THREE ESSAYS IN EMPIRICAL CORPORATE FINANCE

BY

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DISSERTATION

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Abstract

The first essay, Does derivatives speculation affect liquidity holdings?, studies how a non-financial firm's derivatives policy is related to its liquidity management. Specifically, I examine the effect of derivatives speculation on liquidity holdings (e.g., cash, lines of credit). To identify a causal effect, I use SFAS No. 133, Accounting for Derivative Instruments and Hedging Activities, as a natural experiment that exogenously increases the cost of derivatives speculation. By analyzing changes in the liquidity holdings of treated firms following SFAS No. 133, I show that decreased derivatives speculation caused a reduction in liquidity holdings. The channel for this reduction is risk management: a reduction in speculation decreases a firm's risk; therefore, it need not hold as much liquidity to maintain the same level of risk.

In the second essay, Selection or Tunneling? An explanation for the agency problems in chaebol firms, I examine whether agency problems between controlling families and minority shareholders exist in firms that belong to Korean business groups (chaebols). Specifically, I analyze the effect of the ownership structure of chaebol bidders on merger decisions by examining merger announcement returns. First, I find that the merger announcement returns of chaebol bidders are, on average, lower than those of non-chaebol firms. In addition, using more accurate measures for cash flow rights and voting rights than those used in previous studies, I find that the cash flow (voting) rights of the controlling family are positively (negatively) associated with merger announcement returns and that the wedge between voting rights and cash flow rights is negatively related to merger announcement returns. To distinguish between the tunneling and selection (Almeida and Wolfenzon (2006)) explanations for such results, I examine the merger announcement returns of firms that belong to the same group as the bidder firm (non-bidder group firms) and my evidence is consistent with the selection of firms into different positions in the chaebol. Lastly, I consider the possibility that a controlling family pursues a merger to increase the aggregate value of the group, despite the existence of agency problems in selecting the bidder firm. However, I find evidence that does not support this hypothesis. In conclusion, agency problems between controlling families and minority shareholders exist in chaebol firms, and the selection of firms into different positions appears to be an important mechanism.

In the third essay, The effect of CEOs' prior performance on risk taking, I find that CEOs take more (less) risk after good (bad) performance. To measure a CEO's performance, I employ reference points that take into account the CEO's performance in the past and/or industry effects. As a proxy for the riskiness of projects, I employ measures of a firm's asset volatility. The positive effect of CEOs' prior

performance on risk taking exists for CEOs without stock options in their compensation package. These results are consistent with CEOs becoming more (less) confident or less (more) risk averse after good (poor) performance. When separating CEOs based on the age they became the CEO, the ones that became a CEO before the age of 50 exhibit larger sensitivity of risk taking on performance. In addition, this effect is stronger for the first half of each CEO's tenure. These cross-sectional results suggest CEOs in the earlier stage of their career respond more sensitively to their performance.

Contents

1 Does derivatives speculation affect liquidity holdings?

1.1 Introduction

Firms use financial derivative instruments to adjust their risk exposure. For example, a firm may take a derivative position with the intention of reducing risk, i.e., to hedge, or with the intention of making a profit or increasing risk, i.e., to speculate (Geczy et al. (2007)). A firm can also use liquidity holdings (e.g., cash, lines of credit) to manage its risk. Generally, the greater the volume of liquidity holdings, the better a firm is able to manage risk. Because both financial derivatives and liquidity holdings can be used to manage a firm's risk, corporate decisions on derivatives policy and liquidity holdings should be made jointly. The goal of this study is to empirically establish a causal relationship between the derivatives policies and liquidity holdings in non-financial firms. In particular, I examine the effect of derivatives speculation on liquidity holdings.

Despite the large number of studies on both corporate derivatives use and liquidity management, to the best of my knowledge there is no empirical study examining a causal relationship between a firm's derivatives policy and the value of its liquidity holdings. This could be due to the challenge of addressing endogeneity in this setting; because both derivatives policy and liquidity holdings are endogenously determined by firms, it is difficult to identify a causal effect of one on the other. To address this difficulty, I use Statement of Financial Accounting Standards No.133, Accounting for Derivative Instruments and Hedging Activities (hereafter, SFAS 133), to conduct a natural experiment that exogenously increases the cost of derivatives speculation. I then infer the effect of reduced derivatives speculation on liquidity holdings.

Prior to SFAS 133, most non-financial firms adopted an 'off-balance-sheet' approach to using derivatives. This is because most non-financial firms claimed that they use derivatives for hedging purposes, and derivatives held for hedging purposes were generally recorded at historical cost, which was often zero. However, in the absence of a mechanism for verifying the claimed purpose of derivatives use, firms could hide the true purpose of their derivative holdings. For example, Geczy et al. (2007) find that most firms that indicate speculating in confidential surveys do not disclose this information in annual

filings. To improve transparency with respect to derivatives use, the Financial Accounting Standards Board (FASB) issued SFAS 133 in June 1998, requiring firms to disclose the fair amounts and purpose of all derivatives holdings in financial statements from fiscal years beginning after June 15, 2000.[*] In particular, SFAS 133 required that firms record all derivatives as either assets or liabilities at fair value on their balance sheets and recognize unrealized gains or losses due to changes in fair value on their income statements, which in turn could increase earnings volatility. For derivatives that qualify as hedge instruments, however, SFAS 133 allows the application of hedge accounting. Under hedge accounting, a firm's earnings are not affected by unrealized gains or losses on derivatives to the extent that the hedge is effective.

SFAS 133 increased the cost of derivatives speculation for the following reasons: first, recognizing unrealized gains or losses on derivatives in income statements likely increases a firm's earning volatility, which is contrary to managers' preferences, according to previous studies. For example, Graham et al. (2005) find through survey methodology that 78% of CFOs are willing to sacrifice economic value in exchange for smooth earnings. Second, revealing the purpose of derivatives holdings enables investors to evaluate speculation and hedging separately. This likely leads to lower (higher) valuation of firms that speculate (hedge) because empirical evidence suggests that economic gains from speculation are insignificant at best even for firms with superior information (Adam and Fernando (2006), Brown et al. (2006)), whereas hedging enhances firm value (Pérez-González and Yun (2013), Allayannis and Weston (2001), Carter et al. (2006), MacKay and Moeller (2007), and Berrospide et al. (2007)).

