# Insider Share Pledging, Managerial Risk-Taking, and Corporate Policies [*][†]

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### Abstract

Firms expend considerable resources, including designing an appropriate incentive structure, to mitigate the potential conflict of interest between firms' executives and shareholders. By altering the incentives of ownership, pledging can affect risk-taking choices made by management. The practice of share pledging, wherein insiders pledge their shares as collateral for personal loans, has the potential to misalign the incentive structure of management. For example, because pledged shares are subject to margin calls, it may incentivize management to undertake less risky projects than what is optimal for shareholders. By employing a unique sample of share pledging by management in U.S. firms, this paper documents that the practice of insider share pledging affects risk-taking in a negative way. This, in turn, subsequently impairs firms' growth opportunity and shareholder wealth. This paper also links the share pledging to firm's earnings management, as proactive CEO pledgers may be concerned about the involuntary sale of shares, they may level up the use of the earnings management to support the stock price temporarily in the hope to alleviate the margin call pressure. This paper further examines the role of the institutional investors and their capacity as external monitors and their ability to discipline and curb the practice of the share pledging and protect the shareholder value. Overall, this research's findings inform the regulatory debate on the need to provide detailed disclosure and further restrict the share pledging by managers.

# 1. Motivation

The issue on ownership structure of firms' large controlling shareholders has attracted much attention as a subject of considerable research and discussion[1]. One primary feature of managerial ownership is to mitigate the conflict interest between firms' executives and shareholders by aligning the incentives of the two parties (Jensen and Meckling (1976), Morck et al. (1988), McConnell and Servaes (1990), and Mehran (1995)). An abundance of literature predominantly focuses on equity-based compensation, paid in the form of restricted stock, options, and other vehicles whose value is largely associated with firms' future stock returns. Essentially, this growing stream of research has been seeking to establish the relation between equity-based incentive and performance. Under the incentive-alignment view, incentive-based compensation gives firms' Chief Executive Officers (CEOs) and top management a significant stake in their firms (Amihud and Lev (1981) and Hall and Liebman (1998)). However, since CEOs are undiversified with respect to firm-specific wealth, these CEOs (top management team executives) are exposed to greater risk than diversified shareholders, who are assumed to hold diversified portfolios and value stocks. Compared to shareholders, it is more costly for firms' executives to bear the firm-specific risk.

Under the agency cost framework, the main cost of CEO incentives is the loss of diversification of their personal portfolio by forced exposure to huge firm's idiosyncratic risk. Accordingly, it is possible that firm executives seek to derive private benefits from hedging or diversifying their positions that may alleviate the asset volatility associated with their personal wealth[2]. This "undo" of equity-based incentive could potentially exacerbate agency conflicts and influence firm's risk-taking and shareholder wealth (see: Knopf et al. (2002), Garvey and Milbourn (2003), Adam and Fernando (2006), John et al. (2008), and Armstrong and Vashishtha (2012)). To mitigate the risk caused by large undiversified position, firm insiders can pledge their shares for bank loans[3] and thereby leverage their investment outcome without diminishing the ownership of those shares.

In general, share pledging refers to executives who utilize beneficially owned shares as collateral to obtain a personal loan. This practice has been observed worldwide but is especially prevalent in emerging markets[4]. From the perspective of the firm's executive, pledging may be motivated by several considerations. The CEO or insider can achieve financial diversification by virtue of the practice of pledging, which provides them liquidity without selling the pledged shares. Additionally, pledgers "monetize" the equity ownership without diminishing their voting rights, which essentially translates to the misalignment of incentives of executives

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[1] Significant works include: Morck et al., 1988, La Porta et al. (1999), Claessens et al. (2002), Masulis et al. (2011).

[2] There are different types of hedges and pledges, including pledged shares, prepaid variable forward, zero-cost collar, exchange traded funds, and equity swaps. This paper primarily focuses on pledged shares.

[3] This study will employ the term "share-pledging" hereafter to capture insiders' behavior that they pledge personal beneficial shares as collateral for bank loan.

[4] Extant academic studies pertaining share pledging primarily focus on emerging markets, say, India, China, Taiwan, etc., due to the feature that family-controlled firms are more common among these countries (see, Masulis et al. (2011)).

and shareholders (Shleifer and Vishny (1997)). Another motivation for executive insiders to pledge is that share pledging can be more tax-efficient (Larcker and Tayan (2010)), since they are allowed for the deferral of gains toward future[5]. However, from the perspective of the outside shareholder, share pledging by insider executives could be disastrous to a firm. The pledging of firms' stocks may have a detrimental impact on shareholders if stock's beneficial owner is forced to sell the shares to meet a margin call. The forced sale of significant company stock could negatively impact the company's stock price.

Before 2006, the disclosure of firms' share pledging was voluntary. In February 2006, the U.S. Security Exchange Commission (SEC) cited a report[6] commenting that loans extended to WorldCom's former-CEO, Bernard Ebbers, were collateralized by his beneficial stock and eventually contributed to the company's downfall, which, in turn, triggered the U.S. SEC's subsequent regulatory changes on the share-pledging disclosure requirement. After 2006, the SEC required disclosures of share pledging associated with directors, director nominees, and named executive officers in the beneficial ownership table footnotes in the annual proxy statement (DEF14-(a)) on a person-by-person basis and by groups (SEC 2006)[7] [8]. Executives need to sign the "Executive Stock Pledge Agreement" to pledge shares[9].

Specifically, the SEC requires that companies disclosing voting securities beneficially owned by more than five percent holders and company equity securities beneficially owned by directors, director nominees and named executive officers. The intention of these disclosure requirements is to give investors the information regarding concentrated holdings of voting securities and management's equity stake, including stocks for which holders have the right to acquire beneficial ownership within 60 days.

> "...As proposed, we are amending Item 403(b) by adding a requirement for footnote disclosure of the number of shares pledged as security by named executive officers, directors and director nominees. To the extent that shares beneficially owned by named executive officers, directors and director nominees are used as collateral, these shares may be subject to material risk or contingencies that do not apply to other shares beneficially owned by these persons. These circumstances have the potential to influence management's performance and decisions. As a result, we be-

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[5]Tax on gains are supposed to be due on at the time when shares are sold, whereas no tax is imposed when pledging takes place.

[6]A report written by a former chairman of U.S. SEC, Richard C. Breeden, "Restoring Trust: Report to The Hon. Jed S. Rakoff, the United States District Court for the Southern District of New York on Corporate Governance for the Future of MCI, Inc" which is available on the SEC Archive website: https://www.sec.gov/Archives/edgar/data/723527/000119312503044064/dex992.htm

[7]From 2006, despite firms are required to disclose the number of shares being pledged, regulations do not require pledgers to disclose the uses of proceeds.

[8]see: Executive Compensation and Related Person Disclosure: Final Rule and Proposed Rule, 71 FR 53158. Available: http://www.sec.gov/rules/final/2006/33-8732a.pdf and http://www.gpo.gov/fdsys/pkg/CFR-2011-title17-vol2/pdf/CFR-2011-title17-vol2-sec229-403.pdf

[9]SEC's "Executive Stock Pledge Agreement" https://www.sec.gov/Archives/edgar/data/1518222/000119312511099707/dex1012.htm

*lieve that the existence of these securities pledges could be material to shareholders. (p.p. 145) [2006 SEC Executive Compensation and Related Person Disclosure]*"

In the 2006 amendment to the disclosure requirements, the SEC began to implement following regulatory requirement:

"*... a company will be required to disclose named executive officer, director and director nominee pledges of securities, and directors' full beneficial ownership of equity securities, including directors' qualifying shares. The company can inquire as to this information in questionnaires it already circulates to the company's officers and directors. (p.p.250) [2006 SEC Executive Compensation and Related Person Disclosure]*"

After 2008, the Dodd-Frank Wall Street Reform and Consumer Protection Act came into law in 2010 (U.S. Senate and House of Representatives 2010). The act requires the Security Exchange Commissions to provide rules and guidelines for companies to disclose their policies related to hedging and pledging of company shares by employees and directors. However, the Security and Exchange Commission did not make much progress on the issue.

In 2012, Institutional Shareholder Services (ISS) issued its initial recommendation on share pledging. The ISS recommends that companies should implement a policy prohibiting firm executives from the engagement of hedging and pledging. In a survey conducted by the ISS, 49% and 45% of institutional and issuer respondents, respectively, indicated that share pledging by executives or directors is significantly problematic. Only 13% and 20% of institutional investors and issuers responded that pledging is less of concern. Therefore, both investors and issuers view pledging of company shares as a problematic issue worth public attention[10]. So far, in India, Taiwan, Singapore, the U.S., and the U.K. require the disclosure of pledges by insiders. In the U.S., it can be found that many companies currently may have already implemented rational policies on the restriction of insider pledging and hedging (see examples provided in Exhibit 1A and Exhibit 1B).

The degree of current disclosure of share pledging by executives varies from firm to firm. Exhibit 2A and Exhibit 2B provide some examples. For instance, BioMed Realty Trust (in Exhibit 2B) uses the term "non-purpose loan" in the footnote of the beneficial ownership table to capture the use of the loan proceeds, without providing readers any further information. On the other hand, Super Micro Computer Inc. (in Exhibit 2A) clearly states the shares are pledged for "personal credit line" along with the detailed disclosure of share pledging information associated with executive's family members.

Given the controversial nature of the practice, this research aims to inform regulatory parties of the importance and necessity of disclosing detailed information on a firm's pledging activity.

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[10]https://www.issgovernance.com/file/files/2013ExecutiveSummary.pdf

Motivated by the potential agency conflicts between shareholders and firm executives (namely, insiders), this paper investigates whether the practice of insider share pledging affects firm's risk-taking, which, in turn, translates to the reduction of firm performance and overall shareholder wealth. The unique aspect of share pledging is that it changes pledger's payoff structure without altering the control rights. Once a firm's executive begins to pledge[11], stock price declines become more critical to them due to the risk of margin calls. On the other hand, pledging can alleviate executives' concentrated exposure of personal wealth, which engenders excessive risk aversion, ultimately, leading to a desire to reduce risk and avoid bankruptcy. If shares are pledged, severe price falls may result in insiders being forced to sell shares, which translates to higher chances of losing voting control. This paper argues that fearing the downside margin call risk, executives reduce their risk-taking and may pass up profitable opportunities that are risky[12]. This article hypothesizes that, through the incentive-weakening channel, the higher level of pledged positions leads to conservative investment and financial policies. Accordingly, these forgone investment opportunities could be reflected in weaker firm performance and valuation among firms that have pledged shares.

To test the incentive-weakening and value-reducing hypothesis, this paper employs a hand-collected U.S. sample of share pledging from 2006 to 2015 and investigates the share pledging impacts on a series of firms' decision outcomes and firm value. To identify the incremental average treatment effect of share pledging on decision outcomes and alleviate endogeneity, I adopt propensity score matching and bias-corrected nearest neighbor matching approaches throughout the analysis. Controlling for a series of matching covariates, I estimate the share pledging effect on the investment outcomes.

Results show that firms with pledged holdings reduce the investment in R&D but increase the investment in CAPEX - a reallocation of asset - from riskier investment to less risky investment. However, on the financing side, no supporting evidence can be captured from both the baseline OLS tests and matching tests. We further found that this counter-intuitive insignificance is sourced from the non-linear relationship between the firm leverage and insiders' pledged shares. From a series of nonlinearity tests and threshold estimations, we predict an inverse-U shape relationship between the pledge ratio and firm leverage. Once the share pledging level goes beyond a certain threshold, the significant negative impact of share pledging on leverage can be captured. Lastly, both baseline tests and matching estimations show that insider share pledging could lead to weaker firm performance and lower firm value as reflected in the reduction in the firm's ROA and Tobin's Q. Results of this paper are consistent across a series of endogeneity and robustness tests. Overall results show that the monetization of the ownership by insider pledgers could be value-reducing to the shareholders.

Further, we then turn to link firm's pledging to the earnings management, where we propose that the pledging firms may opportunistically increase the use of accruals in response

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[11]Lin et al. (2018) provide evidence that, under the lender's perspective, bank issue loans with higher prices for companies where large shareholders or managers possess high private benefits of control.

[12]This is similar to the line of reasoning presented in John et al. (2008).

to the potential margin call to alleviate the selling pressure temporarily. Results show that firms with higher level of pledged shares tend to have a higher level of discretionary accruals. We further identify that this price-supporting earnings management will be governed by the presence of institutional investors and financial analysts, who served as a strong force of external monitoring. Then, I proceed to investigate the monitoring role of institutional investors on the share pledging. If the pledging misalign the incentive structure of the management and produce value-reducing outcomes, large institutional investors may restrain and deter this conduct as it diverges from the interest of the shareholders. Specifically, this research finds out that firms that are associated with larger institutional ownership has lower pledge ratio.I further identify that institutions' heterogeneous investment horizons entitle investors different abilities to discipline the practice of pledging. The monitoring effect is primarily sourced from the long-term institutional investors who are associated with lower information-gathering cost, and this effect is particularly pronounced among firms that have higher insider ownership.

The rest of the paper is organized as follows. Section 2 discusses the relevant literature. Section 3 presents the hypotheses of this paper. Section 4 describes the data collection and the sample. Section 5 presents the discussion on the share pledging and firm policies and how it affects firm value. Section 6 presents a discussion on the price supporting mechanic through earnings management. Section 7 discusses the institutional investors' monitoring role on the share pledging. Section 8 discusses how the presence of external monitors alter the share pledging impacts on firm's decision outcomes. Section 9 presents the summary and discusses the potential future directions of the research in the area of share pledging.

## 2. Literature Review

According to traditional agency theory, equity-based incentives are powerful tools in alleviating agency problems that are inherent in the separation of ownership and control (Fama and Jensen (1983)). Seminal work of Jensen and Meckling (1976) analyzes the conflicting interest between shareholders and corporate managers and demonstrate that to reduce the agency costs, managers' incentives should be linked to shareholder value. Since the work of Jensen and Meckling (1976), a considerable amount of research has been done on understanding the relationship between incentive alignment mechanisms and the firm's corporate policies and shareholder impact. Several papers, including Morck et al. (1988), Cho (1998), and Himmelberg et al. (1999), examine the link between equity ownership and firm's value and performance under the incentive-alignment framework. Morck et al. (1988) find that ownership structure is positively related to sharing value but when the equity ownership of large shareholders exceeds a certain level of threshold, they will gain almost full control over the firm and they may prefer to extract private benefits at the expense of minority shareholders. Smith and Stulz (1985) argue that to complement equity ownership incentives, stock options serve as a good solution to resolve the risk-related agency problem by compensating risk-averse managers since the convexity feature of stock option's payoff largely mitigate managers' risk aversion. Murphy (1999) provides comprehensive documentation that stock option form of compensation increased largely during the 1990s and is consistent with firm value maximiza-

tion. Its incentive alignment view on options is supported by subsequent research. Core and Guay (1999) show that optimal portfolio of equity-based incentives varies with economic determinants such as firm size, growth opportunity, monitoring costs, etc, and contends that firms actively set optimal level of incentives in a manner that is consistent with contracting theory. Himmelberg et al. (1999) investigate the determinants of managerial ownership and the link between ownership and firm performance on the premise that the owner needs to decide how to allocate equity to managers to align incentives for firm's value maximization. They make the point that it is unknown whether greater incentives are associated with better performance or whether better-performed firms tend to allocate more ownership.

There is a wide variety of literature examining the association between equity-based incentives and firms' investment, misreporting, earnings management, etc. Mis-incentivized firm executives could be myopic and make value-reducing decisions to the firm. Typical research pertaining to misalignment of incentives focus on earnings management, suboptimal strategy on corporate investment, acquisition, etc. Different from pay-for-performance compensation, share-pledging is a potential channel for firms' executives to alter their cashflow payoff under little scrutiny from outside shareholders. The risk-taking incentives could be correspondingly affected by the practice of share-pledging. Therefore, the results of this paper could have significant implications for the literature of managerial risk-taking incentives.

Another line of literature that is relevant to this study is the role executive's inside debt. Inside debt primarily refers to the future obligation of the firm to executives, for example, pension benefits and deferred compensation etc. Relevant studies include: Edmans and Liu (2011), Wei and Yermack (2011), Cassell et al. (2012), and Liu et al. (2014). These studies are related to this research because: first, executive inside debt also reflect future payment to the owners and it is an important debt-like claim to diversify executive positions, like share pledging to allow executives to undo some of the equity incentives; second, inside debt could potentially alter the risk-taking incentives of firm executives. Currently, most of the inside research agrees upon that inside debt will lead to a reduction of firm risk-taking and destroys enterprise value. Specifically, Cassell et al. (2012) hypothesize that there is a negative association between CEO's inside debt holdings and the firm risk (captured by the volatility of future firm stock returns). Further, they predict that reduced risk-taking incentives engendered by the inside debt will lead to the reduction of R&D expenditures investments, an increase in firm's diversification, an increase in working capital and a decrease in financial leverage. Liu et al. (2014) provide evidence that CEO inside debt holdings are higher in more weakly governed firms, which indicates that CEO debt-like compensation contributes to the conflicts between bondholders and shareholders. Similar with Cassell et al. (2012), the starting point of Liu et al. (2014) is the assumption that inside debt triggers a larger degree of risk aversion and leads to conservative firm policies. Their primary hypothesis is that CEOs that are associated with more inside debt holdings will tend to hold higher cash balances to reduce the asset volatility and preserve the value of their debt-like compensation; whereas in poorly governed firms, firm managers tend to spend cash rather than build cash reserves.

To the extent that inside debt holding may lead to conservative firm policies, insider share

pledging has similar characteristics in terms of the reduced risk-taking incentives characterizes by the margin call risk. Therefore, this paper considers that insider share pledging may produce similar corporate outcomes documented in Cassell et al. (2012).

