging. This reflects the percentage change in the dependent variable associated with pledging for firms with insiders engaged in pledging. All regression variables are winsorized at the 1<sup>st</sup> and 99<sup>th</sup> percentiles, and correspond to annual data measured at fiscal year-end. All regressions include time and industry fixed effects given by fiscal year and two-digit SIC dummies, respectively. *p-values* corresponding to robust standard errors clustered at the firm level are reported in parentheses; \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% levels, respectively.

	<i>Panel A. Firm Risk</i>				<i>Panel B. Firm-Specific Risk</i>			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post-Crisis	0.00681*** (0.002)	0.00689*** (0.002)	0.00672*** (0.003)	0.00672*** (0.003)	0.00348* (0.084)	0.00353* (0.079)	0.00341* (0.095)	0.00350* (0.087)
Insider Pledging	-0.00151* (0.096)	-0.00148 (0.101)	-0.00174* (0.050)	-0.00181** (0.049)	-0.00180** (0.043)	-0.00178** (0.043)	-0.00196** (0.025)	-0.00207** (0.023)
Post Crisis × Insider Pledging	0.00228** (0.023)	0.00225** (0.024)	0.00236** (0.016)	0.00243** (0.016)	0.00217** (0.027)	0.00216** (0.027)	0.00223** (0.020)	0.00233** (0.019)
Market Volatility	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Voting Premium	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
EPS Shock	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Short Interest	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Board Independence	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sales Growth	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Beta	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ownership Dispersion	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Analyst Coverage	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Trading Volume	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dividend Yield	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
B/M Ratio	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Size	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Leverage	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Risk-Free Rate	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Inside Ownership	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Age	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ROA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R&D Intensity	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Acquisitions		Yes	Yes	Yes		Yes	Yes	Yes
Capex Ratio			Yes	Yes			Yes	Yes
Change in Debt Ratio				Yes				Yes
Time & Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.0265*** (0.000)	0.0187*** (0.000)	0.0171*** (0.000)	0.0340*** (0.000)	0.0270*** (0.000)	0.0212*** (0.000)	0.0201*** (0.000)	0.0306*** (0.000)
<b>Treatment Effect (%)</b>	<b>9.1</b>	<b>13.1</b>	<b>15.4</b>	<b>7.5</b>	<b>8.6</b>	<b>11.1</b>	<b>12.3</b>	<b>8.2</b>
Observations	666	666	666	663	666	666	666	663
Adjusted R <sup>2</sup>	0.829	0.828	0.833	0.832	0.697	0.696	0.699	0.699