As such, the costs of derivatives speculation increased after SFAS 133 became effective, whereas the benefits of speculation did not change. Therefore, SFAS 133 provided incentives for firms that were speculating with derivatives upon the issuance of SFAS 133 (hereafter, speculators) to close speculative positions, and ideally finish before SFAS 133 became effective. In addition, SFAS 133 is unlikely to affect a firm's liquidity management through channels other than a change in the derivatives use.

[*] SFAS 133 was originally effective for fiscal years beginning after June 15, 1999. However, as a result of receiving several complaints from business entities, the effective date was delayed to fiscal years beginning after June 15, 2000.

Therefore, it created a suitable shock to the cost of derivatives speculation that can be used to identify the effect of speculation on liquidity management.

In my baseline strategy, I construct a treatment group using firms that were using derivatives upon the issuance of SFAS 133 (hereafter, users) and a control group using firms that were not using derivatives upon the issuance of SFAS 133 (hereafter, non-users).[†] I then examine changes in liquidity holdings in the two groups during the period between the issuance and the adoption of SFAS 133 (hereafter, the experiment period). Because speculators belong to users, and non-users were not affected by SFAS 133, the causal effect of reduced speculation on liquidity holdings would be reflected in the change in liquidity holdings of users during the experiment period. The estimates, however, would be a lower bound of the effect because some users likely were engaged only in hedging with derivatives when SFAS 133 was issued (hereafter, hedgers).

Figure 1 displays the liquidity ratio of users and non-users for the period between 1994 and 2000, for which the liquidity ratio is defined as the sum of cash holdings and lines of credit scaled by assets. During the years preceding the issuance of SFAS 133 (1994–1998), the two series appear to follow parallel trends. However, there is a noticeable decrease in the liquidity ratio for users during the experiment period (1998–2000) but not for non-users. Specifically, the liquidity ratio decreases from 10.2% to 9.3% for users, but stays at the 11.2% level for non-users. This figure suggests that SFAS 133 caused users to lower their liquidity holdings by approximately 0.9 percentage points.

The results of a formal difference-in-differences regression analysis are consistent with the Figure 1 graph. I document a 1.7 percentage point decrease in the liquidity ratio for users during the experiment period relative to the ratio for non-users after controlling for observable firm characteristics and industry effects. This effect is economically significant, accounting for approximately 16.7% of users' liquidity ratio. I also show that this result cannot be ascribed to differential trends in liquidity holdings between the two groups prior to the issuance of SFAS 133.

[†] The challenge of identifying speculators among users impedes the construction of the treatment group using only speculators.

Next, to provide additional checks on the logic of my empirical strategy, I conduct a number of tests. First, I replicate the experiment during placebo periods and find that derivatives use is unrelated to changes in liquidity holdings in other periods. In other words, while derivatives use is generally unrelated to changes in liquidity holdings, it affects liquidity holdings precisely when derivatives speculation becomes costly. Second, I extend the time horizon to examine the longer-term effects of SFAS 133. Because SFAS 133 has been in effect since 2001, its effect on liquidity holdings should persist rather than quickly reverse, as it might if it were a one-time event. I find that the effects persist when I extend the period to 2001 and 2002. Finally to support the assumption that speculators decreased speculative derivative positions in response to the issuance of SFAS 133, I document that the profits volatility of users decreased around the issuance and adoption of SFAS 133. This is indirect evidence of reduced speculation among users following the regulation.

To ensure that the decreased liquidity holdings of users are attributable to the reduction in derivatives speculation, I conduct two sets of cross-sectional tests in which I categorize users into hedgers and speculators. First, I construct an ex post measure of derivatives speculation by using information on 2001 derivatives positions; this is the first year for which I can identify all firms' derivatives positions. Assuming that speculators may not have been able to close all speculative positions by the end of 2000, I regard a user as a speculator if it reports any derivative position that is not designated as a hedge in 2001. I also categorize a user that stopped using derivatives in 2001 as a speculator, assuming that it successfully closed all speculative positions. If a user reports only hedging positions, I categorize it as a hedger.

Figure 2 displays the liquidity ratio of speculators and hedgers for the period between 1994 and 2000. Throughout the whole period, speculators' liquidity ratio is higher than that of hedgers, consistent with the proposition that hedging activities reduce liquidity needs. During the years preceding the issuance of SFAS 133 (1994–1998), the two series appear to follow parallel trends. However, there is a noticeable decrease in the liquidity ratio for speculators (from 10.9% to 9.4%) during the period between

1998 and 2000, whereas the liquidity ratio for hedgers increases slightly (from 7.86% to 7.95%). This figure suggests that SFAS 133 affected the liquidity holdings of speculators but not those of hedgers.

The results of the statistical analysis are consistent with the interpretation of Figure 2. In difference-in-differences regression tests, I find that speculators decreased their liquidity ratio by 2.1 percentage points compared with hedgers, or 19% of their pre-treatment liquidity holdings. The economic significance is greater than that obtained in the baseline test in which I compare users to non-users, consistent with speculators' driving the decreased liquidity holdings of users. Next, I do not find differential prior trends in liquidity holdings between speculators and hedgers. In addition, the derivatives positions are unrelated to changes in liquidity holdings during the placebo period.

For the second cross-sectional test, I refer to a number of studies that provide evidence that firms with weak corporate governance engage in speculation to a greater extent than do firms with strong corporate governance (Fauver and Naranjo (2010), Geczy et al. (2007), Allayannis et al. (2012)), and use the level of corporate governance to separate hedgers from speculators. In doing so, I employ commonly used proxies for corporate governance: Gompers, Ishii, and Metrick's (2003) firm-level corporate governance index (the G-Index), Bebchuk, Cohen, Ferrell's (2009) firm-level entrenchment index (the E-index), and institutional ownership. This strategy results in a triple difference analysis that exploits the pre-determined variation in derivatives use and corporate governance upon the issuance of SFAS 133. I find that users with weak governance decreased cash holdings by more than 2 percentage points during the experiment period.[‡] All in all, both cross-sectional tests confirm that the reduction in speculation is the driving force behind the decreased liquidity holdings of users.