Studies directly related to the share pledging are still rare. Most extant research is based on samples from emerging markets. In general, research agrees upon that insider share pledging could produce outcomes that hurt shareholder benefits. By looking at a Taiwanese sample consisting of controlled firms and widely held firms, Dou et al. (2019) document that through the crash risk channel and reduced risk tolerance channel, shareholder wealth is negatively affected by firm managers' pledging. Wang and Chou (2018) show that firms associated with insider pledging experience greater stock returns after Taiwan's regulatory change that reduces the pledging incentives, they also find that insider share pledging effect is more pronounced when the board has small shareholdings, indicating that pledging along with the small director shareholdings could lead to severe agency problems. Singh (2017) contends that insider share pledging has both a bright and a dark side because share pledge for firm loans can provide firms with better access to external finance and improve their valuation despite the increase in bankruptcy risk. The central arguments of Singh (2017) are that share pledges for personal loans create a diversion between control and cashflow rights but the pledge for firm loan improve creditor rights and align incentives of the lenders and controlling shareholders. This research is based on the sample from India, an economy consisting of many family-controlled firms and one in which the data on loan proceeds are available. Anderson and Puleo (2015) contributes to this literature by looking at insider share pledging effect on firms' total risk and firm equity specific risk. They capture that practice of pledging indeed increase the firm's contingency risk. To my knowledge, Anderson and Puleo (2015) is the only research so far that employs U.S. sample.

Based on the evidence from different markets, current research unanimously agrees on shares pledged for personal loans may trigger greater margin call risk and raise companies' exposure to negative price shocks along with a variety of unintended outcomes. Specifically, Dou et al. (2019) documents that pledging announcement incur significant negative market reactions, and the market reaction is proportional to the magnitude of share pledging. They assume that shares are pledged all for personal loans. The primary line of reasoning is that once a personal loan is collateralized by the firm's stock, a significant share price fall will trigger a margin call to the executive for more supply of capital. Despite the alleviation of pledger's personal liquidity concerns, the firm could be encountered by increased crash risk (they term this effect as crash risk hypothesis). Additionally, they hypothesize those firm insider executives will reduce their risk tolerance after the pledge to lower the firm risk and avoid potential bankruptcy. Taking advantage of Taiwanese data, they use pledge disclosure as event dates and conduct an event study on investor's reaction (measured by $CAR_{[-1,+1]}$ centered on the pledge announcement date). Due to the heterogeneous feature of the Taiwanese firm's organization structure, they also conducted a subsample analysis by looking at widely-held firms and controlled firm (firms with one controlling holder). They further use the 2008 financial crisis as an exogenous shock to alleviate the endogeneity issue when testing the crash risk hypothesis and conclude that share pledging is value-reducing to shareholder wealth.

Similar to Dou et al. (2019), Anderson and Puleo (2015) investigate the share pledging impact under the risk perspective as well. They document an increase of firm risk and firm-specific risk (measured by volatility of firms' daily return and volatility of firms' daily abnormal return, respectively ) engendered by the share pledging by looking at a subsample from U.S. S&P 500 firms. They further document a significant negative effect of share pledging on return skewness, along with a significant positive effect on kurtosis[13]. They also use the financial crisis as exogenous shock and implement a difference-in-difference study on to separate the effects of share pledging on firm risk from pledgers' demand for share pledges to exploit inside information in opportunistic hedging. They hypothesize that the share pledging effect on increasing firm risk and firm-specific risk will be more pronounced among firms with share pledging after the financial crisis. Their findings of increased firm-specific risk potentially imply that pledging may alter managerial risk-taking incentives.

# 3.    Hypothesis Development

It is apparent that share pledging has the potential to create a wedge between the cashflow and control rights, which can lead to the misalignment of interests of executives and those of shareholders (Shleifer and Vishny (1997)). Insider executives pledging their personal equity stakes may alter the incentives of ownership and thereby generate differ risk-taking decision-making outcomes.

## 3.1.    Incentive-weakening Hypothesis

In order to mitigate the downside risk triggered by the margin call associated with pledged shares, it is interesting to ask: does the firm's executive become less risk-tolerant and take more conservative investment and financing policies? Since pledged shares may potentially engender the margin call risk, incentive-weakened executives may seek to reduce the firm specific volatility, as reflected in more conservative financial and investment policies (e.g., reduced leverage, higher cash balances, lower investment in R&D, etc.).

On the investment side, I use firm's CAPEX, R&D expense, acquisition to capture firms' investment decision. A properly incentivized executive should increase the level of investment and financing (Guay (1999) and Coles et al. (2006)). Gormley et al. (2013) present causal evidence that under the angle of material risk associated with managerial incentives, less incentivized CEOs tend to reduce the investment, particularly cutting R&D and engaging in diversify acquisitions. They observe that external exogenous shock that changes a firm's risk will lead to CEO's reduced willingness to take the risk and associated with a decline in the

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[13]Negative skewness indicates a distribution with frequent small gains in conjunction with occasional extreme losses, whereas kurtosis captures the likelihood of observing an extreme return relative to the firm's return distribution; higher kurtosis suggests a greater chance of extreme returns.

desired level of investment along with building up cash holdings. This study considers share-pledging is similar in spirit to the material risk view[14] presented in Gormley et al. (2013) and that material risk incurred by pledged shares would dampen managerial incentives on investment.

This line of reasoning can also be applied to the firm's financial policy, reflected in the level of cash holdings and financial leverage. Cash holding literature argues that cash can be regarded as a negative NPV project since the interest income is associated with a tax disadvantage (Opler et al. (1999)), and cash balance reduces firm asset volatility. Tong (2010) documents that the marginal value of cash holdings is higher in firms with higher CEO incentives and higher risk-taking incentives lead to a lower level of cash balances. Liu and Mauer (2011) and Liu et al. (2014) provide evidence between cash holding levels, equity compensation incentives, and debt-like incentives respectively. Liu and Mauer (2011) find that cash holding is positively associated with the risk-taking incentive (vega), which is the opposite of other risk incentive effects, and attribute it to firms with higher risk incentive are likely to be financially constrained and thus build up additional cash for hedging concern. Liu et al. (2014)'s central argument is that cash holdings are higher among firms that have greater inside debt (debt-like incentive), which likely lead to conflicts between shareholders and debt holders. In this research, we consider that if the incentive-weakening argument holds, one should expect pledgers to increase the firm's cash balances seeking to reduce asset volatility due to the margin call concern. Similarly, a reduced overall financial leverage should be expected, since lower financial leverage is a direct proxy for the firm's conservative financial policy (Coles et al. (2006) and Gormley et al. (2013)). Chava and Purnanandam (2010) show that CEOs' risk-decreasing incentives are associated with lower leverage and overall higher cash balances. In the spirit of Coles et al. (2006) and Cassell et al. (2012), one should expect that a less incentivized firm executive may adopt lower financial leverage in conjunction with the increased riskiness of the firm. The above discussion leads to the following hypotheses:

*HYPOTHESIS 1a*: Compared to firms that have no pledged shares, pledging firms will undertake more conservative investment policies.

*HYPOTHESIS 1b*: Compared to firms that have no pledged shares, pledging firms will undertake more conservative financial policies.

*HYPOTHESIS 1c*: Higher the share pledge ratio, the more conservative investment policies followed by the firm.

*HYPOTHESIS 1d*: Higher the share pledge ratio, the more conservative financial policies followed by the firm.

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[14]Gormley et al. (2013) use terms left-tail risk and material risk inter-changeably.

## 3.2.  Value-reducing Hypothesis

Through the incentive-weakening channel, insider share pledging could be value-reducing to the firms due to the forgone positive NPV projects. If the risk-taking incentives of executives are altered by share pledging, it is reasonable to expect that risky but profitable investment opportunities are potentially passed up, along with other conservative policies, which eventually impair firms' value and future growth. Following the incentive-weakening hypothesis, we further propose the following hypothesis.

> *HYPOTHESIS 2a*:  Compared to firms that have no pledged shares, pledging firms exhibit weaker performance and lower value.

> *HYPOTHESIS 2b*: Higher the share pledge ratio, the weaker the firm performance and the lower the firm value.

## 3.3.  Price-Supporting Hypothesis

In addition to the pledging impacts on corporate decisions, it is conceivable that concerns over margin call may induce firm executive pledgers to undertake price supporting actions to maintain the firm share price at a reasonable level. One mechanism is through the earnings management to inflate the share price temporarily. The use of discretionary accruals for earnings manipulation can temporarily alter the reported earnings (Dechow et al. (1995), Bergstresser and Philippon (2006)) to opportunistically boost share prices. Teoh et al. (1998a) and Teoh et al. (1998b) showed that IPO and SEO opportunistically use earnings management during the pre-issue period to obtain high equity prices. Kim and Park (2005) confirm this finding by providing an issuer's greed hypothesis that SEO firms that aggressively push up the offer price through accruals will lead to a decrease of underpricing. This research suggests that earnings management could be a possible channel to maintain the stock price under the margin call pressure. Incentivized executives are more likely to manage their accruals in a more aggressive manner.

Thus, consistent with the incentive weakening channel, this research also asks, do firms try to take price supporting actions to maintain stock price on a certain level to avoid the margin call? Particularly, whether the earnings management is adopted by executive pledgers to alleviate margin call pressure? This leads to the fourth hypothesis of the research:

> *HYPOTHESIS 3*: Higher the share pledge ratio, the higher the level of the earnings management adopted.

## 3.4.  Monitoring Hypothesis

Corporate governance related concerns associated with firms' insider share pledging have also caught the attention of institutional investors. As discussed earlier, the survey conducted by

Institutional Shareholder Services in 2012 demonstrates that around half of all the responding institutional investors in the U.S. regard insider pledging as a problematic governance issue. The growth of institutional investors' equity ownership sparked their indispensable role in corporate monitoring and governance (Black (1992) and Gillan and Starks (2007)). Shleifer and Vishny (1989) and Shleifer and Vishny (1997) that large sophisticated institutional investors tend to have the incentive to collect information and monitor corporate management by virtue of their large holdings because they can achieve greater benefits than individual investors from monitoring corporations. Thus, institutional investors are likely to be incentivized and to take up the monitoring role. Black (1992) documents that one area institutional monitoring can add value is the discouragement of corporate diversification which is value-reducing. Recent research Harford et al. (2017) shows that monitoring institutional investors restrain firm misbehavior and lead positive corporate decision outcomes through both "voice" and "exit" and their interactions (McCahery et al. (2016)).

> *HYPOTHESIS 4*: Share pledging effects are weaker among firms that are associated with higher levels of institutional ownership.

# 4. Data and Sample

Currently, most of the current research that is directly related to share pledging employs samples from emerging markets. In Taiwan and China, share pledging disclosures are mandatory for all listed firms on the markets. Once a corporate insider pledges stocks as collateral for loans, regulations require that the company promptly disclose all the details of the pledge to the market. In China, regulations demand firms provide the date of the pledge, the nature of the pledger, the pledge ratio of large shareholders, and detailed use of the loan proceeds. In both markets, there are integrated databases providing share pledging information.[15] Similarly, in India, the Securities Exchange Board of India (SEBI) requires the disclosure of share pledging. Information can be found in the Prowessdx Database[16]. However, there is no integrated database providing detailed information on the share pledging in the U.S. And the disclosure of the use of the loan proceeds is not mandatory. These data availability issues create challenges for the study of share pledging in the U.S.

This paper employs unique hand-collected data taken from the firm's DEF-14(a) proxy statements. The pledging-relevant information is usually disclosed in the footnotes of the beneficial ownership section. It would be a labor-intensive endeavor to read through every firm's DEF-14(a) proxy statements each year to obtain relevant pledging information. To make the task manageable, I employ a two-step filtering process. I start off with the S&P

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[15]Pledging data can be fetched from TEJ and WIND databases respectively. Taiwan Economic Journal (TEJ) Database: http://www.finasia.biz/ensite/Database/Taiwan/MarketProfile/tabid/121/language/en-US/Default.aspx Wind Data Feed Services for Chinese market: http://www.wind.com.cn/en/data.html

[16]Prowessdx: https://prowessdx.cmie.com/

1500 environment and implement searching by DirectEdgar. I use the textual search capability in DirectEdgar to narrow down the search and extract context around the searched content, which uses words/phrases or basic search queries to identify relevant texts and tables in the documents list. Specifically, it has the following advantages that serve the need of this paper: i). it has a strong search engine to filter searches based on CIK list created outside of search; ii). it can filter searches based on either filing or confirmed dates. iii); it can drill down into specific document types associated with any filing and extract table and context around search contexts.

Specifically, raw data are searched from DirectEdgar with keyword: "CEO w/25 pledg*", "pledg*" over the time frame: 2006-2015. (I extract a firm list from execucomp and merged to compustat to get a distinct CIK list. Then upload it to DirectEdgar to do the search). The first step of the filtering procedure yields around 6000 firm-years that are potentially relevant to share pledging. The readability of the raw result directly extracted from DirectEdgar is limited. It is hard to identify who the current executives are and how many shares are pledged since the information presented in the table (including in the footnotes) become unreadable once it is converted into text environment.

On the second step, based on the filtered results, I use each firm's report date (RDATE) and CIK to manually collect and verify share pledging information of each firm each year from SEC EDGAR company fillings[17] by reading the footnotes of beneficial ownership tables in original proxy statements. The degree of current disclosure of share pledging by executives varies from firm to firm. Exhibit 2A and Exhibit 2B provide some examples. For instance, BioMed Realty Trust (in Exhibit 2B) adopts the term "non-purpose loan" in the footnote of the beneficial ownership table to capture the use of the loan proceeds, without providing readers any further information. Super Micro Computer Inc. (in Exhibit 2A) clearly states the shares are pledged for a "personal credit line" along with the detailed disclosure of share pledging information associated with executive's family members. Therefore, at this point, to conduct research based on the U.S. sample is challenging, since the use of the loan proceeds is not clearly disclosed by all the firms. To a large extent, companies currently tend to shelter this type of information.

In most cases, if a CEO does pledge, the footnotes of the beneficial ownership table will disclose how many shares he or she pledges. I document how many shares that are beneficially owned and the total amount of shares that are being pledged. Many firms have multiple pledgers at the same time, I also record whether firm's top management members are involved in the share pledging activity and document whether the company has a strict policy to prohibit the practice of share pledging or not. For firms that have dual-class share structure (for limited sample size), I aggregate the number of shares pledged and total numbers of beneficial shares. In some firms, it is disclosed that CEO's direct family member (e.g., spouse) also engages share pledging activity. In this case, I treat these pledged shares to be associated with firm's CEO. If the firm just discloses the total value of the shares pledged by the executives,

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[17]U.S. Securities and Exchange Commission EDGAR website https://www.sec.gov/edgar/searchedgar/companysearch.html

I use the share price on CRSP to manually back out the pledge ratio.

Following the data collection process above, this research employs a sample of both pledging and non-pledging firms. Non-pledging firms are matched on a set of firm characteristics that potentially affect the pledging decision, including firm size, market to book ratio, volatility, ROA, R&D, sales growth, institutional ownership, insider ownership, CEO age, CEO tenure, and industry. I use one-to-one exact match without replacement. The matching diagnostics are presented in the appendix. After the matching, the final CEO pledgers sample includes 678 firm-year observations whereas the multi-pledger sample consists of 1,794 firm-year observations.[18] Table 1 present the summary statistics of firm characteristics for both the pledging firms and non-pledging firms.

[Insert Table 1 Here]

Concerning the possibility that firms' decision outcomes might by industry-driven, I calculate the industry distribution of share-pledging firms and the mean pledge ratio across industries based on Fama-French 12 industry classification (presented in Figure 1). 22.5% of the pledging firms are high-tech firms, followed by the service industry and healthcare industry. In terms of the level of shares pledged, the average of the full sample pledge ratio is 30%. Firms in the manufacturing industry, on average, pledge 60%, followed by durable industry with a mean of 55%.

[Insert Figure 1 Here]

# 5. Pledging, Corporate Policies, and Firm Value

To specifically identify the incremental effect of share pledging on corporate decision outcomes and alleviate the endogeneity, I implement two matching approaches testing the pledging firms and non-pledging firms to establish the pledging treatment effects. The first method adopted is propensity score matching (Rosenbaum and Rubin (1983) and Armstrong and Vashishtha (2012)). I first estimate a probit regression capturing the probability (i.e. propensity score) of each potential peer being chosen given a set of firm characteristics.

$$Prob(PLEDGE_{(0,1)} = 1)_{i,t+1} = \beta_{i,t}\mathbf{X}_{i,t} + \delta_t + \eta + \epsilon_{it} \tag{1}$$

Then I identify a potential control sample observation that has the closest propensity score that hasn't been matched. Using this matching procedure, we calculate the average treatment effect of share pledging on the firm's corporate decision outcomes. We identify the matching from without replacement so that a non-pledging firm could be matched only with one chosen observation for a given firm given year. As an alternative approach, I employ bias-corrected nearest neighbor matching (Abadie and Imbens (2006) and Chava et al. (2017)). Compared to the PSM approach, the nearest neighbor matching (NNM) does not specify a formal model

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[18]In this research, I employ two alternative share pledging samples, CEO pledger sample and top-management-team (TMT) multi-pledger sample for robustness.

for either the outcome or the treatment status and is achieved by calculating the distance between pairs of pledging observations with regard to a set of covariates and then matching each subject to comparable observations that are closest to it. It imputes the missing potential outcome for each subject by using an average of the outcomes of similar subjects that receive the other treatment level. The similarity between subjects is based on the weighted function of the covariates for each observation. The treatment effect is computed by taking the average of the difference between the observed and imputed potential outcomes for each subject. The adoption of PSM and NNM allows me to specifically identify the average treatment effect of share pledging on firm outcomes.

To test the incentive-weakening hypothesis, I further examine the impact of share pledging on the firm's investment and financial policy outcomes by using the panel regression. Investment policy is proxied by firm's capital expenditures, research and development expenses, and acquisitions to proxy the to investment outcomes. On the financing side, I employ book leverage, market leverage, net leverage and cash holding to capture firms' financing decision outcomes[19]. The panel regression tests are specified as follows.

$$Y_{i,t+1} = \alpha PLEDGE_{i,t} + \beta \mathbf{X}_{i,t} + \delta_t + \eta + \epsilon_{i,t} \tag{2}$$

The variable of interest is the pledge ratio, $PLEDGE_{i,t}$, constructed as the ratio of the number of pledged shares to the total amount of shares that are beneficially owned. The dependent variables are measured in the year $t+1$ to alleviate the reverse causality issue. The sample period is from 2006 to 2015. In all the regression tests, all continuous control variables are winsorized at $1^{st}$ and $99^{th}$ percentiles to mitigate the impact of outliers. Year effects and industry fixed effects are included to control for industry characteristics and macroeconomic variation over time to address the possibility that there are omitted variables. Year effects and industry fixed effects are denoted by $\delta_t$ and $\eta$ respectively. $\epsilon_{it}$ denotes the error term. Throughout the regression tests, standard errors are clustered at the firm level.