Next, I consider an alternative explanation according to which my findings are attributable to the dot-com bubble episode, which coincides with my experiment period. In particular, Internet-related firms

[‡] Because requiring a firm to have data on both corporate governance and lines of credit decreases the sample size significantly, and because it appears that firms in the sample adjusted liquidity holdings mostly through cash holdings, I report empirical results using cash holdings as a dependent variable. The results using the sum of cash holdings and lines of credit as the dependent variable are provided in the appendix. The coefficients of interest remain economically and statistically significant with one exception: it is only marginally significant when the G-index is used.

gained a more than 1,000 percent return on public equity from early 1998 through February 2000, but this return disappeared by the end of 2000 (Ofek and Richardson (2003)). If the Internet firms were mostly speculators and experienced a drop in liquidity due to the bursting of the dot-com bubble, then I would find decreased liquidity holdings of speculators irrespective of the effects arising from SFAS 133. To test this possibility, I replicate the tests excluding firms that are likely to be Internet firms. For example, I exclude firms that have the same 3- or 4-digit standard industrial classification (SIC) code as the Internet firms in Ofek and Richardson (2003). I also exclude firms that belong to "Business Equipment: Computers, Software, and Electronic Equipment" of the Fama-French 12-industry classification. In all cases, the results do not change qualitatively, suggesting that my findings are not driven by the dot-com bubble episode.

I also consider the effects of the margin requirements; because holding derivatives such as futures and options requires that margin accounts cover future payments to counterparties, a reduction in speculation using such derivatives could be the channel that results in lower levels of liquidity holdings. Although margin requirements can still be viewed as a form of risk management that is enforced by counterparties, it would be interesting to examine whether my findings are attributable to involuntary risk management rather than voluntary risk management by firms. To do so, I replicate the tests, excluding firms that hold either futures or options because these derivatives specifically require margin accounts and find that the results do not change. This result suggests that my findings are not driven by the margin requirement channel and that firms engage in risk management voluntarily.

My study is directly related to two strands in the finance literature: research on corporate derivative policies and research on liquidity management. Specifically, it is motivated by studies investigating the reasons for holding derivatives and for maintaining liquidity. Studies on holdings derivatives focus mostly on derivatives hedging rather than speculation, and suggest that firms hedge to reduce the cost of financial distress (Smith and Stulz (1985)), to relax the underinvestment problem (Froot et al. (1993)), to increase tax benefits (Leland (1998), Smith and Stulz (1985), Graham and Rogers (2002)), or to increase the informativeness of earnings as a signal of management ability (DeMarzo and

Duffie (1995), Brown (2001)). Studies on maintaining liquidity also identify reducing the cost of financial distress (John (1993)) and relaxing the underinvestment problem (Opler et al. (1999), Almeida et al. (2004), Lins et al. (2010)) as important reasons for holding liquidity in addition to reducing transaction costs (Keynes (1936)), increasing competitiveness in the product market (Baskin (1987), Haushalter et al. (2007), Fresard (2010)), or increasing the private benefits of managers (Jensen (1986), Dittmar et al. (2003)).

Both of these strands of the literature find managing the risk of financial distress and underinvestment to be an important reason for derivatives hedging and holding liquidity, respectively. It can be inferred from this concurrent goal that derivative hedging and liquidity holdings are substitutes. That is, corporate decisions on derivative hedging and liquidity holdings would be made jointly to maintain a particular level of risk depending on cost. For example, if the cost of derivatives hedging increases, a firm may decrease such hedging and instead increase liquidity holdings to maintain the same level of risk. However, from the perspective of risk management, speculation is the opposite of hedging. Therefore, derivatives speculation and liquidity holdings are expected to complement one another: if the cost of derivatives speculation increases, then a firm may decrease derivatives speculation and hold less liquidity to maintain the same level of risk.

My findings empirically confirm the complementary relationship between derivatives speculation and liquidity holdings. To the extent that holding liquidity is costly, it is an implicit cost of derivatives speculation. In other words, this study extends the literature on risk management by suggesting a new channel through which risk management affects firm value: costly liquidity holdings. Similarly, this study adds to the literature on liquidity holdings by suggesting an important determinant of a firm's liquidity holdings: derivatives policies.

Despite the large number of studies on derivatives policy and liquidity management, few studies connect the two. Theoretical studies include Bolton et al. (2011) and Mello and Parsons (2000). Bolton et al. (2011) suggest a model of a constrained firm's risk management whereby they bring both derivatives hedging and liquidity management into a unified framework. One of the model's results is that when

derivatives hedging becomes costly, a firm reduces hedging and instead relies more on cash for risk management. Mello and Parsons (2000) show using a dynamic model that a firm that hedges requires a lower level of cash holdings to reach a given value, and they argue that hedging and cash holdings are therefore substitutes for one another.

To the best of my knowledge, the only study empirically examining the causal relationship between derivatives policy and liquidity holdings is Disatnik et al. (2013), who use an instrumental variable approach to address endogeneity and find that cash flow hedging allows a firm to rely to a greater extent on lines of credit because hedging reduces the likelihood of violating financial covenants and, thus, lines of credit typically represent a greater proportion of such a firm's liquidity holdings. Their study focuses, however, on the effect of hedging on the ratio between lines of credit and cash, not on the total volume of liquidity holdings. Other empirical studies that consider the relationship between derivatives hedging and cash holdings, but not the causal effect, include Haushalter et al. (2007) and Tufano (1996). Haushalter et al. (2007) find that product market competition is positively associated with a firm's use of derivatives and the amount of cash holdings but the likelihood that a firm uses derivatives is negatively associated with its cash holdings; thus, they conclude that cash holdings and derivatives are substitutes for one another. Using a Tobit analysis, Tufano (1996) finds that firms that hold more cash hedge less using derivatives, consistent with the idea that firms use derivatives hedging and cash holdings as substitutes for one another.

My study generates relevant implications for corporate risk management. For example, my findings imply that firms save liquidity as a cushion when they take on additional risk. Although this is a straightforward result from a theoretical perspective, it is nevertheless an empirical question because firms may indeed speculate without holding additional liquidity. Second, SFAS 133 appears to have been effective in reducing firms' speculative activities. Finally, my work suggests that optimal risk management for managers and shareholders can differ and emphasizes the importance of reducing information asymmetry in order to align managerial incentives with shareholder wealth.

The paper proceeds as follows. In Section I, I introduce the baseline empirical strategy. I describe the data and summary statistics in Section II. In Section III, I report the results of the baseline empirical strategy explained in Section I. In section IV, I provide results of the two cross-sectional tests in which I separate speculators from hedgers. In Section V, I conduct additional tests to rule out alternative explanations. Section VI concludes the paper.

1.2 Empirical strategy

In this section, I describe SFAS 133 as well as the baseline experimental design.

1.2.1 SFAS 133: The experiment

Prior to SFAS 133, the accounting treatment for derivatives depended on the claimed purpose of the derivatives holdings. If a firm claimed to hold derivatives for trading purposes, it was required to record the derivatives on the balance sheet at fair value and to recognize unrealized gains or losses on the derivatives on the income statement. On the other hand, if a firm claimed that the derivatives were held for hedging purposes, the accounting treatment for the derivative instruments was determined based on the accounting treatment of the hedged items, which can include existing assets, liabilities, and forecasted transactions. If the hedged items were recorded at historical cost (fair value), the derivatives were also recorded at historical cost (fair value). Because most non-financial firms claimed that their derivatives were held for hedging purposes and the hedged items were generally recorded at historical cost, their derivatives were also recorded at historical cost, which was often zero. However, in the absence of a mechanism for verifying the claimed purpose of derivatives use, firms could easily hide the true purpose of their derivatives holdings, as evidenced by Geczy et al. (2007). Therefore, it is difficult for investors to know the fair amounts and purpose of derivatives holdings prior to the adoption of SFAS 133.

Motivated by several derivatives scandals in the early 1990s, the FASB issued SFAS 133 in June 1998 with the goal of improving transparency with respect to derivatives use. SFAS 133 requires firms to record all derivatives as either assets or liabilities at fair value on their balance sheets from fiscal years beginning after June 15, 2000. In addition, firms should recognize unrealized gains or losses due to

changes in fair value on their income statements, which may increase the volatility of reported earnings. However, SFAS 133 allows firms to apply hedge accounting to derivatives that qualify as hedge instruments. Under hedge accounting, a firm's earnings are not affected by unrealized gains or losses on derivatives to the extent that the hedge is effective. For example, for a derivative that qualifies as a hedge on exposure to changes in the fair value of a recognized asset or liability (a fair value hedge), firms can record the changes in fair value of the derivative and the changes in fair value of the hedged item simultaneously on an income statement. If a derivative qualifies as a hedge on exposure to variability in the cash flows of an asset or liability, or of a forecasted transaction (a cash flow hedge), the gains or losses on the derivative are initially recorded as a component of other comprehensive income and subsequently reclassified into earnings when cash flows affect earnings. To qualify a derivative as a hedge instrument, the firm must specify the hedged item, identify the hedging strategy, and document the basis for expecting the hedge to be effective in offsetting the designated risk exposure. The documentation of such a strategy must be completed before entering into the hedge, and on an ongoing basis. The firm must also regularly perform retrospective testing to determine the effectiveness of the hedge.

SFAS 133 increased the cost of derivatives speculation: first, a firm's earnings become more volatile from recognizing the unrealized gains and losses on derivatives on income statements, and empirical evidence suggests that managers and investors prefer smooth earnings. Second, revealing the purpose of derivatives holdings enables investors to evaluate speculation and hedging separately, which likely leads to the lower valuation of speculators. However, SFAS 133 did not affect the benefit of derivatives speculation. Therefore, it provides an incentive for speculators to reduce derivatives speculation. In addition, SFAS 133 is unlikely to affect liquidity management through channels other than the change in derivatives policy. Therefore, SFAS 133 creates a suitable shock to the cost of derivatives speculation that can be used to identify the effect of reduced speculation on liquidity holdings.

1.2.2 Decreased speculation

My strategy for identifying the effect of reduced speculation on liquidity holdings relies on the assumption that users decreased speculation upon the issuance of SFAS 133. Although the goal of SFAS 133 was to discourage derivatives speculation by increasing the transparency of derivatives use, it is difficult to provide direct evidence of decreased speculation because firms' derivatives policies are not verifiable prior to SFAS 133. To overcome this challenge, Lins et al. (2011) take advantage of survey data and find that the requirement to report derivatives at fair values reduced speculative activities. Zhang (2009) classifies a derivative user as a hedger or a speculator based on the change in risk exposure after its initiation of a derivatives program. Specifically, if a firm's risk exposure increases (decreases) after it starts using derivatives, then it is categorized as a speculator/ineffective hedger (effective hedger). Zhang finds that the volatility of cash flows and risk exposures decreased for speculators/ineffective hedgers after the adoption of SFAS 133 but not for effective hedgers, and concludes that speculators/ineffective hedgers became more prudent about risk management after the adoption of SFAS 133. I examine volatility in profits around SFAS 133 and find that it decreased for users but not for non-users.[§] Finally, Melumad, Weyns, and Ziv (1999) provide theoretical evidence that more information on risk exposures and hedging policies enables the market to better assess the hedging decisions of a given firm and encourages the optimal use of derivatives. This result suggests that SFAS 133 would discourage the speculative use of derivatives if it does not contribute to an increase in firm value.

1.2.3 Baseline model

My empirical strategy exploits the predetermined variation in derivatives use upon the issuance of SFAS 133 to proxy for the influence of SFAS 133 on derivatives policies. Specifically, I construct a treatment group using users and a control group using non-users, and analyze their liquidity holdings during the period between the issuance and the adoption of SFAS 133 (1998–2000). Because speculators belong to users, and non-users were not affected by SFAS 133, the effect of decreased speculation on liquidity holdings would be reflected in changes in users' liquidity holdings relative to those of non-users.

[§] The empirical evidence is presented in III.E, after I explain the baseline model.