## 5.1. The Association Between Share Pledging and Investment and Financing

To test Hypothesis 1 and investigate the treatment effect of share pledging on firm's investment policy and alleviate the endogeneity, we employ both the propensity score matching (Rosenbaum and Rubin (1983)) and bias-corrected nearest neighbor matching (Abadie and Imbens (2006)) to establish the treatment effects of share-pledging, matched on a series of covariates that are defined earlier. To ensure the results are not subject to the matching variable selection, three sets of matching covariates are employed. Table 2 presents the results. As can be seen from the results, under the first matching set, the average treatment effect (ATE) of share pledging on R&D is -0.012, significant at 1% level. As more firm and CEO

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[19]I will primarily focus on the book leverage as Welch (2004) indicates that market leverage may change passively simply because of the change in stock price performance, and market leverage may more directly affect executives' incentives through its effect on volatility.

characteristics are included in the matching criterion, one can observe the negative effects of pledging on $R\&D$ are consistent across all three alternative matching criteria. Results in Table 2 also suggest a positive pledging effect on the $CAPEX$, which is significant across all the matching covariates as well. The results are held for both the propensity score matching and nearest neighbor matching estimation. However, no consistent evidence can be found on the acquisition policy. To a large extent, Table 2 and Table 3 confirm the incentive-weakening hypothesis that insider executives with pledged share positions will take conservative investment policies to alleviate the margin call pressures associated with pledged positions.

[Insert Table 2 Here]

To the extent that insider CEOs with pledged shareholdings prefer policies that leads to lower firm risk, one should expect that the coefficient on the share pledge ratio to be negative when the dependent variable is $R\&D$ and positive when the dependent variable is $CAPEX$, which indicates a re-allocation of risky assets throughout the investment process (Coles et al. (2006)). $R\&D$ is associated with higher risk compared to the capital expenditure investments, as the $R\&D$ is associated with more information asymmetry and is intangible in nature (Aboody and Lev (2000), Gatchev et al. (2009), Baxamusa et al. (2015)). CAPEX tends to be focused on the investments in fixed assets, such as property, plant and equipment, where the accounting rules treat it to be immediately expensed. Aboody and Lev (2000) claim that investments in $R\&D$ are expensed with little disclosure on the potential future cash flows. Beyond that, compared to CAPEX, $R\&D$ is associated with greater future stock return and earnings volatility (Kothari et al. (2002) and Coles et al. (2006)). To the extent that $R\&D$ expense represent investments that are less informationally transparent, it is legitimate to draw that an investment re-allocation form $R\&D$ to capital expenditure capture a risk reduction in the firms' investment decision-making process.

$$INVESTMENT_{i,t+1} = \alpha PLEDGE_{i,t} + \beta \mathbf{X}_{i,t} + \delta_t + \eta + \epsilon_{i,t} \tag{3}$$

The results of panel OLS tests implemented to investigate the first hypothesis are presented in Table 3. In panel regression tests, we present estimation results for univariate tests (Column 1) and estimation based on three alternative control sets (Columns 2-4). Share pledging impacts on $R\&D$ and $CAPEX$ are presented in Panel A and B respectively. The control variable set in this section includes firm size, as the size of the firm could be relevant to the riskiness of the firm investment (Pastor and Veronesi (2003)). Market-to-Book and sales growth ratio are included to capture the firm's investment, and growth opportunities (Coles et al. (2006)), as high growth firms may take on additional risks, and high growth firms are usually young firms that are likely having more difficulties to access the capital needed to finance risky opportunities. Insider ownership is included to control for the equity compensation. I further control the CEO's age and tenure as these characteristics could be relevant to the risk-taking (Berger et al (1997) and Coles et al. (2006)); CEOs with longer tenure, in general, tend to be entrenched and are associated with greater risk-aversion. Detailed variable definitions are provided in the appendix.

[Insert Table 3 Here]

In Table 3, throughout the baseline regression tests, it can be seen that the estimated coefficients on $PLEDGE\ RATIO$ are all negatively significant at 1% level across all the control variable sets. In Model 2 of Panel A, the full model, the pledging impact is -0.026 (t=-2.73), which indicates that one unit increase of pledge ratio would produce a reduction of $R\&D$ by 2.6%. This result is consistent with the findings in Model 1-3, showing that the insider CEOs with pledged shares may reduce the investment in the $R\&D$ spendings. Turning to the capital expenditure investment, it can be noted in Panel B that the share-pledging impact is positively significant in Model 3 but insignificant at conventional levels in the full control set specifications. Panel A and Panel B jointly show that insider executives with pledged shares may take conservative investment decisions as reflected in the reduction in $R\&D$ and the increase in $CAPEX$. This represents a re-allocation of capital from riskier $R\&D$ investment to less risky $CAPEX$, as $R\&D$ projects are inherently uncertain. Investments in $R\&D$ are expected to be associated with the huge information asymmetry about the project risk due to their intangible nature and disclosure quality. On the other hand, $CAPEX$ investments are associated with the more tangible fixed asset investment so that they are associated with less information asymmetry and less risk (Kothari et al. (2002) and Baxamusa et al. (2015)). Overall, given the prior discussion, both the matching test and Panel OLS test capture a risk-reduction in firms that have pledged shares.

Turning to the financial policy, executives with pledged shareholdings are expected to take a series of conservative financial policies to alleviate the riskiness of the firm and avoid the margin calls. To capture the financial decision outcome, I construct the book leverage, market leverage, net leverage (net of cash), and cash holdings. If the CEOs are properly incentivized, an increased leverage and decreased the level of cash holding should be expected (Coles et al. (2006), and Liu et al. (2014)).

In Table 3, Model 5-12, estimation tests of pledging effect on book leverage, market leverage, net leverage, and cash holding are presented in Panel C, D, E, and F respectively. If the incentive-weakening hypothesis holds, insider executives with pledged holdings may adopt conservative financial policies and thus we should expect a negative share pledging impact on leverage and a positive impact on cash holdings. Surprisingly, from the baseline OLS estimations, the signs of coefficients on all the leverage proxies are positive and no consistent significance can be found across all the model specifications (in Panel C, D, and E). In the cash holding test, model 11-12 of Panel D, the coefficients of the pledge ratio on cash holding are all negative, which are contradictory to the original incentive-weakening hypothesis. Even in the matching tests (Table 2), we found no evidence that supports the hypothesis and document no average treatment effect of share pledging on the financing outcomes.

### 5.1.1. Non-linear impacts on Financing

Though the finding of pledging impact on leverage and cash holding is counter-intuitive on its own, a perhaps more important question is what drives such results. One plausible explanation is that the relationship held for the share pledging and financing outcome is non-linear. For instance, the marginal effect of pledge share on CEO's risk-taking incentive sourced from the top thirty percent may be different from marginal effect sourced from bottom thirty per-

cent. A minimum amount of pledged shares may not be strong enough to alter executives' risk-taking. Despite CEO pledger's fear of forced exposure to sell shares, the margin call will only be triggered once the collateral value falls below certain pre-specified value. If this explanation holds, the negative impact of share pledging on financial policies will be in effect after the pledge ratio is beyond the certain threshold. What we cannot tell is the exact margin call share price, because it is subject to the loan requirements and unique to each firm. A quadratic fit of book leverage against the pledge ratio (presented in Figure 2 (a)) gives us an intuition. This inverse-U shaped relation suggests that CEO pledger's risk-taking incentives may not be linearly relevant to the pledged holdings, and the count-intuitive results presented earlier are likely to be driven by such non-linearity relationship.

If the true mean of the pledge ratio is not linear and the assumption about the functional form of the mean is incorrect, the estimates we obtained from OLS are inconsistent. To more rigorously identify such relation, I further implement the nonparametric estimation (Figure 2 (b) and (c)), which makes no assumption about the functional form of the relationship between the decision outcome and pledge ratio along with other covariates. The bandwidth is chosen to minimize the cost of the tradeoff between bias and variance as suggested by Li and Racine (2004) and Hurvich, Simonoff, and Tsai (1998).

[Insert Figure 2 Here]

The influence of the pledged holdings on leverage can be clearly seen in Figure 2 (d). To further visualize such nonlinear relation underlying the pledged shareholdings and the leverage decisions, I introduce the squared term of pledge ratio into the leverage regressions,

$$Y_{i,t+1} = \alpha PLEDGE_{i,t} + \gamma PLEDGE_{i,t}^2 + \beta_{i,t}\mathbf{X}_{i,t} + \delta_t + \eta + \epsilon_{it} \tag{4}$$

where $PLEDGE_{i,t}^2$ is the squared term of the pledge ratio. If the nonlinearity relation truly exists, in the traditional ols setting, one should expect that the sign on the coefficient of squared pledge ratio to be negative, Table 4 presents the share pledging impact on leverages when the squared term of pledge ratio is included. As can be seen, from model 1 to 3, the squared term of pledge ratio are all negative, around -0.6 to -0.9, significant at 1% level, across all three leverage alternatives, whereas the pledge ratios are all positively significant. I further implemented the U-test documented in Lind and Mehlum (2010) and find that the t-stats are all significant at 1% level, with extreme points of 0.520, 0.484, and 0.540 respectively. This finding confirms the underlying nonlinearity relationship between the leverage and pledged shareholdings.

Turning to the cash holdings, one should expect that CEOs with significant pledged shareholdings will increase cash holdings as firm leverage increases to hedge the risk of financial distress and further alleviate the margin call pressure. Inspired by Liu et al. (2014) who investigate the impact of insiders' inside debt on cash holding based on different leverage groups, I adopt a similar setup to explore how the CEOs' pledged holdings affect the cash holdings by grouping sample firms into zero, low, and high leverage groups.

Table 5 shows the share pledging impact on cash holdings when firms are classified into different leverage groups. Variables of interests are the interaction terms. In Table 5, note that in model 1 when the pledge ratio interacts with zero leverage dummy, it has a negative impact on cash holding (-0.638, significant at 1% level). When introducing high leverage dummy and interactions in model 2 and model 3, the share pledge impact turns out to be positive among high leverage groups, for instance, in model 3, the pledging effect is 0.254 (significant at 5% level). This finding indicates that the pledge ratio may lead the high-levered firm to adopt conservative cash holding policy and leverage clearly influences the relationship between the cash holdings and the pledge ratio.

A series of non-linear findings motivate me to further test the threshold of the share pledging impact. The square term of the pledge ratio used to capture the threshold impact of pledged shareholding imposes a priori restriction that the effect of pledging on financial policy monotonically and symmetrically increases and decreases with the level of pledged shares. It is plausible that a certain level of pledged holdings has to be attained before it can have any impact on the financial decision. Hansen (1999) and Hansen (2000) provides an econometric method to identify the threshold by sample splitting with grid bootstrapping. Here, I estimate the following model to capture the pledging threshold.

$$Y_{i,t} = \mu + \mathbf{X}_{i,t}(q_{i,t} \leqslant \gamma)\beta_1 + \mathbf{X}_{i,t}(q_{i,t} > \gamma)\beta_2 + \eta + \epsilon_{it} \tag{5}$$

where the $q_{i,t}$ is the threshold variable pledge ratio, $\gamma$ is a threshold parameter that divides the equation into two regimes with coefficients $\beta_1$ and $\beta_2$. Estimation procedure follows Hansen (1999). Table 6 presents the results. Column 1 is the results of the univariate test. As can be seen, when the pledge ratio is below the threshold, $\gamma$, 0.482, the coefficient of pledge ratio is 0.361 (t-value = 3.06), whereas the pledge ratio coefficient turns to -0.604 when it goes beyond 0.482. Even when controlling other firm characteristics, the nonlinear relation still holds. After the pledged share level attains the threshold, $\gamma = 0.492$, the pledging impact is -0.806, significant at 1% level, which is very close to the results presented in Table 4. This test provides evidence that further explains why there is no supporting evidence in the OLS and matching tests. CEOs with pledged shareholdings will adopt conservative financial policies after it attains a certain threshold.

[Insert Table 4-6 Here]

sectionThe Association Between Share Pledging and Firm Value Turning to the value-reduction hypothesis, I test the possibility that CEO pledgers' motivation to undertake conservative investment and financial policies, which further translates to the foregone positive NPV projects and lower valuation. To test this value-reducing hypothesis, I first investigate the average treatment effect of share pledging on firm's return on assets and Tobin's Q.

When propensity score matching and nearest neighbor matching procedures are employed, negative average treatment effects of share pledging on ROA and Tobin's Q can be captured

across all the matching covariate sets and matching alternatives, despite the mere insignificance of PSM estimator under the first matching criterion.

[Insert Table 7 Here]

We further look at how the level of valuation outcomes are associated with pledge ratio by testing the following set of panel regression specification:

$$\begin{cases} ROA_{i,t+1} = \alpha PLEDGE_{i,t} + \beta \mathbf{X}_{i,t} + \delta_t + \eta + \epsilon_{i,t} \\ Tobin's\ Q_{i,t+1} = \alpha PLEDGE_{i,t} + \beta \mathbf{X}_{i,t} + \delta_t + \eta + \epsilon_{i,t} \end{cases} \tag{6}$$

where all dependent variables are measured in $t+1$ to reduce reverse causality. Table 8 presents the panel OLS results. In model 1, the share pledging impact is -0.043, significant at 10%. Across both control sets, from model 2 to model 4, the negative association are consistent, which indicates that the increased pledged shares would lead to a reduction of ROA in $t+1$ period. To a large extent, both the matching and panel regression results are consistent with our null value-reducing hypothesis that share pledging could produce value reduction outcomes due to the incentive-weakened CEOs.

[Insert Table 8 Here]

## 5.2. Discussion on Endogenous Share Pledging

Despite the attempt to alleviate endogeneity issue by employing propensity score matching approach, the estimation results can still be problematic due to omitted variable bias. To further support the evidence presented earlier, I implement a two-stage estimation by employing housing price index of each state as an instrumental variable. Intuitively, insider pledgers cash out their holdings for personal spending and consumption. Based on a variety of anecdotal evidence, one potential use of these proceeds could be the purchase of lands and luxury houses. Examples include Mr. McClendon of Chesapeake who borrowed more than $500 million from Goldman Schas Group and J.P. Morgan to buy real estate. Despite the fact that there is a variety of personal use of loan proceed from pledging, real estate investment is a plausible and significant portion of the use of proceeds. To control the endogenous nature of share pledging, I use the housing price index at state level from Federal Housing Finance Agency (FHFA)[20] as an exogenous variable to instrument the pledge ratio, which is less likely to be relevant to the firm outcome variables.[21] By employing $HPI$ as a plausible source of exogeneity, we estimate the following specifications

$$PLEDGE_{i,t} = \alpha HPI_{i,t} + \beta \mathbf{X}_{i,t} + \delta_t + \eta + \epsilon_{it} \tag{7}$$

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[20]The Housing price index is diclosed at the FHFA website: https://www.fhfa.gov/DataTools/Downloads/Pages/House-Price-Index.aspx

[21]Specifically, state-level housing price index data is merged with the main sample by the state where the company's CEO located.

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where $HPI_{i,t}$ represents the housing price index, $\mathbf{X}_{i,t}$ regresents the control sets defined earlier. The estimated pledge ratio $\widehat{PLEDGE}_{i,t}$ is employed in the second stage estimation specified below.

$$Y_{i,t+1} = \gamma \widehat{PLEDGE}_{i,t} + \beta \mathbf{X}_{i,t} + \delta_t + \eta + \epsilon_{it} \tag{8}$$

where the outcome variable $Y_{i,t+1}$ is measured at $t+1$ period.

[Insert Table 9 Here]

As can be seen from Table 9, the housing price index $HPI$ and seasonally adjusted housing price index $HPI_{adj}$ are statistically relevant to the pledge ratio (in Panel A.). In the second stage, the instrumented pledge ratio $\widehat{PLEDGE}$ is employed to estimate the firm decision outcomes. In Panel B, there is a negative association between the instrumented pledge ratio $\widehat{PLEDGE}$ and firm outcome variables, all are statistically significant at conventional levels (from model 3 to model 10). One can still observe the investment capital reallocation presented earlier - pledging negatively affects risky R&D but increase the less risky CAPEX. These forgone opportunities further translate to the decrease of firm's Tobin's Q and ROA.[22].

# 6. Price Supporting through Earnings Management

In this section, we turn to the examination on the relationship between the share pledging and earnings management. It is well acknowledged that the discretion in financial reporting may exert material impacts on the stock price. In the context of share pledging, the margin call and forced sales would be triggered if the stock price fall below a certain level. Given the disastrous consequences discussed earlier, pledging firms are likely to use corporation resources to support the stock price in order to absorb the margin call pressure.

By linking the firms' share pledging to earnings management, we propose that the pledging firms may increase the level of the use of accrual in response to the potential margin call to alleviate the selling pressure. Pledgers who face severe margin call pressures may likely use the discretionary accrual to boost the firm's performance. Improperly incentivized CEOs may likely to use accruals to manipulate reported earnings (Bergstresser and Philippon (2006)).

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[22]Up to now, all the tests implemented are based on the insider CEOs with pledged holdings. Despite that the characteristics of CEOs are potentially crucial for firm decision outcomes, it is worthwhile to consider whether top management team members, rather than CEOs alone, provides better prediction outcomes. A variety of research has shown that top management team members also play a role in influencing the firm's risk-taking decisions and further affecting firms' performance (e.g. John and John (1993) and Gilley et al. (2002) etc.) Wang and Chou (2018) uses the top management level data to investigate the pledging effect on shareholder wealth. Here, this study looks at whether top management team members who engaged in share pledging also lead to similar impacts noted earlier. I adopt the same matching design based on the top management team insider pledgers and further gauge the average treatment effect of pledgers on the decision outcomes and value proxies. As can be seen from the appendix tables, results are largely similar with the finding documented in earlier sections - the practice of share pledging could potentially lead to the reduction of the overall shareholder wealth.

It has been documented that firms may increase accruals around the issuance of SEOs and realize a lower post-issue stock return and firm operating performance (Kim and Park (2005)). Likewise, Teoh et al. (1998b) found that the relation between price-supporting accruals and future stock returns is stronger and more persistent for SEO issuers than for non-issuers. I consider insider pledgers may make similar opportunistic accounting decisions to inflate the stock price at the sacrifice of future performance.