This empirical strategy results in Eq. (1). The dependent variable, $\Delta liquidity_i|_{2000\text{-}1998}$, is the change in liquidity holdings between 1998 and 2000. User is an indicator variable that is assigned a value of one if the firm reports derivatives use in 1998 and zero otherwise. The control variables include change in assets, change in market-to-book ratio, change in cash flows, and change in book leverage between the years 1997 and 1999. INDs are industry dummies that use the first three digits of the SIC code. Including industry dummies can mitigate the concern that users belong disproportionately to industries that experienced a decline in liquidity holdings for reasons unrelated to derivatives use. If the reduced derivatives speculation reduces liquidity holdings, then the coefficient a_1 will be negative:

$$\Delta liquidity_i|_{2000\text{ - }1998} = a_0 + a_1 \cdot User_i + a_2 \cdot \Delta Controls_i|_{1999\text{-}1997} + INDs + \varepsilon_i \quad (1)$$

1.3 Data and summary statistics

1.3.1 Data and variables

Information on a firm's derivatives holdings is manually obtained from 10-Ks. Because most firms do not report the fair amounts of their derivatives holdings, and the absence of effective accounting guidance for derivatives reporting makes it difficult to gather even the notional amount of derivatives holdings prior to SFAS 133, I consider only whether the firm uses derivatives at all. Specifically, as noted above, I create a variable indicating derivatives use, User, which is assigned a value of one if the firm reports derivatives use and zero otherwise. The data on lines of credit are taken from the DealScan database and additional firm characteristics are gathered from the Compustat database.

Liquidity holdings represents the sum of Cash and Lines of credit. Cash is the ratio of cash and short-term investments (CHE) to total assets (AT) and Lines of credit is the amount in lines of credit scaled by total assets (AT).[**] Assets is the natural log of a firm's total assets (AT) measured in millions of dollars. MTB stands for the market-to-book asset ratio ((AT + PRCC_F*CSHO - CEQ)/AT), and

[**] Lines of credit totals are constructed from the Dealscan database following the method used by Acharya et al. (2013).

Leverage is the sum of long-term debt (DLTT) and debt in current liabilities (DLC) scaled by total assets (AT). Lastly, Cash flows is the ratio of EBITDA over total assets (AT).

The sample includes only firms with 10-Ks available from the U.S. Securities and Exchange Commission (SEC)'s website for years between 1998 and 2000. In addition, sample firms must be covered by both the DealScan database and the Compustat database. Financial firms (with SICs 6000–6999) and utilities (with SICs greater than 8000) are excluded.

1.3.2 Summary statistics

Table 1 presents the summary statistics on firms that are used in the empirical analysis. The first column describes the average characteristics for all firms, and the subsequent columns separately present the characteristics for users and non-users. Of the total of 943 firms, 400 are users and 543 are non-users. All firm characteristics are from the year 1998. The firms in the sample hold, on average, liquidity amounting to approximately 10.8% of assets. Users hold lower levels of liquidity than non-users. In addition, users hold significantly more assets than non-users. These statistics are consistent with previous findings on large firms' active use of derivatives and lower liquidity ratios. When I break liquidity holdings into cash and lines of credit, users hold more (less) cash (lines of credit) than non-users, and both groups of firms hold more cash than lines of credit.

1.4 Baseline results

This section presents the findings from the baseline empirical strategy described in section I.

1.4.1 Central test

Table 2 presents the results of the difference-in-differences analysis described above. The dependent variable is the change in liquidity holdings shown in the first column. The coefficient of interest, a_1, is statistically and economically significant, suggesting that users decreased the liquidity ratio by 1.7 percentage points during the two-year experiment period. This is a decrease of approximately 16.7% in liquidity holdings for derivatives users. The positive coefficients on chg in MTB are consistent with

previous findings that firms with better investment opportunities hold more liquidity to take better advantage of those opportunities.

To further examine whether this result is driven by either cash holdings or lines of credit, I separate these two variables and repeat the tests. The results for cash holdings and lines of credit are presented in the second and third columns, respectively. The coefficients on User in both tests are negative and statistically significant, indicating that users decreased both cash holdings and lines of credit. These results indicate that the decrease in liquidity holdings of derivative users is driven by the decreases in both cash holdings and lines of credit: of the 1.7 percentage point decrease in the liquidity holdings of users, the decrease in cash holdings accounts for 0.9 percentage points, and the remaining 0.8 percentage points are attributed to the decrease in lines of credit. This suggests that users decreased cash holdings and obtained (renewed) less in lines of credit than non-users.

1.4.2 Placebo test

My identification strategy is to show the causal effects of reduced derivatives speculation on liquidity holdings. SFAS 133 provides an ideal setting for this because it increases the cost of derivatives speculation, which would incentivize speculators to reduce speculation. I find that such a reduction in speculation indeed caused decreased liquidity holdings. In normal times, however, the cost of speculation would change very little. Therefore, I expect the derivatives use to be unrelated to changes in liquidity holdings in periods prior to the issuance of SFAS 133 or periods long after SFAS 133 became effective (placebo periods). To confirm this logic, I replicate the baseline test for the 1993–1995, 1995–1997, and 2006–2008 periods.[††] I first use information on derivatives use from the years 1993, 1995, and 2006 to classify firms into derivatives users and non-users in each year. I then examine the changes in the firms' liquidity holdings over the subsequent two years. Specifically, User93 (User95, User06) is assigned a value of one if a firm reports derivatives use in 1993 (1995, 2006) and zero otherwise.

[††] The periods 1993–1995 and 1995–1997 are chosen because the firms' 10-Ks are mostly unavailable prior to 1993 from the SEC's website and the G-index and the E-index are available for the years 1993 and 1995. The period 2006–2008 seems to be far enough away from the issuance of SFAS 133 that it is no longer a shock in this period.

Table 3 reports the results of placebo tests. The first (middle, last) column shows the results for 1993–1995 (1995–1997, 2006–2008). In all specifications, the coefficients of interest are not statistically significant, suggesting that derivatives use is unrelated to changes in liquidity holdings in these placebo periods. These results allow us to rule out alternative explanations, such as unobservable firm characteristics simultaneously affecting derivatives use and the change in liquidity holdings.

1.4.3 Pre-trends

To make inferences from the baseline test's specification, each group of firms should have followed parallel trends in liquidity holdings prior to the issuance of SFAS 133. If there was a pre-existing trend, the differences found in the liquidity holdings during the experiment period cannot be ascribed to SFAS 133. Although Figure 1 suggests that no particular trend exists in the pre-treatment periods, I conduct a statistical analysis to determine whether there are differential prior trends in liquidity holdings for users and non-users. In particular, I repeat the baseline regression test for the pre-treatment periods, 1993–1995 and 1995–1997. The differential trends in the liquidity holdings of users, if any, will be captured in the coefficient on User. The first (last) column of Table 4 presents the results from the period 1993–1995 (1995–1997). None of the coefficients on User is statistically or economically significantly, indicating that users' decreased liquidity holdings are not driven by pre-existing trends.

1.4.4 Persistence of the effect

Because SFAS 133 has been in effect since 2001, its effect on liquidity holdings should persist rather than reverse immediately after it became effective, as might occur with a one-time event. To test this logic, I further extend the time period to the years 2001 and 2002 and repeat the difference-in-differences regression analysis. The results for the extension up to 2001 (2002) is provided in the first (second) column of Table 5. The magnitude of the coefficient on User remains at a level similar to that of the central test in both tests. This result indicates that the effect of SFAS 133 persisted.

1.4.5 Profits volatility

To examine whether derivatives speculation decreased following the issuance of SFAS 133, I analyze the volatility of users' profits around the experiment period. In doing so, I consider three sources of profits:

cash flows from investing activities, cash flows from operating activities, and cash flows from financing activities. Because the purchase or sale of derivatives falls under investing activities, the volatility of cash flows from investing activities would decrease for users if they reduced derivatives speculation. I define the annual profits volatility of a firm as the firm-level, within-year standard deviation of a quarterly profits measure divided by the lagged total assets. Then, I compute the three-year average of the annual profits volatility for the periods before the issuance (1995–1997) and after the adoption (2001–2003) of SFAS 133.

Table 6 present the regression results. The dependent variable is the change in volatility of cash flows from investing activities shown in the first column. Consistent with the drop in speculation, the coefficients on User are significantly negative, indicating that users' volatility of cash flows from investing activities decreased by 11.7% (0.9 percentage points). The dependent variable is the volatility of cash flows from operating (financing) activities in the second (last) column. The coefficients on User are not significant in either case.

1.5 Cross-sectional tests

The evidence thus far suggests that users decreased liquidity holdings during the period between the issuance and adoption of SFAS 133. However, I do not distinguish between hedgers and speculators. To confirm that users' decreased liquidity holdings are driven by speculators, I categorize users into hedgers and speculators using cross-sectional variation in firm characteristics in two ways. First, I construct an ex post measure of derivatives speculation based on a firm's derivatives position in 2001. Second, I use the level of corporate governance to separate hedgers from speculators.

1.5.1 Derivatives positions in 2001

I categorize users into hedgers and speculators based on their derivatives positions in the year 2001 because it is the first year for which I can identify all firms' derivatives positions. Assuming that speculators may not have been able to close all speculative positions by the end of 2000, I regard a user as a speculator (treated firm) if it reports any derivative position that is not designated as a hedge in its 10-K

filing in 2001. I also categorize a user that stopped using derivatives in 2001 as a speculator, assuming that it successfully closed all speculative positions. Finally, if a user reports only a hedging position in 2001, I categorize it as a hedger (control firm). This strategy results in a regression model, Eq. (2). The variable of interest is Spec01, which is assigned a value of one for speculators and zero for hedgers.

$$\Delta \text{ liquidity}_i|_{2000-1998} = b_0 + \mathbf{b_1 \cdot Spec01_i} + b_2 \cdot \Delta \text{Controls}_i|_{1999-1997} + \text{INDs} + \varepsilon_i \quad (2)$$

1.5.2 Central test: derivatives positions in 2001

Table 7 reports the results of the regression test specified in Eq. (2). The coefficient on Spec01 is negative and statistically significant, suggesting that speculators decreased liquidity ratio by 2.1 percentage points relative to hedgers during the two-year period, accounting for 19% of speculators' liquidity holdings. To further examine whether my results are driven by either cash holdings or lines of credit, I conduct two separate regression tests in which the dependent variables are Cash and Lines of credit, respectively. The results are presented in the second and third columns. The coefficient on Spec01 of the cash holdings regression is negative and statistically significant, whereas that of the lines of credit regression is not significant. This result indicates that speculators adjusted liquidity holdings mostly through cash holdings during the experiment period.

1.5.3 Placebo test: Derivatives positions in 2001

Because separate information on the speculative and hedging positions of derivatives is available only after SFAS 133 became effective, the placebo test can be conducted only for 2001 and beyond. To be consistent with the previous section, I replicate the central test in the 2006–2008 period. However, I use information on the derivatives positions of firms in 2006 and 2009 to separate hedgers from speculators. I use the 2006 information because it is more relevant in liquidity holdings of 2006–2008. However, to be consistent with the previous test, I construct an ex post measure using 2009 information. Specifically, I construct an indicator variable Spec06 (Spec09) which is assigned a value of one for speculators and zero for hedgers for 2006 (2009).

Table 8 reports the results of the placebo test. The coefficients on Spec06 and Spec09 are statistically and economically insignificant. This result suggests that the speculative derivatives position is unrelated to changes in liquidity holdings in the placebo period.

1.5.4 Pre-trends: Derivatives positions in 2001

I conduct a statistical analysis to confirm the interpretation of Figure 2 that there are no differential trends in liquidity holdings between the two groups of firms during the pre-treatment periods. In particular, I repeat the regression test in the pre-announcement periods, 1993–1995 and 1995–1997. The differential trends in liquidity holdings will be captured in the coefficient on Spec01.

The regression results are presented in table 9. The first and last columns show the results from 1993–1995 and 1995–1997, respectively. None of the coefficients on Spec01 is significant, suggesting no differential prior trends in liquidity holdings between the two groups.