To investigate the pledging-earnings management relationship, we primarily adopt the discretionary accrual and modified Jones discretionary accrual to proxy the level of the earnings management. First, following prior research (Jones (1991), Dechow et al. (1995), Teoh et al. (1998b), Teoh et al. (1998a), Bergstresser and Philippon (2006), and Armstrong et al. (2013)), we calculate total current accruals ($TCA$) for a given time $t$ as the difference between earnings and cash flows from operations. We then remove the components of accruals that are nondiscretionary (Jones (1991)), which is beyond the control of managers. Thus, the discretionary current accruals ($DCA$) measure the misreporting and managerial misbehavior that can be conducted by managers and is adopted as the proxy for the level of earnings management.

$$TCA_{i,t} = (\Delta CA_{i,t} - \Delta CL_{i,t} - \Delta Cash_{i,t} + \Delta STD_{i,t} - Depr_{i,t})/AT_{i,t-1} \tag{9}$$

where $TCA_{i,t}$ is the total current accrual. We remove components of accruals that are nondiscretionary, following Dechow et al. (1995), where the nondiscretionary portion is fitted from a regression of $TCA$ on lagged size, the chage in sales and $PPE$ scaled by total asset. We first estimate the following specification:

$$TCA_{i,t} = \alpha + \alpha_1 \frac{1}{AT_{i,t-1}} + \alpha_2 \Delta REV_{i,t} + \alpha_3 PPE_{i,t} + \epsilon_{i,t} \tag{10}$$

The estimated coefficients are extracted to calculate the the $NDCA$.

$$\widehat{NDCA}_{i,t} = \widehat{\alpha} + \widehat{\alpha_1} \frac{1}{AT_{i,t-1}} + \widehat{\alpha_2} \Delta REV_{i,t} + \widehat{\alpha_3} PPE_{i,t} \tag{11}$$

where the $REV_{i,t}$ is the change in sales. Then the discretionary accrual can be obtained by taking the difference between the total accrual and the nondiscretionary protion as below:

$$\widehat{DCA_{i,t}} = TCA_{i,t} - \widehat{NDCA}_{i,t} = TCA_{i,t} - \widehat{\alpha} - \widehat{\alpha_1} \frac{1}{AT_{i,t-1}} - \widehat{\alpha_2} \Delta REV_{i,t} - \widehat{\alpha_3} PPE_{i,t} \tag{12}$$

I also employed the modified the modified Jones model by substituting the term ($\Delta REV_{i,t} - \Delta REC_{i,t}$) for the change in sales in the earlier construction of $NDCA$:

$$\widehat{NDCA_{i,t}^{modified}} = \beta_0 + \beta_1(\Delta REV_{i,t} - \Delta REC_{i,t}) + \beta_3 PPE_{i,t} \tag{13}$$

where $\Delta REV_{i,t} - \Delta REC_{i,t}$ is the difference between the change in sales and the change in

receivables. I further get the modified version of discretionary accrual as below

$$DA_{i,t}^{\widehat{modified}} = TA_{i,t} - NDC\widehat{A_{i,t}^{modified}} \tag{14}$$

We keep the absolute value of the discretionary accrual, as the absolute value captures the amount of earnings transfer without being sensitive to the accurate timing of when earnings are either increased or decreased Bergstresser and Philippon (2006). Proactive CEO pledgers should realize the potential margin call associated with the forced sale of the shares, therefore, it is rational to expect pledgers to increase the level of the accruals (serving as the major tool of earnings management) to support the stock price in the near future. Specifically, we estimate the below regression model to see how the level of discretionary accrual is relevant to the pledge ratio.

$$DCA_{i,t+1} = \beta_0 + \beta_1 * PLEDGE_{i,t} + \gamma \mathbf{X}_{i,t} + \delta_t + \eta + \epsilon_{i,t} \tag{15}$$

Table 10 shows that the discretionary accruals are positively associated with the share pledging. In both the $DCA$ and $DCA^{modified}$ estimation, the coefficients on the pledge ratio are all statistically significant.

[Insert Table 10 Here]

# 7. Institutional Invesors' Monitoring Role on Share Pledging

In this section, we turn to the investigation on the monitoring roles of institutional investors on firm insiders' share pledging. It has been well acknowledged in finance literature that institutional investors serve as a strong and effective force of monitoring and corporate governance. Compared to retail investors, large sophisticated institutional investors tend to have the incentive to collect information and monitor corporate management by virtue of their large holdings because they reap greater benefit from monitoring corporations (Shleifer and Vishny (1989) and Shleifer and Vishny (1997)). If the practice of share pledging potentially misaligns the incentive structure of the management and creates value-reducing outcomes of the company, which is indicated by the findings of earlier section, it is likely that institutional holders exert monitoring effort and influence firm insiders' pledging decisions.

Prior studies show that effective monitors tend to strengthen the governance and restrain firms' misbehaviors. As a response to the potential gains from addressing the agency issues (Gillan and Starks (2007)), the institutional activists achieved an extraordinary measure of the influence of the management by effectively delegating the decisions to managers whose interests diverge from those of their outside shareholders. As discussed earlier, the practice of share pledging will misalign the CEO's objective and lead to value-reducing outcomes of the company given's ownership-monetization nature. So far, studies directly look at how the monitoring role affect the firms' pledging decisions are still limited. One thing needs to be noted is that we have an enormous amount of empirical and theoretical research looking at

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the institutional monitors. When viewing such evidence, we need to be careful and recognize that institutional investors differ regarding their trading incentive, styles, regulatory environments, and capability in gathering value-enhancing information. For instance, empirical evidence suggests that, compared to long-term investors, short-term ones are less likely to stay in the firm until the benefits of corporate decisions realize.

Indeed, conflicting evidence shows that not all institutions are homogenous nor do they have similar effects on a firm's governance, decision-making, performance, and liquidity, etc. It would be challenging to investigate the role of institutional investors on liquidity and determine which specific group drives the ownership-pledging relationship in the absence of any partition that effectively separates institutional investors. To investigate the impact of institutional ownership on corporate decisions, we need to better understand the differences among large sophisticated institutional investors. Differential investment horizon drives institutional investors' motivations to compel value-enhancing management to engage in decisions (Tirole (2010)). Investors with longer investment horizons can directly engage with management to monitor firms' behavior. If such monitoring cost is high or too time-consuming, investors may exit through selling off their shares in response to unfavorable firm performance (Chen et al. (2007) and McCahery et al. (2016)). Turning to the short-term institutional investors, they generally tend to have fewer incentives to allocate resources in monitoring and the cost for them to collect sufficient information to ensure a proper monitoring within a limited horizon is prohibitive, as they are less likely to remain long enough to reap the corresponding benefits (Grossman and Hart (1980) and Shleifer and Vishny (1989)).

Extant studies provide evidence that the investment horizon of institutions influences firm R&D decisions (Bushee (1998); Bushee (2001)), stock returns (Yan and Zhang (2007)), stock price efficiency (Cremers and Pareek (2015)), acquisition premium (Gaspar et al. (2005)), equity offerings (Hao (2014)), firm valuation (Cremers et al. (2016); Borochin and Yang (2017)), governance (Harford et al. (2017)), stock liquidity (Ng et al. (2016)), and corporate social responsibility (Nguyen et al. (2017)). Here, this study is interested in how the share pledging is affected by institutional investors and propose that effective instituional monitors would reduce the level of shares pledged by firm insiders.

To construct institutional investmnet horizon, first, following Gaspar et al. (2005) and Gaspar and Massa (2007), I compute the churn rate, which measures how frequently an institutional investor rotates the holding of all stocks in the portfolio. I then construct firm-level turnover measure ($IOTurnover$) using churn rates to capture the investment horizons of institutional shareholders of a firm. The portfolio turnover measures the frequency of institutional investors rotating their holdings of firms. High level of portfolio turnover implies that investors trade their holdings frequently, vice versa. We employ the cutoff points of 25% and 75% to define long-term and short-term investors[23]. If the portfolio turnover of an investor is above the 75% breakpoint or is missing, this investor is regarded as a short-term institutional investor. On the other hand, when an institution has a portfolio turnover that is below the

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[23]The results are robust when adopting other breakpoints, such as 33% and 66%

25% breakpoint, this institution is classified as a long-term investor. After defining the investment horizon of each institution, we construct firm-level institutional ownership: long-term institutional ownership ($LONGIO$) and short-term institutional ownership ($SHORTIO$). $LONGIO$ is defined as the fraction of shares owned by institutional investors that are long-term investors. $SHORTIO$ is defined as the fraction of shares owned by short-term investors. $IO$ captures the level of the total institutional ownership. In the subsequent the empirical tests, I will focus on impacts sourced from the level of $LONGIO$, $SHORTIO$, and $IO$.

To more rigorously identify the heterogeneous effects of institutional investors associated with different horizons on pledging, we further explore this relationship on a platform of Institutional Shareholder Service market-wide advisory on the prohibition of pledging in 2012. Since 2006, the institutional investors have been vocal on the issue of share pledging, realizing the collateral nature of this practice may have a detrimental effect on shareholders if the officer is involuntarily forced to sell shares. Until 2012, the Institutional Shareholder Services (the ISS) implemented a policy survey indicating that half of the institutional investors (49% of the respondents) regard pledging as a severe problematic practice and drafted the policy on the practice of pledging should be discouraged and further prohibited.[24] In the ISS 2012 advisory, ISS explicitly recommended companies to adopt the anti-pledging policies. Here, panel A reports results based on the following specifications:

$$
\begin{cases}
PLEDGE_{i,t} = \beta_0 + \beta_1 * LONGIO_{i,t-1} + \gamma \mathbf{X}_{i,t-1} + \delta_t + \eta + \epsilon_{i,t} \\
PLEDGE_{i,t} = \beta_0 + \beta_1 * SHORTIO_{i,t-1} + \gamma \mathbf{X}_{i,t-1} + \delta_t + \eta + \epsilon_{i,t} \\
PLEDGE_{i,t} = \beta_0 + \beta_1 * IO_{i,t-1} + \gamma \mathbf{X}_{i,t-1} + \delta_t + \eta + \epsilon_{i,t}
\end{cases}
\tag{16}
$$

where $LONGIO$, $SHORTIO$, and $IO$ represent long-term, short-term, and total institutional ownership, respectively. All the estimations control for a series of firm characteristics including firm size, market-to-book ratio, annual stock return volatility, insider ownership, CEO age and tenure, Tobin's Q, and dividend payments. All the independent variables are lagged by one period to alleviate reverse causality. To remove the outliers, control variables are winsorized at $1^{st}$ and $99^{th}$ percentiles.

Tabel 11 Panel A presents the results. As can be seen in column (1), long-term institutional ownership is negatively associated with the pledge ratio, where the coefficient of $LONGIO$ is -0.276 (t-value=-2.04) and statistically significant at 5% level. Turning to the short-term and total institutional ownership, there is no significant statistical ownership-pledging association. Consistent with the prior discussion that the longer an institution has been investing in a firm, the better would be the institution's knowledge of the firm managers. Here, I argue that the monitoring effect on share pledging is primarily sourced from long-term investors, who are associated with lower monitoring cost and are better motivated.

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[24]https://www.issgovernance.com/file/files/2012ISSSRIUSPolicy.pdf (6d-15.Adopt Anti-Hedging/Pledging/Speculative Investments Policy); https://www.issgovernance.com/file/files/2013ExecutiveSummary.pdf (Institutional Shareholder Services, 2012. 2012–2013 Policy Survey Summary of Results.)

Given the intention of the ISS market-wide advisory in 2012, one should expect that the institutional monitoring effect of firms' pledging should be more pronounced after the ISS recommendation. To investigate the impact, I interact continuous ownership variables with a post-event indicator variable $POST$. In Table 11, we can see that the monitoring effect of the institutional investors is indeed stronger after the ISS recommendation. I then follow the standard difference-in-difference framework and adopt the following specification reported in Tabel 11 Panel B:

$$PLEDGE_{i,t} = \beta_0 + \beta_1 * POST_t + \beta_2 * dum(IO)_i + \beta_3 \\ * POST_t * dum(IO)_i + \gamma \mathbf{X}_{i,t} + \delta_t + \eta + \epsilon_{i,t} \tag{17}$$

where $POST$ is a post-event indicator variable, which equals to one if the observation is after the 2012 ISS advisory, zero otherwise. $dum(IO)$ is the indicator variable for whether the firm has above the median level of the ownership ($LONGIO$, $SHORTIO$, and $IO$, respectively). The variable of interest is the difference-in-difference estimator, the interaction term $POST_t * dum(IO)_i$. I drop the year fixed effects considering the potential multicollinearity issues.

Tabel 11 Panel B contrasts the heterogeneous treatment effect of long-term, short-term, and total institutional ownership on the pledging respectively. As expected, in column (1), the coefficient of the interaction $POST_t * dum(LONGIO)_i$ is negative, statistically significant at 10% level. This confirms the conjecture that the institutional monitoring impact is even stronger after the ISS advisory. A further look at column (5), we observe that no significant effect can be found on the short-term institutional investors, whereas the coefficient of term $POST_t * dum(IO)_i$ in column (6) is highly significant and negative (t-value=-2.9). This indicates that the monitoring effect of institutional investors is primarily sourced from long-term ones as they are better motivated and have better access to the firm's information.

In untabulated results, we further show that the monitoring effect of long-term institutional investors is more pronounced among firms associated with higher insider ownership. Literature suggests that high degree of the insider ownership and entrenchment of the management will generate sub-optimal or value-reducing outcomes of the company in many aspects, including capital structure decisions (Berger et al. (1997)), incentive and firm value (Claessens et al. (2002)), compensation structure (Almazan and Suarez (2003)), and stock market performance (Lilienfeld-Toal and Ruenzi (2014)), etc. Inspired by this rationale, I consider effective institutional monitors are more active in firms with higher insider ownership.

# 8. A Further Look at Monitoring Effects on the Share Pledging

As discussed earlier in the preceding section, institutional investors have the function of the monitoring and disciplining the management. Given their potential monitoring role, it is

natural to conjecture that the share pledging impacts on firms' investment and financing may be temerped by the presence of institutional invevestors. In the earlier sections, it is documented that share pledging may lead to firms' suboptimal investment and financing policy outcomes, for instance, incentive-weakened pledgers may lead to a conservative asset-reallocation, an increase in capital expenditure and a decrease in R&D. To further identify the monitoring effect in this context, I set up the following specification:

$$Investments\ (Financing)_{i,t+1} = \beta_0 + \beta_1 * PLEDGE_{i,t} + \beta_2 * INSTOWN_{i,t} + \beta_3 \\ * PLEDGE_{i,t} * INSTOWN_{i,t} + \gamma \mathbf{X}_{i,t} + \delta_t + \eta + \epsilon_{i,t} \tag{18}$$

where the dependent variable set includes the investment and financing policy outcomes. $INSTOWN_{i,t}$ is the institutional investor ownership. The variable of interest in this test is the interaction term of pledge ratio and the institutional ownership, $PLEDGE_{i,t} * INSTOWN_{i,t}$. A dummy variable $dum(INSTOWN_{i,t})$ is also employed, which takes value of one if the firm has above-median institutional ownership, zero otherwise. The coefficient of the interaction term captures the discipling effect of institutional investors. Table 12 presents that the coeffecients of the interaction term, in model (1) and (2), are both marginally statistically significant, in a sense that institutional monitors may curb the negative impact of share pledging on R&D investments. Surprisingly, on the CAPEX side, I do not find significant monitoring effect on the capital expenditure. Turning to the financing policy outcomes, one can observe that the interaction between pledge ratio and institutional ownership positively affects the leverage, as reproted in model (5) to (10), whereas the negatively affects the cash holding level. To a large extent, the existence of insititutional monitors indeed alter the findings documented in earlier section.

[Insert Table 12 Here]

# 9. Concluding Remarks

## 9.1. Summary

The effects of the share pledging are relatively unexplored. This paper contributes to this literature by directly testing the insider's pledging impacts on firms decision outcomes and shareholder wealth using a unique U.S sample from 2006 to 2015. Motivated by a series of anecdotal evidence and U.S. SEC's disclosure mandate of share pledging, this paper is among the first that provides credible evidence to suggest that firm insider executives' pledged holdings could lead to conservative policies, which in turn, translates to the deduction of firm performance and shareholder wealth. This paper aims to inform the regulatory party the importance and necessity of restricting firm's share pledging behavior.

The primary characteristic of the practice of share pledging is that it alters pledgers' cash-flow payoff without changing their control rights. Despite the potential personal benefits of share pledging, insider pledgers face severe downside risk of margin call that is directly associated with pledged holdings. Once the share price declines, the deduction of the collateral

value may lead pledgers to supply more capital or involuntarily sell shares. To alleviate the risk, pledgers tend to adopt conservative policies which are value-reducing to the shareholders. Using propensity score matching and nearest neighbor matching approaches, this paper finds that insider executives tend to reduce the R&D investment and increase the CAPEX, which indicates an asset reallocation from riskier investment to less risky investment. Then, I investigate the relationship between the share pledging and financial policy. Surprisingly, no evidence can be found to support the conservative financing hypothesis. However, by using a series of nonparametric tests, I further find that this insignificance is soured from the nonlinear relationship between the pledged shares and firm leverage. Once the pledged shares are beyond a certain threshold level, significant negative effects of share pledging on leverage can be predicted.

Further, this paper shows that these firm decision outcomes translate to the deduction of firm value and performance, as reflected in the negative average treatment effects on share pledging on firms' Tobin's Q and ROA. The results are consistent across a series of endogeneity tests and robustness tests. Evidence in this paper shows that the monetization of ownership alters firm's risk-taking in a negative way and is value-destroying to the overall shareholder wealth.

Further, this research links the share pledging to firm's earnings management, as proactive CEO pledgers may be concerned about the involuntary sale of shares, they may level up the use of the earnings management to support the stock price temporarily in the hope to alleviate the margin call pressure. By looking into the use of discretionary accrual, I present the evidence that the level of discretionary accrual is positively associated with the share pledge ratio.

As pledging misaligns the incentive structure of the management and produces value-reducing outcomes, we found that institutional investors take the monitoring role to discipline the practice of the share pledging to protect shareholder value. Primarily, the level of the pledge ratio is negatively associated with the institutional ownership and this monitoring function is mainly sourced from long-term institutions who are better equipped and motivated to ensure effective monitoring. I further find out that the monitoring effect of institutional investors on share pledging is more pronounced after the Institutional Shareholder Service's market-wide advisory in 2012.