1.5.5 Corporate governance

I use the level of corporate governance upon the issuance of SFAS 133 to separate hedgers from speculators. In particular, if a user has weak governance (WG user), then I categorize it as a speculator. On the other hand, if a user has strong governance (SG user), then I categorize it as a hedger. In doing so, I employ three commonly used proxies for corporate governance: the G-Index, the E-index, and institutional ownership. The G-index proxies for shareholders' rights, using the incidence of 24 governance provisions. The E-index focuses only on the 6 provisions out of the 24 in the G-index that are most responsible for shareholders' rights. For every firm, one point is added for every provision that restricts shareholder rights; thus, the higher the point total the weaker the corporate governance. Institutional ownership is the percentage of institutional ownership holdings of a firm's common stock. Firms with higher institutional ownership are expected to have stronger corporate governance.

A number of studies lend support to this classification. For example, Fauver and Naranjo (2010) find a negative relationship between Tobin's Q and derivatives use for firms with more significant agency and monitoring problems, measured by the E-index and institutional ownership. Geczy et al. (2007) also show that speculation is associated with firms with weak internal governance, as measured by the G-index.

Lel (2012) finds through a cross-country analysis that firms with strong governance tend to use derivatives to hedge currency exposure, whereas firms with weak governance use them for other reasons. Allayannis et al. (2012) find that the use of currency derivatives is associated with a value premium only for firms that have strong internal firm-level or external country-level governance, and conclude that well-governed firms are more likely to use derivatives to hedge rather than speculate.

One concern arising from comparing the change in liquidity holdings between WG users and SG users is that the observed difference may be attributable to corporate governance and not derivatives policy. For example, if some macro effects cause the liquidity holdings of weak governance firms to decrease in general during the experiment period, the decreased liquidity holdings of WG users cannot be the ascribed to reduced speculation. To control for the effect of corporate governance, I conduct a triple differences analysis as specified in Eq. (3). Weak is an indicator variable that is assigned a value of one for weak governance firms and zero otherwise.

$$\Delta liquidity_i|_{2000\text{-}1998} = c_0 + c_1 \cdot Weak_i + c_2 \cdot User_i + \mathbf{c_3 \cdot Weak_i \cdot User_i} + c_4 \cdot \Delta Controls_i|_{1999\text{-}1997} + INDs + \varepsilon_i \quad (3)$$

1.5.6 Central test: corporate governance

Because the sample is restricted significantly when I require a firm to have data on corporate governance and to be covered by the DealScan database for lines of credit, I focus on cash holdings. Focusing the analysis on cash holdings appears to be reasonable as the results from the previous section indicate that firms use cash holdings to adjust liquidity. A firm is categorized as either a strong or a weak governance firm by the median value of the proxies for corporate governance. Specifically, a firm is considered to have weak governance if its G-index is above 9, its E-index is above 2, and if institutional ownership is lower than 25%.

Table 10 presents the results of the cash holdings test separately for the G-index, the E-index and institutional ownership. The coefficients on the interaction term are negative and significant in all cases. For example, when the G-index (E-index, institutional ownership) is used, the decrease in cash holdings of WG users is 2.2 (2.6, 2.7) percentage points. In addition, none of the coefficients on User is significant, suggesting that the decreased liquidity holdings of users are not attributable to derivative users in general.

These results again support the logic that the reduction in speculation is the driving force behind the decreased liquidity holdings of users.

1.5.7 Placebo test: corporate governance

I replicate the triple differences test in placebo periods (1993–1995, 1995–1997, and 2006–2008). In particular, I begin with information on derivatives use and corporate governance from the years 1993, 1995, and 2006 to sort firms into four groups. I then examine changes in the firms' liquidity holdings over the subsequent two years. Requiring 10-Ks for information on derivatives use for 1993 and 1995 along with the governance index decreases the number of sample firms significantly.

The results are presented in Table 11. Due to lack of access to data on institutional ownership for these years, only the G-index and the E-index are used. The first (middle, last) two columns show results for the period 1993–1995 (1995–1997, 2006–2008). In all specifications, none of the coefficients on Weak·User is significant. These results suggest that the combination of derivatives use and corporate governance is unrelated to changes in liquidity holdings for the placebo periods.

1.5.8 Pre-trends: corporate governance

I analyze prior trends in liquidity holdings by repeating the triple differences test for the pre-announcement periods, 1993–1995 and 1995–1997. The differential trends in the liquidity holdings of WG users, if any, will be captured in the coefficient of Weak·User. The regression results are presented in Table 12. The first (last) three columns report results from the 1993–1995 (1995–1997) period. In all specifications, none of the coefficients of interest is significant. This is evidence that the central results were not driven by pre-existing trends in the liquidity holdings of treated firms.

1.6 Alternative explanations

In this section, I conduct an additional analysis to further minimize concerns about alternative explanations. In particular, I consider the burst of the dot-com bubble in 2000 and a margin requirement for futures and options contracts.

1.6.1 Dot-com bubble

The Internet sector experienced a rise and fall during the experiment period of this study, which could confound my results. If Internet firms were mostly speculators and experienced a drop in liquidity due to the burst of the dot-com bubble, then I would find decreased liquidity holdings of speculators irrespective of the effect arising from SFAS 133. To check this possibility, I repeat the baseline test and cross-sectional tests, excluding firms that are likely to be Internet firms. For example, I exclude all firms with the same 4(3)-digit SIC codes as the Internet firms in Ofek and Richardson (2003) because these industries are likely to contain more Internet firms. I also replicate the tests excluding firms that belong to "Business Equipment: Computers, Software, and Electronic Equipment" of the Fama-French 12-industry classification.

The results are presented in Table 13. Panel A reports the results for the baseline strategy whereby I examine users' liquidity holdings relative to those of non-users. Panel B presents the results of the cross-sectional test in which I construct the ex post measure of speculation. Panel C reports the results from the cross-sectional tests using corporate governance. In each panel, I exclude firms with the same 4 (3)-digit SIC code as the Internet firms in Ofek and Richardson (2003) in the first (second) panel and firms in "Business Equipment: Computers, Software, and Electronic Equipment" in the last column. In all cases, the results do not change qualitatively relative to the tests using the full samples: the coefficients of interest remain economically and statistically similar to those of the original test. These results suggest that my findings are unlikely to be driven by the dot-com bubble episode.