Moreover, given the external monitoring function of institutional investors, I found that earlier findings on inventive-weakening and value-reducing hypothesis can be potentially altered by the presence of external monitors. The existence of institutional monitors may discipline the conservative investment and financing policies, and align the incentive structure of the management. Moreover, the price supporting effect associated with the share pledging is tempered by the institutional investors and analyst coverage as well.

Overall, this research, along with much anecdotal evidence, informs that it is imperative to strictly regulate the practice of share pledging.

## 9.2. Future Direction of the Research in Share Pledging

A further and the broader question relevant to this issue is that whether the problem of this practice should be resolved by the governance or government regulation. In the 2012 ISS advisory, ISS points out that the practice of pledging should be regarded as "a failure of risk oversight and thus considered a governance failure" in a sense that the directors and CEOs should be held accountable. Moreover, pledging of shares is a world-wide practice. For instance, about 11% of China's market capitalization, or \$632 billion has been pledged by October 2018. China has the second-largest stock market in the world. It would be interesting to further investigate the share pledging impact on stock liquidity and crash risk, as sharp stock declines could lead to a widespread material impact on the market and pledgers who intend to shelter the value-reducing information may further lead to the crash risk. On the other end of the spectrum, the risk-shifting problem is particularly pronounced in the emerging markets, as the controlling shareholders have exclusive control rights and are inclined to undertake excessive risk, leaving the cost to the firm creditors. It would be worthwhile to further investigate the creditors' reaction to the share pledging.

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Figure 1: Industry Distritution of Share-Pledging Firms and Mean Pledge Ratios

Subfigure (a) plots the industry distribution of share-pledging firms based on Fama-French 12 industry classification. Subfigure (b) plots the share-pledge ratio across industries based on Fama-French 12 industry classification, with the overall mean pledge ratio of 32.52%. Each stock traded on NYSE, AMEX, and NASDAQ is assigned to an industry portfolio at the end of June of the year based on its four-digit SIC code at that time. 12 industries are defined as follows. "Chemical" industry includes chemicals and allied products; "Durables" industry includes cars, TVs, furniture, household appliances; "Energy" industry includes oil, gas, and coal extraction and products; "Health Care" industry includes medical equipment, and drugs; "High Tech" industry includes computers, software, and electronic equipment; "Manufacturing" industry includes machinery, trucks, planes, paper, computer printing; "Non-durables" industry includes food, tobacco, textiles, apparel, leather, toys; "Others" includes mines, construction, BldMt, transportation, hotels, bus service, entertainment; "Service" industry includes shops, wholesale, retail, and some services (laundries, repair shops); "Telecom." industry includes telephone and television transmission.
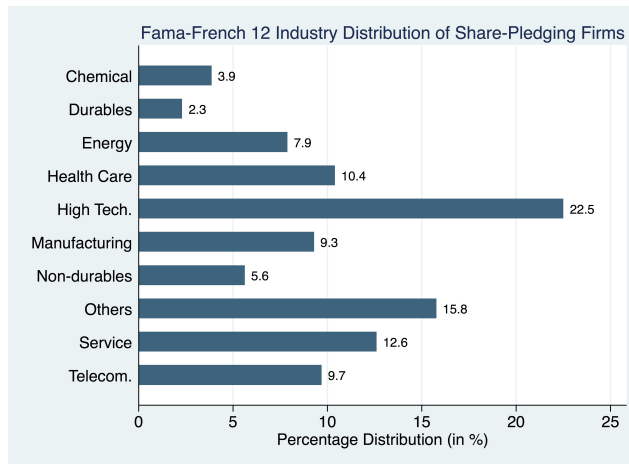


(a) *Industry Distritution of Share-Pledging Firms*
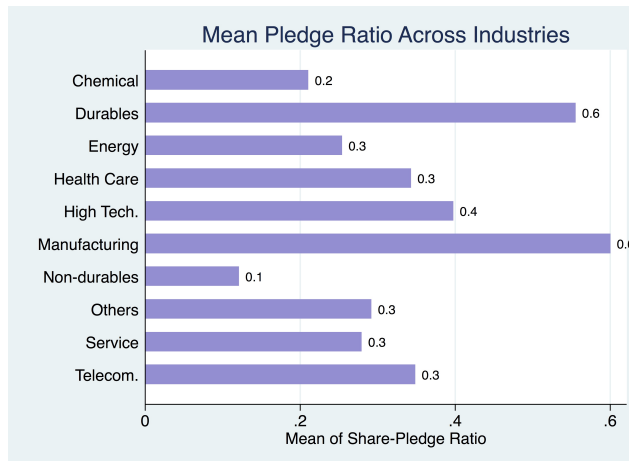


(b) *Share-Pledge Ratio Across Industries*

## Figure 2: Nonlinear Relationship between Book Leverage and Pledge Ratio

This figure presents the nonlinear relationship between firms' book leverage and the pledge ratio. Subfigure (a) presents the quadradtic fit of the book leverage and the pledge ratio. Subfigure (b) presents the polynomial fit based on Robinson (1988)'s semiparametric estimation. Subfigure (c) presents the nonlinear relation based on nonparametric estimation. Subfigure (d) presents the predicted margins of share pledging effect on the book leverage with confidence interval of 95%.
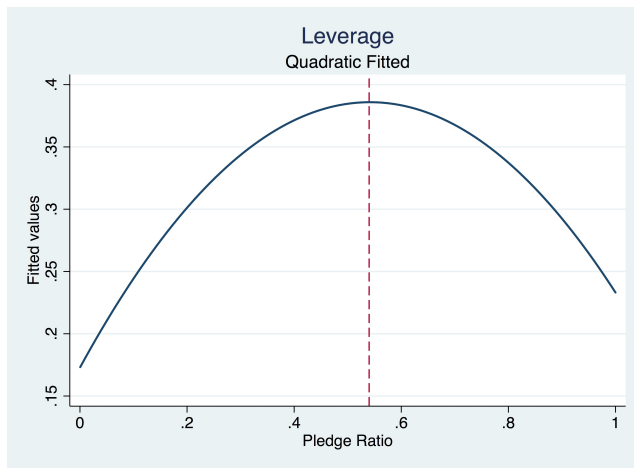


(a) *Quadratic Fit of Book Leverage v.s. Pledge Ratio*
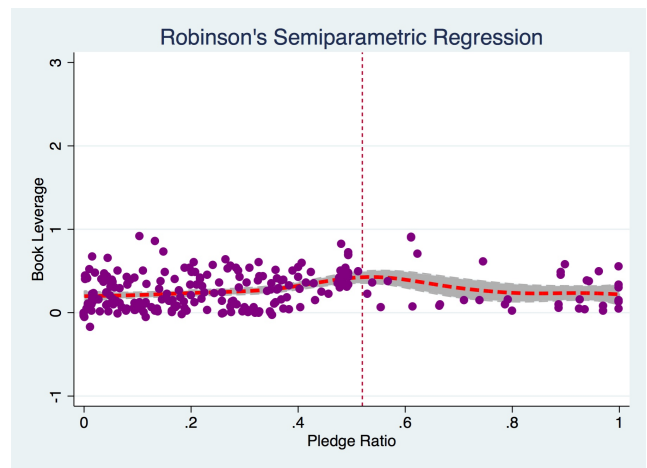


(b) *Robinson's Semi-parametric Regression Estimates*
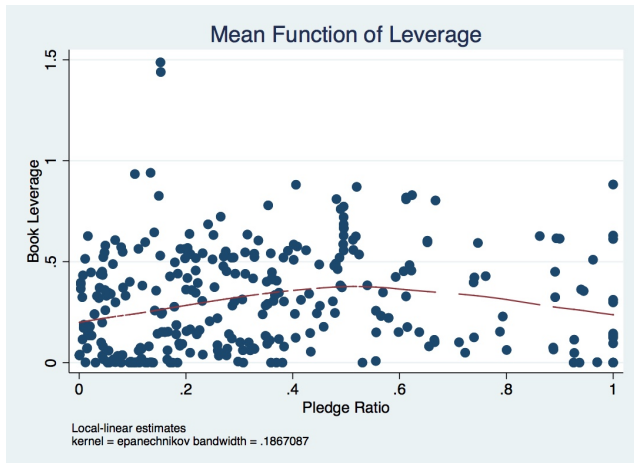


(c) *Non-parametric Regression Estimates*
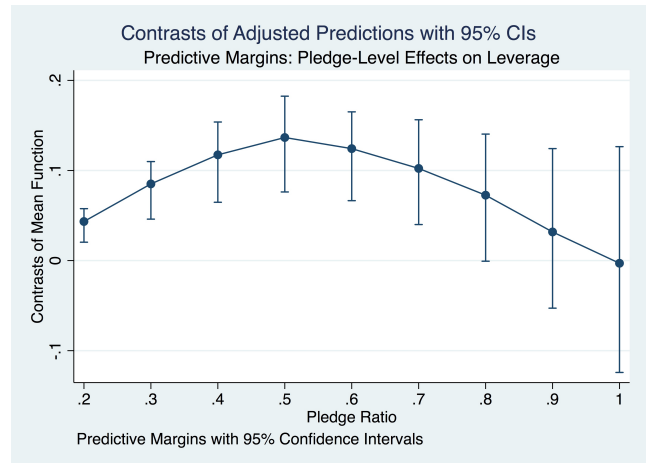


(d) *Marginal Effects of Share Pledging on Book Leverage*

Table 1: Descriptive Statistics: Firm Characteristics (Pledging Firms & Non-Pledging Firms)

This table presents descriptive statistics of firm characteristics of both pledging firms and propensity score matched non-pledging firms. Panel A. reports the summary statistics for the full sample; Panel B. reports the summary statistics for the pledging firms; Panel C. reports the summary statistics for the non-pledging firms based on the propensity score matching. $R\&D$ represents firm's research and development expenses; $CAPEX$ is the capital expenditure expenses; $ROA$ is return on asset; $Tobin's\ Q$ is Tobin's Q; $BOOKLEV$ is firm's book leverage; $MKTLEV$ is firm's market leverage; $NETLEV$ is firm's book leverage net of cash; $CASH$ is firm's cash holdings; $INSTOWN$ is firm's total institutional ownership; $INSIDEOWN$ is the aggregated insider owneship. All the variables are scaled by the total asset and winsorized at $1^{st}$ and $99^{th}$ percentiles. The sample period is 2006 to 2015. The definitions of all variables are described in Appendix.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Panel A: Full Sample* | | | | | | | | |
| Variable | Obs | Mean | Std. Dev. | Min | Max | P25 | P50 | P75 |
| | | | | | | | | |
| $R\&D$ | 678 | .025 | .063 | 0 | .675 | 0 | 0 | .014 |
| $CAPEX$ | 678 | .049 | .08 | 0 | 1.291 | .009 | .028 | .059 |
| $ROA$ | 678 | .13 | .128 | -.756 | 1.247 | .074 | .124 | .182 |
| $Tobin's\ Q$ | 678 | 2.11 | 1.61 | .197 | 26.245 | 1.173 | 1.602 | 2.445 |
| $BOOKLEV$ | 678 | .272 | .252 | 0 | 2.766 | .065 | .227 | .408 |
| $MKTLEV$ | 678 | .172 | .162 | 0 | .952 | .039 | .135 | .261 |
| $NETLEV$ | 678 | .299 | .283 | 0 | 3.626 | .076 | .255 | .437 |
| $SIZE$ | 678 | 8.017 | 1.815 | 2.03 | 13.713 | 6.757 | 8.004 | 9.188 |
| $MB$ | 678 | .901 | 85.345 | 0 | 175.998 | 1.19 | 2.038 | 3.503 |
| $VOLITILITY$ | 678 | .104 | .056 | .026 | .7 | .067 | .093 | .127 |
| $INSIDEROWN$ | 678 | 3.639 | 7.068 | 0 | 92.116 | .292 | .978 | 3.498 |
| $INSTOWN$ | 678 | .732 | .228 | 0 | 1.539 | .628 | .764 | .882 |
| $DIVIDENDS$ | 678 | .016 | .052 | 0 | 1.783 | 0 | .002 | .019 |
| $SALES\ GROWTH$ | 678 | .072 | .25 | -3.454 | 1.933 | -.014 | .066 | .162 |
| $CEO\ AGE$ | 678 | 4.009 | .144 | 3.434 | 4.477 | 3.912 | 4.007 | 4.094 |
| $CEO\ TENURE$ | 678 | 1.765 | .857 | 0 | 3.829 | 1.099 | 1.792 | 2.398 |

Table 1. Cont'd: Descriptive Statistics: Firm Characteristics (Pledging Firms & Non-Pledging Firms)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Panel B: Pledging Firms | | | | | | | | |
| Variable | Obs | Mean | Std. Dev. | Min | Max | P25 | P50 | P75 |
| $R\&D$ | 339 | .015 | .051 | 0 | .592 | 0 | 0 | 0 |
| $CAPEX$ | 339 | .06 | .099 | 0 | .805 | .009 | .031 | .067 |
| $ROA$ | 339 | .134 | .12 | -.642 | 1.085 | .085 | .125 | .183 |
| $Tobin's\ Q$ | 339 | 2.08 | 1.692 | .572 | 26.245 | 1.179 | 1.639 | 2.296 |
| $BOOKLEV$ | 339 | .3 | .237 | 0 | 1.487 | .08 | .285 | .459 |
| $MKTLEV$ | 339 | .196 | .173 | 0 | .952 | .05 | .165 | .304 |
| $NETLEV$ | 339 | .323 | .253 | 0 | 1.591 | .096 | .31 | .487 |
| $SIZE$ | 339 | 8.04 | 1.722 | 3.862 | 12.014 | 6.767 | 8.071 | 9.28 |
| $MB$ | 339 | 2.193 | 14.013 | 0 | 175.998 | 1.109 | 2.043 | 3.502 |
| $VOLITILITY$ | 339 | .108 | .061 | .027 | .7 | .072 | .095 | .133 |
| $INSIDEROWN$ | 339 | 4.87 | 7.985 | 0 | 92.116 | .414 | 1.6 | 5.875 |
| $INSTOWN$ | 339 | .737 | .238 | 0 | 1.539 | .653 | .778 | .891 |
| $DIVIDENDS$ | 339 | .02 | .036 | 0 | .417 | 0 | .006 | .026 |
| $SALES\ GROWTH$ | 339 | .069 | .196 | -1.324 | 1.436 | -.009 | .064 | .151 |
| $CEO\ AGE$ | 339 | 4.006 | .16 | 3.584 | 4.477 | 3.892 | 4.007 | 4.094 |
| $CEO\ TENURE$ | 339 | 1.926 | .878 | 0 | 3.784 | 1.386 | 1.946 | 2.485 |
| Panel C: Non-Pledging Firms | | | | | | | | |
| $R\&D$ | 339 | .031 | .069 | 0 | .675 | 0 | 0 | .026 |
| $CAPEX$ | 339 | .051 | .075 | 0 | 1.291 | .013 | .031 | .061 |
| $ROA$ | 339 | .142 | .134 | -.756 | 1.247 | .085 | .132 | .19 |
| $Tobin's\ Q$ | 339 | 2.216 | 1.634 | .197 | 15.993 | 1.221 | 1.696 | 2.597 |
| $BOOKLEV$ | 339 | .273 | .265 | 0 | 2.766 | .057 | .225 | .401 |
| $MKTLEV$ | 339 | .166 | .159 | 0 | .903 | .027 | .13 | .257 |
| $NETLEV$ | 339 | .303 | .302 | 0 | 3.626 | .067 | .255 | .434 |
| $SIZE$ | 339 | 7.873 | 1.845 | 2.03 | 13.713 | 6.588 | 7.766 | 9.039 |
| $MB$ | 339 | .343 | 101.739 | 0 | 152.44 | 1.231 | 2.038 | 3.521 |
| $VOLITILITY$ | 339 | .104 | .052 | .026 | .465 | .068 | .095 | .127 |
| $INSIDEROWN$ | 339 | 3.388 | 7.09 | 0 | 62.303 | .25 | .781 | 3.039 |
| $INSTOWN$ | 339 | .74 | .228 | 0 | 1.503 | .633 | .774 | .888 |
| $DIVIDENDS$ | 339 | .016 | .062 | 0 | 1.783 | 0 | 0 | .018 |
| $SALES\ GROWTH$ | 339 | .072 | .266 | -3.454 | 1.933 | -.014 | .068 | .163 |
| $CEO\ AGE$ | 339 | 4.007 | .139 | 3.434 | 4.443 | 3.932 | 4.007 | 4.094 |
| $CEO\ TENURE$ | 339 | 1.697 | .837 | 0 | 3.829 | 1.099 | 1.792 | 2.303 |

Table 2: Average Treatment Effect of Share Pledging on Investment and Financing Policy

This table reports the average treatment effects (ATE) of share pledging on firm's investment policy based on CEO pledger sample. The outcome variable ($Y$) is proxied by firm's R&D expenses ($R\&D$) and capital expenditure expenses ($CAPEX$), which are measured in $t+1$. Horizontal Panel I. reports results based on matching covariates including firm size, market to book ratio, volatility, institutional ownership, insider ownership, book leverage, sales growth, CEO age, CEO tenure, and industry. Horizontal Panel II. reports results based on matching covariates including firm size, market to book ratio, volatility, ROA, R&D, sales growth, institutional ownership, insider ownership, CEO age, CEO tenure, and industry. Results in Panel A. is based on the propensity score matching estimator. Results in Panel B. is based on the nearest neighbor matching estimator. ATE of share pledging are reported in column (1) and (6). Abadie-Imbens robust standard errors are reported in column (2) and (7). Variable definitions are provided in the appendix. The sample period is from 2006 to 2015. All matching variables are winsorized at $1^{st}$ and $99^{th}$ percentiles. Statistical significance is denoted by *, **, and *** at the 10%, 5%, and 1% levels, respectively.

| Outcome Variable (Y) | ATE | Panel A: Propensity Score Matching Estimator | | | | | Panel B: Nearest Neighbor Matching Estimator | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | | Coeff. | AI Robust Std. Err. | Z | P - Value | [95% Conf. Interval] | Coeff. | AI Robust Std. Err. | Z | P - Value | [95% Conf. Interval] |
| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| Investment Policy - Matching Criterion: Size, Market to Book, Volatility, Insider Ownership, Institutional Ownership, Book Leverage, Sales Growth, CEO Age, CEO Tenure, Industry | | | | | | | | | | | |
| Y = R&D    PLEDGE (1 vs 0) | | -0.012*** | 0.004 | -3.040 | 0.002 | [-.020, -.004] | -0.016*** | 0.002 | -6.460 | 0.000 | [-.020, -.011] |
| Y = CAPEX    PLEDGE (1 vs 0) | | 0.023** | 0.009 | 2.570 | 0.010 | [.005, .041] | 0.021*** | 0.007 | 2.840 | 0.004 | [.006, .035] |
| Financing Policy - Matching Criterion 3: Size, Market to Book, Volatility, ROA, R&D, Sales Growth, Insider Ownership, Institutional Ownership, CEO Age, Tenure, Industry | | | | | | | | | | | |
| Y = BOOKLEV    PLEDGE (1 vs 0) | | -0.031 | 0.021 | -1.480 | 0.139 | [-.072, .010] | 0.004 | 0.015 | 0.260 | 0.795 | [-.026, .034] |
| Y = MKTLEV    PLEDGE (1 vs 0) | | -0.006 | 0.013 | -0.470 | 0.637 | [-.033, .019] | 0.020** | 0.010 | 2.050 | 0.041 | [.001, .039] |
| Y = NETLEV    PLEDGE (1 vs 0) | | -0.035 | 0.022 | -1.590 | 0.113 | [-.786, .008] | -0.013 | 0.017 | -0.760 | 0.447 | [-.045, .019] |
| Y = CASH    PLEDGE (1 vs 0) | | 0.009 | 0.021 | 0.450 | 0.654 | [-.032, .050] | -0.014 | 0.009 | -1.630 | 0.103 | [-.030, .003] |

Table 3: The Association between Pledge Ratio and Investment and Financing Policy

This table presents panel regression results in which the dependent variables are R&D expenses (*R&D*), capital expenditure expenses (*CAPEX*), book leverage (*BOOKLEV*), market leverage (*MKTLEV*), net leverage (*NETLEV*), and cash holdings (*CASH*) in Panel A, B, C, D, E, and F respectively. The dependent variables are measured in year $t + 1$. The model is based on $Y_{i,t+1} = \alpha PLEDGE_{i,t} + \beta \mathbf{X}_{i,t} + \delta_t + \eta + \epsilon_{it}$. $\mathbf{X}_{i,t}$ is a control set including firm's size, market-to-book ratio, annual volatility, institutional ownership, insider ownership, CEO age, and CEO tenure. The variable of interest is *PLEDGE RATIO*, which is calculated as CEO's pledged shares divided by the total amount of shares owned. Variable definitions are provided in the appendix. The sample period is from 2006 to 2015. All control variables are winsorized at $1^{st}$ and $99^{th}$ percentiles. Year and industry fixed effects are included. t-statistics, based on standard errors clustered at firm level, are reported in parentheses. Statistical significance is denoted by *, **, and *** at the 10%, 5%, and 1% levels, respectively.

| | Share-Pledging Impact on Investment Policy | | | | | | Share-Pledging Impact on Financing Policy | | | | | |
| | Panel A: R&D | | Panel B: CAPEX | | Panel C: BOOKLEV | | Panel D: MKTLEV | | Panel E: NETLEV | | Panel F: CASH | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variable of Interest | | | | | | | | | | | | |
| PLEDGE RATIO | -0.038*** | -0.026*** | 0.052** | 0.033 | 0.129** | 0.111* | 0.034 | 0.034 | 0.200*** | 0.182*** | -0.080** | -0.077 |
| | (-4.11) | (-2.73) | (2.20) | (1.41) | (2.28) | (1.76) | (0.88) | (0.74) | (3.13) | (2.62) | (-1.98) | (-1.56) |
| Control Variable Set | | | | | | | | | | | | |
| SIZE | -0.007** | -0.003 | -0.043*** | -0.032*** | 0.076*** | 0.080*** | 0.118*** | 0.121*** | 0.093*** | 0.093*** | -0.071*** | -0.080*** |
| | (-2.15) | (-0.73) | (-4.91) | (-3.50) | (3.00) | (3.10) | (6.80) | (6.53) | (3.38) | (3.44) | (-4.01) | (-4.07) |
| MB | -0.000 | 0.001 | -0.004 | -0.004 | 0.016** | 0.017** | 0.012** | 0.013** | 0.021*** | 0.022*** | 0.008* | 0.007 |
| | (-0.34) | (0.65) | (-1.36) | (-1.58) | (2.17) | (2.41) | (2.50) | (2.55) | (2.64) | (2.97) | (1.68) | (1.31) |
| VOLATILITY | 0.137* | 0.200*** | 0.324* | -0.045 | 1.330*** | 1.235** | 0.947*** | 1.012*** | 1.464*** | 1.330** | 0.029 | -0.085 |
| | (1.87) | (2.74) | (1.70) | (-0.25) | (2.94) | (2.47) | (3.06) | (2.82) | (3.01) | (2.56) | (0.09) | (-0.22) |
| Constant | -0.016 | 0.196*** | 0.045 | -0.091 | -0.102 | -0.157 | 0.150 | -0.220 | -0.191 | 0.116 | 0.312 | -0.367 |
| | (-0.43) | (2.85) | (0.45) | (-0.53) | (-0.35) | (-0.34) | (0.76) | (-0.66) | (-0.62) | (0.24) | (1.57) | (-1.03) |
| Observations | 339 | 339 | 339 | 339 | 339 | 339 | 339 | 339 | 339 | 339 | 339 | 339 |
| R-squared | 0.508 | 0.578 | 0.541 | 0.582 | 0.382 | 0.394 | 0.586 | 0.601 | 0.390 | 0.404 | 0.450 | 0.467 |
| Other Controls? | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes |
| Firm Cluster | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

Table 4: The Association between Suqared Pledge Ratio and Leverage

This table presents panel regression results in which the dependent variable are firm's book leverage ($BOOKLEV$), market leverage ($MKTLEV$), and net leverage ($NETLEV$). The dependent variables are measured in year $t + 1$. The model is based on the following specification

$$Y_{i,t+1} = \alpha PLEDGE_{i,t} + \gamma PLEDGE_{i,t}^2 + \beta_{i,t} \mathbf{X}_{i,t} + \delta_t + \eta + \epsilon_{it}$$

where $\mathbf{X}_{i,t}$ is a control set including firm's size, market-to-book ratio, annual volatility, ROA, R&D, sales growth, institutional ownership, insider ownership, CEO age, and CEO tenure. $PLEDGE\ RATIO$, which is calculated as CEO's pledged shares divided by the total amount of shares owned. Lind and Mehlum (2010)'s U-test statistics and U-shape extreme value are reported in the bottom. The variable of interest is $PLEDGE_{i,t}^2$. Variable definitions are provided in the appendix. The sample period is from 2006 to 2015. All control variables are winsorized at $1^{st}$ and $99^{th}$ percentiles. Year and industry fixed effects are included. t-statistics, based on standard errors clustered at firm level, are reported in parentheses. Statistical significance is denoted by *, **, and *** at the 10%, 5%, and 1% levels, respectively.

|  | BOOKLEV | MKTLEV | NETLEV |
|---|---|---|---|
|  | (1) | (2) | (3) |
| **Variable of Interest** |  |  |  |
| PLEDGE RATIO | 0.920*** | 0.613*** | 0.941*** |
|  | (5.05) | (4.67) | (4.71) |
| PLEDGE RATIO SQUARED | -0.884*** | -0.633*** | -0.871*** |
|  | (-4.69) | (-4.67) | (-4.03) |
| **Control Variable Set** |  |  |  |
| SIZE | 0.089*** | 0.127*** | 0.096*** |
|  | (3.65) | (7.29) | (3.74) |
| MB | 0.023*** | 0.017*** | 0.026*** |
|  | (3.50) | (3.64) | (3.74) |
| VOLATILITY | 1.243*** | 1.018*** | 1.355*** |
|  | (2.65) | (3.02) | (2.74) |
| roa | 0.096 | 0.221 | 0.171 |
|  | (0.38) | (1.21) | (0.63) |
| R&D | -2.137*** | -0.863** | -2.304*** |
|  | (-4.52) | (-2.54) | (-4.52) |
| SALES GROWTH | 0.078 | 0.020 | 0.090 |
|  | (0.90) | (0.31) | (0.98) |
| INSTOWN | -0.059 | -0.011 | -0.078 |
|  | (-0.58) | (-0.15) | (-0.73) |
| INSIDEROWN | 0.003 | -0.000 | 0.003 |
|  | (1.59) | (-0.16) | (1.34) |
| CEO AGE | -0.002 | 0.056 | -0.031 |
|  | (-0.02) | (0.77) | (-0.29) |
| CEO TENURE | -0.054*** | -0.020 | -0.047** |
|  | (-2.77) | (-1.44) | (-2.26) |
| Constant | -0.101 | -0.180 | 0.054 |
|  | (-0.23) | (-0.57) | (0.12) |
| Observations | 339 | 339 | 339 |
| R-squared | 0.467 | 0.648 | 0.459 |
| Firm Cluster | Yes | Yes | Yes |
| Insdustry Effect | Yes | Yes | Yes |
| Year Effect | Yes | Yes | Yes |

Table 5: The Association between Share-Pledging and Cash-Holding by Leverage Groups

This table presents panel regression results in which the dependent variables is firm's cash holdings ($CASH$). The dependent variables is measured in year $t + 1$. The model is based on $Y_{i,t+1} = \alpha PLEDGE_{i,t} + \beta \mathbf{X}_{i,t} + \delta_t + \eta + \epsilon_{it}$. $\mathbf{X}_{i,t}$ is a control set including firm's market capitalization, size, market-to-book ratio, annual volatility, institutional ownership, insider ownership, CEO age and CEO tenure. Variables of interest are $PLEDGE\ RATIO$, which is calculated as CEO's pledged shares divided by the total amount of shares owned, and interactions $PLEDGERATIO * ZEROLEVERAGE$, $PLEDGERATIO * LOWLEVERAGE$, and $PLEDGERATIO * HIGHLEVERAGE$. $ZEROLEVERAGE$, $LOWLEVERAGE$ and $HIGHLEVERAGE$ are leverage dummy variables. Variable definitions are provided in the appendix. The sample period is from 2006 to 2015. All control variables are winsorized at $1^{st}$ and $99^{th}$ percentiles. Year and industry fixed effects are included. t-statistics, based on standard errors clustered at firm level, are reported in parentheses. Statistical significance is denoted by *, **, and *** at the 10%, 5%, and 1% levels, respectively.

|  | CASH | | |
|---|---|---|---|
|  | (1) | (2) | (3) |
| PLEDGE RATIO | 0.021 | -0.029 | -0.113 |
|  | (0.43) | (-0.48) | (-1.31) |
| PLEDGE RATIO*ZERO LEVERAGE | -0.638*** | -0.607*** | -0.723*** |
|  | (-4.42) | (-4.20) | (-4.62) |
| ZERO LEVERAGE | 0.260*** | 0.225*** | 0.202*** |
|  | (6.26) | (5.34) | (4.52) |
| HIGH LEVERAGE |  | -0.107*** | -0.092** |
|  |  | (-3.01) | (-2.23) |
| PLEDGE RATIO*HIGH LEVERAGE |  | 0.174* | 0.254** |
|  |  | (1.94) | (2.29) |
| LOW LEVERAGE |  |  | 0.048 |
|  |  |  | (1.15) |
| PLEDGE RATIO*LOW LEVERAGE |  |  | 0.193 |
|  |  |  | (1.50) |
| SIZE | -0.061*** | -0.054*** | -0.050*** |
|  | (-3.29) | (-2.95) | (-2.79) |
| MB | 0.005 | 0.011** | 0.011** |
|  | (1.06) | (2.20) | (2.26) |
| VOLATILITY | 0.176 | 0.334 | 0.275 |
|  | (0.52) | (0.99) | (0.82) |
| ROA | 0.030 | 0.039 | 0.060 |
|  | (0.16) | (0.22) | (0.34) |
| R&D | 1.604*** | 1.442*** | 1.308*** |
|  | (4.48) | (4.08) | (3.73) |
| SALES GROWTH | 0.034 | 0.054 | 0.059 |
|  | (0.55) | (0.86) | (0.97) |
| INSTOWN | 0.055 | 0.039 | 0.056 |
|  | (0.75) | (0.54) | (0.78) |
| INSIDEROWN | 0.001 | 0.001 | 0.000 |
|  | (0.40) | (0.68) | (0.30) |
| CEO AGE | 0.151** | 0.142* | 0.122* |
|  | (2.05) | (1.97) | (1.74) |
| CEO TENURE | 0.003 | 0.004 | 0.011 |
|  | (0.22) | (0.28) | (0.81) |
| Constant | -0.336 | -0.326 | -0.343 |
|  | (-1.06) | (-1.05) | (-1.12) |
| Observations | 339 | 339 | 339 |
| R-squared | 0.574 | 0.594 | 0.617 |
| Firm Cluster | Yes | Yes | Yes |
| Insdustry Effect | Yes | Yes | Yes |
| Year Effect | Yes | Yes | Yes |

Table 6: Threshold Regression Test (Hansen (1999)) on Leverage

This table presents threshold regression estimated from the threshold model specified in Hansen (1999): $y_{i,t} = \mu + \mathbf{X}_{i,t}(q_{i,t} \leqslant \gamma)\beta_1 + \mathbf{X}_{i,t}(q_{i,t} > \gamma)\beta_2 + \eta + \epsilon_{it}$, where the $q_{i,t}$ is the threshold variable pledge ratio, $\gamma$ is a threshold parameter that divides the equation into two regimes with coefficients $\beta_1$ and $\beta_2$. Control variable set includes firm's market capitalization, size, market-to-book ratio, annual volatility, ROA, R&D. The sample period is from 2006 to 2015. All control variables are winsorized at $1^{st}$ and $99^{th}$ percentiles. t-statistics, based on standard errors clustered at firm level, are reported in parentheses. Statistical significance is denoted by *, **, and *** at the 10%, 5%, and 1% levels, respectively.

| | BOOKLEV | |
| --- | --- | --- |
| | (1) | (2) |
| Panel A: PLEDGE RATIO $< \gamma$ | | |
| PLEDGE RATIO | 0.361*** | 0.410*** |
| | (3.06) | (3.78) |
| SIZE | | 0.082*** |
| | | (3.32) |
| MB | | 0.020** |
| | | (2.50) |
| VOLATILITY | | 1.068*** |
| | | (3.11) |
| ROA | | 0.131 |
| | | (0.55) |
| R&D | | -1.643*** |
| | | (-3.78) |
| Constant | 0.206*** | 0.032 |
| | (7.48) | (0.30) |
| Panel B: PLEDGE RATIO $>= \gamma$ | | |
| PLEDGE RATIO | -0.604*** | -0.806*** |
| | (-4.15) | (-4.31) |
| SIZE | | -0.175*** |
| | | (-2.58) |
| MB | | -0.005 |
| | | (-0.42) |
| VOLATILITY | | -0.694 |
| | | (-0.76) |
| ROA | | -0.665 |
| | | (-0.76) |
| R&D | | -2.983*** |
| | | (-3.18) |
| Constant | 0.819*** | 1.403*** |
| | (7.63) | (3.50) |
| Observations | 339 | 339 |
| Threshold $\gamma$ | 0.482 | 0.492 |
| BIC | -873.372 | -621.130 |
| HQIC | -882.419 | -652.938 |

Table 7: Average Treatment Effect of Share Pledging on Firm Value

This table reports the average treatment effects (ATE) of share pledging on firm's valuation based on CEO pledger sample. The outcome variable ($Y$) is proxied by firm's tobin's Q ($Tobin\ Q$) and return on asset ($ROA$), which are measured in $t+1$. Matching covariates include firm size, volatility, book leverage, institutional ownership, insiderownership, dividends, sales growth, CAPEX, and industry. Results in Panel A. is based on the propensity score matching estimator. Results in Panel B. is based on the nearest neighbor matching estimator. ATE of share pledging are reported in column (1) and (6). ATE of share pledging are reported in column (2) and (7). Variable definitions are provided in the appendix. The sample period is from 2006 to 2015. All matching variables are winsorized at $1^{st}$ and $99^{th}$ percentiles. Statistical significance is denoted by *, **, and *** at the 10%, 5%, and 1% levels, respectively.

| Outcome Variable (Y) | ATE | Panel A: Propensity Score Matching Estimator | | | | | Panel B: Nearest Neighbor Matching Estimator | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Coeff. | AI Robust Std. Err. | Z | P - Value | [95% Conf. Interval] | Coeff. | AI Robust Std. Err. | Z | P - Value | [95% Conf. Interval] |
| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
| Y = Tobin Q | PLEDGE (1 vs 0) | -0.286*** | 0.096 | -2.990 | 0.003 | [-.474, -.098] | -0.330*** | 0.062 | -5.340 | 0.000 | [-.451, -.208] |
| Y = ROA | PLEDGE (1 vs 0) | -0.022*** | 0.006 | -3.910 | 0.000 | [-.032, -.010] | -0.020*** | 0.006 | -3.300 | 0.001 | [-.032, -.008] |

## Table 8: The Association between the Pledge Ratio and the Firm Value

This table presents panel regression results in which the dependent variables are firm's return on asset ($ROA$) and tobin's Q ($Tobin's\ Q$), in Panel A and B respectively. The dependent variables are measured in year $t+1$. The model is based on $Y_{i,t+1} = \alpha PLEDGE_{i,t} + \beta \mathbf{X}_{i,t} + \delta_t + \eta + \epsilon_{it}$. $\mathbf{X}_{i,t}$ is a control set including firm's size, market-to-book ratio, annual volatility, institutional ownership, insider ownership, dividends, sales growth, and CAPEX. The variable of interest is $PLEDGE\ RATIO$, which is calculated as CEO's pledged shares divided by the total amount of shares owned. Variable definitions are provided in the appendix. The sample period is from 2006 to 2015. All control variables are winsorized at $1^{st}$ and $99^{th}$ percentiles. Year and industry fixed effects are included. t-statistics, based on standard errors clustered at firm level, are reported in parentheses. Statistical significance is denoted by *, **, and *** at the 10%, 5%, and 1% levels, respectively.

| | Share-Pledging Impact on Firm's Valuation | | | |
| --- | --- | --- | --- | --- |
| | Panel A. ROA | | Panel B: Tobin Q | |
| | (1) | (2) | (3) | (4) |
| Variable of Interest | | | | |
| PLEDGE RATIO | -0.043* | -0.048** | -0.800*** | -0.884*** |
| | (-1.76) | (-2.00) | (-2.79) | (-3.18) |
| Control Variable Set | | | | |
| SIZE | 0.018*** | 0.017*** | 0.146** | 0.141** |
| | (3.66) | (3.40) | (2.52) | (2.46) |
| BOOKLEV | -0.057* | -0.066** | -0.918*** | -1.060*** |
| | (-1.93) | (-2.28) | (-2.63) | (-3.13) |
| VOLATILITY | -0.098 | -0.057 | 0.889 | 2.009 |
| | (-0.76) | (-0.39) | (0.58) | (1.17) |
| INSTOWN | 0.105*** | 0.093** | 1.128** | 0.924** |
| | (2.77) | (2.45) | (2.54) | (2.09) |
| INSIDEROWN | 0.001 | 0.000 | 0.010 | 0.001 |
| | (1.38) | (0.63) | (1.10) | (0.15) |
| Constant | 0.279*** | 0.260** | 2.101* | 1.723 |
| | (2.66) | (2.52) | (1.71) | (1.44) |
| Observations | 339 | 339 | 339 | 339 |
| R-squared | 0.294 | 0.330 | 0.221 | 0.280 |
| Other Controls? | No | Yes | No | Yes |
| Firm Cluster | Yes | Yes | Yes | Yes |
| Insdustry Effect | Yes | Yes | Yes | Yes |
| Year Effect | Yes | Yes | Yes | Yes |

Table 9: Endogenous Share Pledging: Instrumental Variable Estimation

This table presents two stage regression results in which the instrumental variable is the FHFA housing price index (HPI), both seasonally adjusted and non-seasonally adjusted. The results are based on the following specifications,

$$PLEDGE_{i,t} = \alpha HPI_{i,t} + \beta \mathbf{X}_{i,t} + \delta_t + \eta + \epsilon_{it}$$

$$Y_{i,t+1} = \gamma \widehat{PLEDGE}_{i,t} + \beta \mathbf{X}_{i,t} + \delta_t + \eta + \epsilon_{it}$$

where the estimated pledge ratio $\widehat{PLEDGE}_{i,t}$ is employed on the second stage estimation. Panel A. reports the first stage regression results where the dependent variable is the pledge ratio and the IV is the HPI. Panel B. reports second stage regression results where the dependent variables are R&D, capital expenditure expenses, Tobin's Q, and return on asset (from Column (3) to (10)). The instrumented pledge ratio $\widehat{PLEDGE}$ is the variable of interest in the second stage estimation. Control variabel set includs firm's size, market-to-book ratio, annual volatility, institutional ownership, sales growth, CEO's age and tenure. Housing price index data are merged with firm data at state level. Variable definitions are provided in the appendix. The sample period is from 2006 to 2015. All control variables are winsorized at $1^{st}$ and $99^{th}$ percentiles. Year and industry fixed effects are included. t-statistics, based on standard errors clustered at firm level, are reported in parentheses. Statistical significance is denoted by *, **, and *** at the 10%, 5%, and 1% levels, respectively.

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Table 9 Cont'd: Endogenous Share Pledging: Instrumental Variable Estimation

| | Panel A. First Stage PLEDGE RATIO | | Panel B. Second Stage | | | | | | | |
| | | | R&D | CAPEX | Tobin Q | ROA | R&D | CAPEX | Tobin Q | ROA |
| | | | Non-seasonally adjusted HPI instrument | | | | Seasonally adjusted HPI instrument | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Variable of Interest** | | | | | | | | | | |
| HPI | -0.544*** | | | | | | | | | |
| | (-3.57) | | | | | | | | | |
| HPI adjusted | | -0.539*** | | | | | | | | |
| | | (-3.51) | | | | | | | | |
| $\widehat{PLEDGE}$ | | | -0.066** | 0.163* | -1.721* | -0.156* | -0.064** | 0.176* | -1.749* | -0.157* |
| | | | (-2.24) | (1.78) | (-1.75) | (-1.84) | (-2.17) | (1.77) | (-1.74) | (-1.82) |
| SIZE | 0.002 | 0.002 | 0.001 | 0.003 | -0.049 | 0.001 | 0.001 | 0.003 | -0.048 | 0.001 |
| | (0.15) | (0.16) | (0.38) | (0.44) | (-0.89) | (0.25) | (0.37) | (0.44) | (-0.89) | (0.25) |
| MB | -0.011 | -0.011 | 0.001 | 0.002 | 0.210*** | 0.008*** | 0.001 | 0.002 | 0.209*** | 0.008*** |
| | (-1.57) | (-1.57) | (0.68) | (0.57) | (6.98) | (3.18) | (0.70) | (0.62) | (6.92) | (3.15) |
| VOLATILITY | 0.993* | 0.996* | 0.212*** | -0.240 | 2.528 | -0.324* | 0.211*** | -0.254 | 2.553 | -0.322* |
| | (1.95) | (1.95) | (3.46) | (-0.89) | (1.23) | (-1.83) | (3.44) | (-0.90) | (1.24) | (-1.81) |
| INSTOWN | 0.443*** | 0.445*** | -0.041** | -0.101 | 0.927 | 0.133*** | -0.042** | -0.110 | 0.940 | 0.134*** |
| | (4.31) | (4.33) | (-2.31) | (-1.36) | (1.55) | (2.75) | (-2.33) | (-1.38) | (1.55) | (2.72) |
| BOOKLEV | 0.171** | 0.171** | -0.019* | -0.078** | -1.061*** | -0.016 | -0.019* | -0.081** | -1.055*** | -0.016 |
| | (2.28) | (2.27) | (-1.80) | (-2.41) | (-3.05) | (-0.57) | (-1.82) | (-2.38) | (-3.01) | (-0.56) |
| SALES GROWTH | 0.039 | 0.039 | 0.008 | 0.075** | 0.843*** | 0.152*** | 0.008 | 0.076** | 0.845*** | 0.152*** |
| | (0.44) | (0.44) | (0.83) | (2.07) | (2.58) | (5.55) | (0.83) | (2.03) | (2.58) | (5.53) |
| CEO AGE | 0.174 | 0.175 | -0.034** | 0.032 | 0.354 | 0.072* | -0.034** | 0.031 | 0.360 | 0.072* |
| | (1.43) | (1.44) | (-2.35) | (0.77) | (0.73) | (1.80) | (-2.36) | (0.71) | (0.74) | (1.80) |
| CEO TENURE | -0.034 | -0.035 | 0.001 | -0.002 | -0.180* | -0.008 | 0.001 | -0.001 | -0.181* | -0.008 |
| | (-1.53) | (-1.55) | (0.22) | (-0.19) | (-1.95) | (-1.08) | (0.24) | (-0.09) | (-1.95) | (-1.08) |
| Constant | 1.944** | 1.912* | 0.148** | 0.027 | 1.090 | 0.091 | 0.149** | 0.033 | 1.060 | 0.089 |
| | (1.98) | (1.93) | (2.26) | (0.14) | (0.50) | (0.50) | (2.28) | (0.17) | (0.48) | (0.49) |
| Observations | 339 | 339 | 339 | 339 | 339 | 339 | 339 | 339 | 339 | 339 |
| R-squared | 0.378 | 0.376 | 0.526 | 0.278 | 0.383 | 0.308 | 0.529 | 0.231 | 0.380 | 0.305 |
| Sanderson–Windmeijer F | 13.47 | 12.97 | | | | | | | | |
| Insdustry Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

Instrumental Variable Estimation (Instruments: HPI and Seasonally Adjusted HPI)

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Table 10: The Association between Share Pledging and Earnings Management

This table presents regression results based on the following designs

$$DCA_{i,t+1} = \beta_0 + \beta_1 * PLEDGE_{i,t} + \gamma \mathbf{X}_{i,t} + \delta_t + \eta + \epsilon_{i,t}$$

The variable of interest is $PLEDGE\ RATIO$, which is calculated as CEO's pledged shares divided by the total amount of shares owned. Variable definitions are provided in the appendix. The sample period is from 2006 to 2015. All control variables are winsorized at $1^{st}$ and $99^{th}$ percentiles. We control for industry fixed effects. t-statistics, based on standard errors clustered at firm level, are reported in parentheses. Statistical significance is denoted by *, **, and *** at the 10%, 5%, and 1% levels, respectively.

| | Discretionary Accrual | Modified Discretionary Accrual |
|---|---|---|
| | (1) | (2) |
| *Variable of Interest* | | |
| PLEDGE RATIO | 0.796** | 1.006** |
| | (2.19) | (2.04) |
| *Control Variable Set* | | |
| BOOKLEV | -1.381*** | -1.360*** |
| | (-3.12) | (-3.32) |
| INSTOWN | -0.043 | -0.643 |
| | (-0.08) | (-0.87) |
| CAPEX | 0.923 | 0.777 |
| | (1.17) | (0.96) |
| SIZE | -0.021 | -0.073 |
| | (-0.25) | (-0.70) |
| MB | 0.008 | 0.016 |
| | (0.58) | (0.89) |
| CF | -1.349** | -0.850 |
| | (-2.05) | (-1.52) |
| INSIDEROWN | -0.000 | -0.004 |
| | (-0.02) | (-0.35) |
| CEO AGE | 1.277 | 1.815 |
| | (1.22) | (1.23) |
| CEO TENURE | -0.060 | -0.124 |
| | (-0.27) | (-0.41) |
| ANALYST COVERAGE | -0.501** | -0.431 |
| | (-2.21) | (-1.59) |
| Constant | -3.271 | -4.724 |
| | (-0.95) | (-0.97) |
| Observations | 339 | 339 |
| R-squared | 0.113 | 0.173 |
| Firm Cluster | Yes | Yes |
| Insdustry Effect | Yes | Yes |
| Year Effect | Yes | Yes |

**Table 11: Heterogeneous Impacts of Institutional Investors Ownership on Share Pledging**

This table presents regression results the impact of institutional ownership on pledge ratio. *LONGIO* represents the long-term institutional ownership. *SHORTIO* represents the short-term institutional ownership. *IO* represents the total instiutional ownership. Ownership construction follows the steps in Gaspar et al. (2005). The dependent variable is *PLEDGE RATIO*, which is calculated as CEO's pledged shares divided by the total amount of shares owned. Variable definitions are provided in the appendix. The sample period is from 2006 to 2015. All control variables are winsorized at $1^{st}$ and $99^{th}$ percentiles. We control for industry fixed effects and year fixed effects. t-statistics, based on standard errors clustered at firm level, are reported in parentheses. Statistical significance is denoted by *, **, and *** at the 10%, 5%, and 1% levels, respectively.

| | OLS | | | Diff-in-Diff | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Variable of Interest | | | | | | |
| LONGIO | -0.276** | | | 0.024 | | |
| | (-2.04) | | | (0.76) | | |
| SHORTIO | | -0.049 | | | 0.031 | |
| | | (-0.38) | | | (1.08) | |
| IO | | | -0.044 | | | 0.076** |
| | | | (-1.20) | | | (2.10) |
| POST*LONGIO DUMMY | | | | -0.086* | | |
| | | | | (-1.89) | | |
| POST*SHORTIO DUMMY | | | | | -0.081 | |
| | | | | | (-1.65) | |
| POST*IO DUMMY | | | | | | -0.134*** |
| | | | | | | (-2.90) |
| POST | | | | 0.075 | 0.068* | 0.102** |
| | | | | (1.63) | (1.71) | (2.35) |
| Control Variable Set | | | | | | |
| SIZE | -0.005 | -0.008 | -0.007 | -0.007 | -0.009 | -0.007 |
| | (-0.66) | (-1.07) | (-0.88) | (-0.70) | (-0.88) | (-0.67) |
| MB | 0.001 | 0.001 | 0.001 | -0.000 | -0.000 | -0.000 |
| | (0.46) | (0.61) | (0.50) | (-0.00) | (-0.02) | (-0.00) |
| VOLATILITY | -0.236 | -0.328* | -0.259 | -0.162 | -0.199 | -0.182 |
| | (-1.31) | (-1.72) | (-1.36) | (-0.93) | (-1.17) | (-1.03) |
| INSIDEROWN | 0.000 | 0.000 | 0.000 | -0.001 | -0.000 | 0.000 |
| | (0.03) | (0.28) | (0.13) | (-0.27) | (-0.26) | (0.11) |
| CEO AGE | -0.013 | -0.016 | -0.016 | -0.018 | -0.015 | -0.013 |
| | (-0.88) | (-1.10) | (-1.11) | (-0.99) | (-0.86) | (-0.79) |
| CEO TENURE | 0.030** | 0.028** | 0.029** | 0.027 | 0.025 | 0.021 |
| | (2.38) | (2.16) | (2.26) | (1.43) | (1.36) | (1.12) |
| TOBIN Q | -0.000 | 0.000 | 0.001 | 0.003 | 0.003 | 0.002 |
| | (-0.05) | (0.03) | (0.19) | (0.32) | (0.34) | (0.22) |
| DIVIDENDS | 0.532 | 0.614* | 0.530 | 0.472 | 0.512 | 0.485 |
| | (1.53) | (1.77) | (1.50) | (0.90) | (0.94) | (0.88) |
| Constant | 0.239*** | 0.253*** | 0.257*** | 0.208** | 0.205** | 0.160* |
| | (3.03) | (3.22) | (3.27) | (2.07) | (2.17) | (1.68) |
| Observations | 678 | 678 | 678 | 678 | 678 | 678 |
| R-squared | 0.023 | 0.016 | 0.018 | 0.052 | 0.050 | 0.060 |
| Firm Cluster | Yes | Yes | Yes | Yes | Yes | Yes |
| Insdustry Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Effect | Yes | Yes | Yes | Yes | Yes | Yes |

Table 12: A Further Look At Institutional Investors' Monitoring

This table presents regression results based on the following designs

$$Investment\ (Financing)_{i,t+1} = \beta_0 + \beta_1 * PLEDGE_{i,t} + \beta_2 * INSTOWN_{i,t} + \beta_3 * PLEDGE_{i,t} * INSTOWN_{i,t} + \gamma \mathbf{X}_{i,t} + \delta_t + \eta + \epsilon_{i,t}$$

The dependent variable set includes the investment policy proxies and financing policy proxies. *PLEDGE RATIO* is calculated as CEO's pledged shares divided by the total amount of shares owned. The variable of interests is the interaction term between the pledge ratio and institutional ownership. Variable definitions are provided in the appendix. The sample period is from 2006 to 2015. All control variables are winsorized at $1^{st}$ and $99^{th}$ percentiles. We control for industry fixed effects. t-statistics, based on standard errors clustered at firm level, are reported in parentheses. Statistical significance is denoted by *, **, and *** at the 10%, 5%, and 1% levels, respectively.

| | Panel A. | | | | Panel B. | | | | | | | |
| | R&D | | CAPEX | | BOOKLEV | | MARKET LEV | | NETLEV | | CASH HOLDINGS | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLEDGE RATIO * INSTOWN | 0.037* (1.77) | | 0.042 (0.75) | | 0.279** (2.55) | | 0.152* (1.75) | | 0.379*** (3.21) | | -0.264*** (-3.01) | |
| PLEDGE RATIO * dum(INSTOWN) | | 0.085* (1.93) | | -0.014 (-0.12) | | 0.423* (1.80) | | 0.268 (1.44) | | 0.735*** (2.76) | | -0.455** (-2.37) |
| PLEDGE RATIO | -0.022 (-1.33) | -0.067* (-1.83) | -0.024 (-0.53) | 0.015 (0.14) | -0.099 (-1.14) | -0.267 (-1.35) | -0.125* (-1.80) | -0.246 (-1.57) | -0.073 (-0.82) | -0.425** (-2.01) | 0.050 (0.74) | 0.254 (1.62) |
| INSTOWN | -0.075*** (-3.12) | -0.091*** (-4.53) | -0.050 (-0.67) | -0.017 (-0.28) | 0.185 (1.44) | -0.111 (-0.98) | 0.172* (1.69) | -0.078 (-0.87) | 0.201 (1.54) | -0.194 (-1.64) | 0.006 (0.07) | 0.219** (2.48) |
| dum(INSTOWN) | -0.005 (-0.49) | | 0.003 (0.10) | | -0.168*** (-2.98) | | -0.132*** (-2.96) | | -0.200*** (-3.43) | | 0.115*** (2.62) | |
| Constant | 0.112 (1.53) | 0.116 (1.59) | -0.348* (-1.76) | -0.332* (-1.69) | -0.227 (-0.59) | -0.189 (-0.49) | -0.163 (-0.53) | -0.155 (-0.50) | -0.170 (-0.44) | -0.132 (-0.33) | 0.062 (0.21) | 0.024 (0.08) |
| Observations | 339 | 339 | 339 | 339 | 339 | 339 | 339 | 339 | 339 | 339 | 339 | 339 |
| R-squared | 0.357 | 0.362 | 0.229 | 0.230 | 0.351 | 0.328 | 0.478 | 0.460 | 0.388 | 0.367 | 0.401 | 0.387 |
| Other Controls? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Insdustry Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

# Appendix

## Variable Definitions:

I. Pledging Characteristics:

- $PLEDGE\ RATIO$: Share pledging ratio is calculated as amount of shares being pledged divided by the total amount of shares that are beneficially owned. Data Source: Edgar DEF14-A.

II. Firm Characteristics[25]:

- $SIZE$: Firm size is measured by the natural logarithm of the totoal asset. Data Source: COMPUSTAT.

- $MB$: Market-to-book is measured as the ratio of the market value of the equity to the book value of the asset. Data Source: COMPUSTAT.

- $VOLATILITY$:Annaual stock volatility over fiscal year $t-1$. Data Source: CRSP.

- $INSIDEROWN$: Firm's insider ownership is constructed as the percentage of shares owned by the firms' insiders. Data Source: EXECUCOMP.

- $INSTOWN$: Firm's institutional ownership is calculated as the ratio of the shares held by 13F institutions to the total share outstanding. Data Source: 13F and CRSP.

- $BOOKLEV$:Firm's book leverage is calculated as $(DLTT + DLC)/AT$. Data Source: COMPUSTAT.

- $MKTLEV$: Firm's market leverage is calculated as $(dltt+dlc)/(at-ceq+prcc\_f*csho)$; Data Source: COMPUSTAT.

- $NETLEV$: Firm's net leverage is calculated as$(dltt + dlc)/(lat - lch)$; Data Source: COMPUSTAT.

- $CASH$: Firm's cash holding is calculated as $CH/AT$. Data Source: COMPUSTAT.

- $SALES\ GROWTH$: Sales growth is the natural logarithm of sales ratio, $log(SALE/SALE_{t-1})$. Data Source: COMPUSTAT.

- $CAPEX$: $(CAPX)/AT$ Data Source: COMPUSTAT.

- $R\&D$: $MAX(0, XRD)/AT$ Data Source: COMPUSTAT.

- $CEO\ AGE$: CEO age is measured by the natural logarithm of current CEO's age for year $t$. Data Source: EXECUCOMP.

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[25]Outcome variables are led by one period forward, $t+1$.

- *CEO TENURE*: CEO tenure is measured by the natural logarithm of current CEO's tenure for year $t$. Data Source: EXECUCOMP.

- *ROA*: Return on asset is calculated as $OIBDP/TA$. Data Source: COMPUSTAT.

- *Tobin Q*: Tobin's Q is calculated as $(AT - CEQ + CSHO * PRCC\_F)/LAT$. Data Source: COMPUSTAT.

- *DIVIDENDS*: Dividend is calculated as $DV/AT$. Data Source: COMPUSTAT.

- *HPI*: Housing price index at state level. Data Source: FHFA

# Appenix Exhibit 1:
## Corporate Policies on Share Pledging - An Example: Apple Inc.'s Prohibition on Share Pledging

This exhibit presents Apple Inc.'s current compensation practices. Under the section "Risk management", it clearly states that share pledging by executive officers are prohibited. (Information Source: Apple Inc's DEF 14(a) Proxy Statement, Filing Date: 2017-12-27, Period of Report: 2018-02-13. File: https://www.sec.gov/Archives/edgar/data/320193/000119312517380130/d400278ddef14a.htm )

**Compensation Practices**

| | |
|---|---|
| **Independent compensation consultant** | The Compensation Committee has directly retained an independent compensation consultant that performs no services for Apple other than services for the Compensation Committee. |
| **Annual compensation risk assessment** | The Compensation Committee conducts an annual risk assessment of our compensation program. |
| **Risk management** | We prohibit short sales, transactions in derivatives of Apple securities, including hedging transactions, and pledging of shares by all executive officers. |
| **Stock ownership guidelines** | We have robust stock ownership guidelines for our executive officers. |
| **Equity clawback policy** | Our RSU agreements have a recoupment provision requiring repayment to Apple of any shares or other amount that may be paid in respect of RSUs in the event of certain acts of misconduct. |
| **Vesting and performance conditions on dividend equivalents** | We apply the same vesting restrictions and performance conditions on dividend equivalents as on the underlying RSUs. |
| **At-will employment** | We employ our executive officers at will. |
| **No pension or other special benefits** | We do not provide pensions or supplemental executive retirement, health, or insurance benefits. |
| **No change of control payments** | We do not offer change of control payments or gross-ups of related excise taxes. |
| **No retirement vesting** | We do not include retirement vesting provisions in equity awards. |
| **No repricing** | We do not allow repricing of stock options without shareholder approval. |

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**Appenix Exhibit 1, Cont'd:**
**Corporate Policies on Share Pledging - An Example: General Motor's**
**Prohibition on Share Pledging**

This exhibit presents General Motors' current compensation practices. Under the section "WHAT WE DON'T DO", it states that share pledging by executives or directors are not allowed. (Information Source: GM's DEF 14(a) Proxy Statement, Filing Date: 2016-04-22, Period of Report: 2016-04-22. File: https://www.sec.gov/Archives/edgar/data/1467858/000130817916000367/lgm2016_def14a.htm )

► Compensation Governance and Best Practices

**WHAT WE DO**

✔ Provide short and long-term incentive plans with performance targets aligned to business goals

✔ Conduct annual advisory vote for shareholders to approve executive compensation

✔ Maintain a Compensation Committee composed entirely of independent directors

✔ Establish stock ownership requirements for approximately 300 senior leaders

✔ Enter into non-compete and non-solicitation terms with approximately 300 senior leaders

✔ Retain independent executive compensation consultants to the Compensation Committee

✔ Maintain a Securities Trading Policy requiring directors and executive officers to trade only during established window periods after contacting the GM Legal Staff prior to any sales or purchases of common stock

✔ Require equity awards to have a double-trigger (termination of employment and change-in-control) to initiate protection provisions of outstanding awards

✔ Complete annual incentive compensation risk reviews

**WHAT WE DON'T DO**

✘ Grant awards to executive officers that are not subject to clawback

✘ Provide gross-up payments to cover personal income taxes or excise taxes pertaining to executive or severance benefits

✘ Allow directors or executives to engage in hedging or pledging of GM securities

✘ Reward executives for excessive, inappropriate, or unnecessary risk-taking

✘ Allow the repricing or backdating of equity awards

# Appenix Exhibit 2A:
## Disclosure on Share Pledging - An Example: Super Micro Computer Inc's disclosure on pledged shares (With Detailed Disclosure)

This exhibit presents Super Micro Computer Inc's disclosure on pledged shares. The footnote of Beneficial Ownership Table discloses that the shares are pledged for personal line of credit and provides information on shares that are pledged by executives' family members as well. (Information Source: Super Micro Computer Inc's DEF 14(a) Proxy Statement, Filing Date: 2015-01-20, Period of Report: 2015-01-20. File: https://www.sec.gov/Archives/edgar/data/1375365/000162828015000168/proxystatementfy2014.htm

### PRINCIPAL STOCKHOLDERS AND STOCK OWNERSHIP BY MANAGEMENT

The following table sets forth certain information known to us regarding beneficial ownership of our common stock as of December 31, 2014 by:

- each of the named executive officers;

- each of our directors and nominees;

- all directors and executive officers as a group; and

- all person known to us beneficially own 5% or more of our outstanding common stock.

| Name and Address of Beneficial Owner(1) | Amount and Nature of Beneficial Ownership(2) | Percent of Common Stock Outstanding(3) |
| --- | --- | --- |
| Executive Officers and Directors: | | |
| Charles Liang(4) | 8,926,868 | 18.8% |
| Howard Hideshima(5) | 235,716 | * |
| Phidias Chou(5) | 124,247 | * |
| Chiu-Chu (Sara) Liang(6) | 8,926,868 | 18.8% |
| Yih-Shyan (Wally) Liaw(7) | 2,251,111 | 4.8% |
| Gregory K. Hinckley(5) | 9,000 | * |
| Hwei-Ming (Fred) Tsai(8) | 338,000 | * |
| Laura Black(5) | 21,375 | * |
| Sherman Tuan(5) | 54,500 | * |
| Michael S. McAndrews | — | * |
| All directors and executive officers as a group (9 persons)(9) | 11,960,817 | 24.8% |
| **5% Holder Not Listed Above:** | | |
| FMR LLC(10) | 6,390,039 | 13.8% |

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\* Represents beneficial ownership of less than one percent of the outstanding shares of common stock.

(1) Except as otherwise indicated, to our knowledge the persons named in this table have sole voting and investment power with respect to all shares of Common Stock shown as beneficially owned by them, subject to community property laws applicable and to the information contained in the footnotes to this table.

(2) Under the SEC rules, a person is deemed to be the beneficial owner of shares that can be acquired by such person within 60 days upon the exercise of options.

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**Appenix Exhibit 2A, Cont'd:**
**Disclosure on Share Pledging - An Example: Super Micro Computer Inc's**
**disclosure on pledged shares (With Detailed Disclosure)**

(3) Calculated on the basis of 46,455,352 shares of common stock outstanding as of December 31, 2014, provided that any additional shares of Common Stock that a stockholder has the right to acquire within 60 days after December 31, 2014 are deemed to be outstanding for the purposes of calculating that stockholder's percentage of beneficial ownership.

(4) Includes 973,833 shares issuable upon the exercise of options exercisable within 60 days after December 31, 2014. Also includes: 2,283,622 shares jointly held by Mr. Liang and his spouse, 1,703,468 shares of which are pledged as security for a personal credit line, 850,000 shares held by Mr. Liang which are pledged as security for a personal credit line, 15,000 shares held by Green Earth Charitable Trust, for which Mrs. Liang serves as trustee, 6,100 shares held by Mr. Liang's daughter, 24,400 shares held by Mr. Liang's children, for which Mrs. Liang serves as custodian; 495,620 shares held directly by Mrs. Liang and 153,200 shares issuable upon the exercise of options held by Mrs. Liang and exercisable within 60 days after December 31, 2014. See footnote 6.

(5) Consists of shares issuable upon the exercise of options exercisable within 60 days after December 31, 2014.

(6) Includes 153,200 shares issuable upon the exercise of options exercisable within 60 days after December 31, 2014. Also includes: 2,283,622 shares jointly held by Mrs. Liang and her spouse, 1,703,468 of which are pledged as security for a personal credit line, 15,000 shares held by Green Earth Charitable Trust, 6,100 shares held by Mrs. Liang's daughter, 24,400 shares held by Mrs. Liang's children, for which Mrs. Liang serves as custodian, 4,975,093 shares held by Charles Liang, Mrs. Liang's spouse, 850,000 shares of which are pledged as security for a personal credit line, and 973,833 shares issuable upon the exercise of options held by Mr. Liang and exercisable within 60 days after December 31, 2014. See footnote 4.

(7) Includes 97,221 shares issuable upon the exercise of options exercisable within 60 days after December 31, 2014. 2,056,416 shares held by Liaw Family Trust, for which Mr. Liaw and his spouse serve as trustees, 17,760 shares held by Mr. Liaw's daughters, 68,177 shares held by Mrs. Liaw, and 11,537 shares issuable upon the exercise of options granted to Mrs. Liaw, exercisable within 60 days after December 31, 2014.

(8) Includes 60,000 shares issuable upon the exercise of options exercisable within 60 days after December 31, 2014.

(9) Includes 1,740,629 shares issuable upon the exercise of options exercisable within 60 days after December 31, 2014.

(10) The information with respect to the holdings of FMR LLC ("FMR") is based solely on Schedule 13G/A filed February 13, 2014 by FMR. FMR has the sole power to vote and dispose of all of such shares. The address for FMR is 82 Devonshire Street, Boston, Massachusetts 02109.

## Disclosure on Share Pledging - An Example: BioMed Realty Trust's disclosure on pledged shares (Without Detailed Disclosure)

This exhibit presents BioMed Realty Trust, Inc's disclosure on pledged shares. The footnote of Beneficial Ownership Table only discloses how many shares are beneficially without further information. (Information Source: BioMed Realty Trust, Inc's DEF 14(a) Proxy Statement, Filing Date: 2009-04-14, Period of Report: 2009-05-27. File: https://www.sec.gov/Archives/edgar/data/1289236/000093639209000169/a52041dedef14a.htm

### SECURITY OWNERSHIP OF CERTAIN BENEFICIAL OWNERS AND MANAGEMENT

The following table sets forth as of March 11, 2009, except as otherwise set forth in the footnotes to the table, the beneficial ownership of shares of our common stock and shares of common stock into which units of limited partnership in our operating partnership, BioMed Realty, L.P., a Maryland limited partnership of which we are the sole general partner, are exchangeable for (1) each person who is the beneficial owner of 5% or more of our outstanding common stock, (2) each executive officer named in the Summary Compensation Table below (the "Named Executive Officers"), (3) each director and nominee for director and (4) executive officers and directors as a group. Each person named in the table has sole voting and investment power with respect to all of the shares of common stock shown as beneficially owned by such person, except as otherwise set forth in the footnotes to the table. The extent to which a person holds operating partnership units as opposed to shares of common stock is set forth in the footnotes below. Unless otherwise indicated, the address of each named person is c/o BioMed Realty Trust, Inc., 17190 Bernardo Center Drive, San Diego, California 92128. We are not aware of any arrangements, including any pledge of our common stock, that could result in a change in control of the company.

| Name and Address | Number of Shares of Common Stock and Units Beneficially Owned(1) | Percentage of Shares of Common Stock Beneficially Owned(2) | Percentage of Shares of Common Stock and Units Beneficially Owned(2)(3) |
|---|---|---|---|
| Alan D. Gold(4) | 1,785,707 | * | 2.2% |
| R. Kent Griffin, Jr.(5) | 217,763 | * | * |
| Gary A. Kreitzer(6) | 959,255 | * | 1.2 |
| Matthew G. McDevitt(7) | 291,212 | * | * |
| John F. Wilson, II(8) | 575,433 | * | * |
| Barbara R. Cambon(9) | 12,000 | * | * |
| Edward A. Dennis, Ph.D.(9) | 14,500 | * | * |
| Richard I. Gilchrist(9) | 4,000 | * | * |
| Theodore D. Roth(9)(10) | 14,000 | * | * |
| M. Faye Wilson(9) | 12,000 | * | * |
| Cohen & Steers, Inc.(11) | 7,186,484 | 8.9% | 8.9 |
| Barclays Global Fund Advisors(12) | 6,806,262 | 8.4 | 8.4 |
| The Vanguard Group, Inc.(13) | 6,541,241 | 8.1 | 8.1 |
| Deutsche Bank AG(14) | 6,354,260 | 7.8 | 7.8 |
| All executive officers and directors as a group (9 persons)(15) | 3,310,437 | * | 4.0 |

* Less than 1%.

(1) Amounts assume that all units are exchanged for shares of our common stock.

(2) Based on a total of 81,180,596 shares of our common stock outstanding as of March 11, 2009.

(3) Based on a total of 2,795,364 limited partnership units and 566,540 LTIP units outstanding as of March 11, 2009, which may be exchanged for cash or shares of our common stock under certain circumstances. The total number of shares of common stock and units outstanding used in calculating these percentages assumes that none of the units held by other persons are exchanged for shares of our common stock.

(4) Includes 1,141,742 limited partnership units, 110,000 LTIP units, 179,927 shares of common stock and 175,000 shares of restricted stock held by Mr. Gold directly. 1,141,742 limited partnership units and 179,927 shares of common stock held by Mr. Gold directly are pledged as security for a loan and as security for a related interest rate swap agreement. Also includes Mr. Gold's interest in 179,038 limited partnership units held by entities in which Messrs. Gold and Kreitzer share voting and investment power.

(5) Includes 120,529 shares of restricted stock and 63,882 LTIP units.

(6) Includes 642,528 limited partnership units, 80,879 LTIP units and 3,000 shares of restricted stock held by Mr. Kreitzer directly, of which 424,069 limited partnership units are pledged as security for a non-purpose loan. Also includes 80,000 limited partnership units held by Ventanas Del Mar, L.P., over which Mr. Kreitzer

has sole voting and investment power, and includes Mr. Kreitzer's interest in 109,715 limited partnership units held by entities in which Messrs. Gold and Kreitzer share voting and investment power.

(7) Includes 44,541 limited partnership units, 125,012 LTIP units and 60,000 shares of restricted stock held by Mr. McDevitt directly, of which 44,541 limited partnership units are pledged as security for a non-purpose loan. Also includes 43,659 limited partnership units and 18,000 shares of common stock held by Mr. McDevitt's wife, which are also pledged as security for the same non-purpose loan.

(8) Includes 111,661 LTIP units held by Mr. Wilson directly. Also includes 425,073 limited partnership units by SIXJWS, L.P., over which Mr. Wilson has sole voting and investment power, and which, along with 31,823 shares of common stock held by Mr. Wilson directly, have been pledged as security for a non-purpose loan. Also includes 6,876 limited partnership units held by Mr. Wilson's wife.

(9) Includes 2,000 shares of restricted common stock.

(10) Includes 6,500 shares of common stock held in a margin account.

(11) Cohen & Steers, Inc.'s address is 280 Park Avenue, 10th Floor, New York, New York 10017. The foregoing information is based on Cohen & Steers, Inc.'s Schedule 13G/A filed with the Securities and Exchange Commission on January 9, 2009.

(12) Includes 2,438,278 shares, 92,848 shares and 29,152 shares beneficially owned by Barclays Global Investors, NA., Barclays Global Investors, Ltd, and Barclays Global Investors Japan Limited, respectively. Barclays Global Fund Advisors' address is 400 Howard Street, San Francisco, California 94105. The foregoing information is based on Barclays Global Fund Advisors' Schedule 13G filed with the Securities and Exchange Commission on February 5, 2009.

(13) Includes 109,784 shares beneficially owned by Vanguard Fiduciary Trust Company ("VFTC"), a wholly-owned subsidiary of The Vanguard Group, Inc., as a result of its serving as investment manager of collective trust accounts. VFTC directs the voting of these shares. The Vanguard Group, Inc.'s address is 100 Vanguard Boulevard, Malvern, Pennsylvania 19355. The foregoing information is based on The Vanguard Group, Inc.'s Schedule 13G/A filed with the Securities and Exchange Commission on February 12, 2009.

(14) Reflects shares beneficially owned by the Private Clients and Asset Management business group of Deutsche Bank AG, and does not reflect any shares beneficially owned by any other business group of Deutsche Bank AG. Deutsche Bank AG's address is Theodor-Heuss-Allee 70, 60468 Frankfurt am Main, Germany. The foregoing information is based on Deutsche Bank AG's Schedule 13G filed with the Securities and Exchange Commission on February 12, 2009.

(15) Excludes Mr. Wilson, who retired from his position as Executive Vice President of BioMed on December 31, 2008.

## EXECUTIVE OFFICERS

Our executive officers and their ages as of March 11, 2009 are as follows:

| Name | Position | Age |
|------|----------|-----|
| Alan D. Gold | Chairman and Chief Executive Officer | 48 |
| Gary A. Kreitzer | Executive Vice President and General Counsel | 54 |
| R. Kent Griffin, Jr. | President, Chief Operating Officer and Chief Financial Officer | 39 |
| Matthew G. McDevitt | Executive Vice President, Acquisitions and Leasing | 43 |

Biographical information with respect to Messrs. Gold and Kreitzer is set forth above under "Election of