1.6.2 Margin requirements

Holding derivatives such as futures and options requires margin accounts to cover future payments to counterparties. Therefore, a reduction in speculation using such derivatives could be the channel that results in lower levels of liquidity holdings. If such an effect is significant, then my findings could be ascribed to this margin requirement channel. Although a margin requirement can be considered a form of enforced risk management, or risk management enforced by the counterparty, it would be interesting to examine whether my findings are attributable to involuntary risk management rather than voluntary risk

management. To do so, I replicate the tests, excluding firms holding either futures or options contracts because these derivatives specifically require margin accounts.

The results are presented in Table 14. Panels A, B, and C separately report the results of the baseline test, the cross-sectional test using the ex post measure of speculation, and the cross-sectional test using corporate governance. In all tests, the results do not change qualitatively relative to the original tests, suggesting that that my previous findings are not driven by the margin requirement channel.

1.7 Conclusion

While corporate liquidity holdings and financial derivatives policy are both important topics in corporate finance, they have been studied mostly in isolation. To the best of my knowledge, this study is the first to empirically examine the causal effect of derivatives policy on the total value of liquidity holdings. Using an exogenous shock to the cost of derivatives speculation, I provide evidence that reduced speculation causes decreased liquidity holdings. My explanation for this result is as follows. Less derivatives speculation reduces a firm's risk. Therefore, to maintain the same level of risk, the firm can reduce costly liquidity holdings.

My study contributes to the relevant bodies of literature in a number of ways. First, the study provides empirical evidence that derivatives speculation and liquidity holdings are complements. Second, building on this insight, I find evidence that derivatives hedging and liquidity holdings are substitutes, as hedging is, from the perspective of risk management, the opposite of speculation. This is consistent with the concurrent goals of hedging and liquidity holdings, namely reducing the risk of financial distress and underinvestment. Third, to the extent that holding liquidity is costly, my results suggest that the cost of liquidity holdings is an implicit cost (benefit) of speculation (hedging) by firms. In other words, this study contributes to the literature on risk management by identifying a new channel through which risk management affects firm value: costly liquidity holdings. Next, the study also provides empirical evidence of firms' actively managing risk in the sense that they save liquidity as a buffer when taking on additional risk. Although such a result is straightforward from a theoretical perspective, it is nevertheless

an empirical question because firms may indeed speculate without holding additional liquidity. Finally, the results suggest that optimal risk management for managers and shareholders can differ and emphasizes the importance of reducing information asymmetry for aligning managerial incentives with shareholder wealth.

More generally, this study emphasizes the importance of studying interconnected corporate policies simultaneously. Because managers make decisions by taking into account all relevant factors rather than in isolation, focusing on potentially related policies may generate better understanding of the policy of interest.

1.8 Figures and Tables

Figure 1

Liquidity ratio during 1994–2000 for users and non-users

This figure displays the average liquidity ratio separately for users and non-users across the years 1994–2000. If a firm reports derivatives use in 1998, then it is categorized as a User. Otherwise, it is categorized as a non-user. SFAS 133 was issued in 1998, and it became effective from 2000 onward. Liquidity ratio is the sum of Cash and LC. Cash is cash and short-term investments (CHE) from the Compustat database divided by assets. LC represents lines of credit from the Dealscan database.

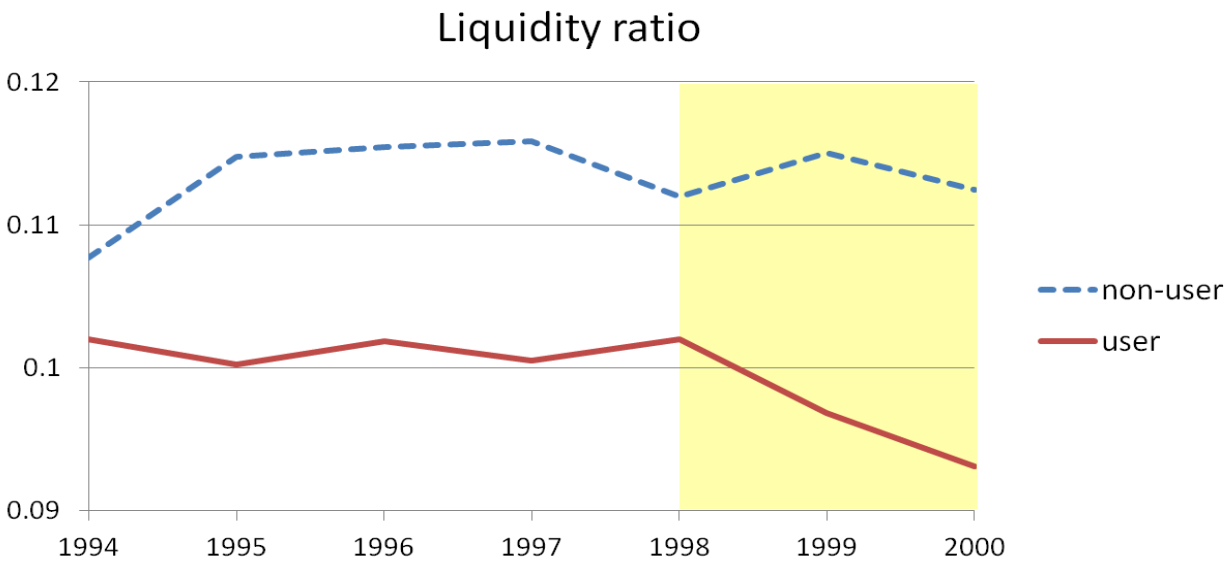

Figure 2

Liquidity ratio during 1994–2000 for hedgers and speculators

This figure displays the average liquidity ratio separately for hedgers and speculators across the years 1994–2000. Among the derivatives users of 1998, firms that report any derivatives position that is not designated as a hedge in 2001 and firms that stopped using derivatives in 2001 are categorized as speculators. A firm is categorized as a hedger if it reports only 2001 hedging positions. SFAS 133 was issued in 1998, and it became effective from 2000 onward. Liquidity ratio is the sum of Cash and LC. Cash is cash and short-term investments (CHE) from the Compustat database divided by assets. LC represents lines of credit from the Dealscan database.

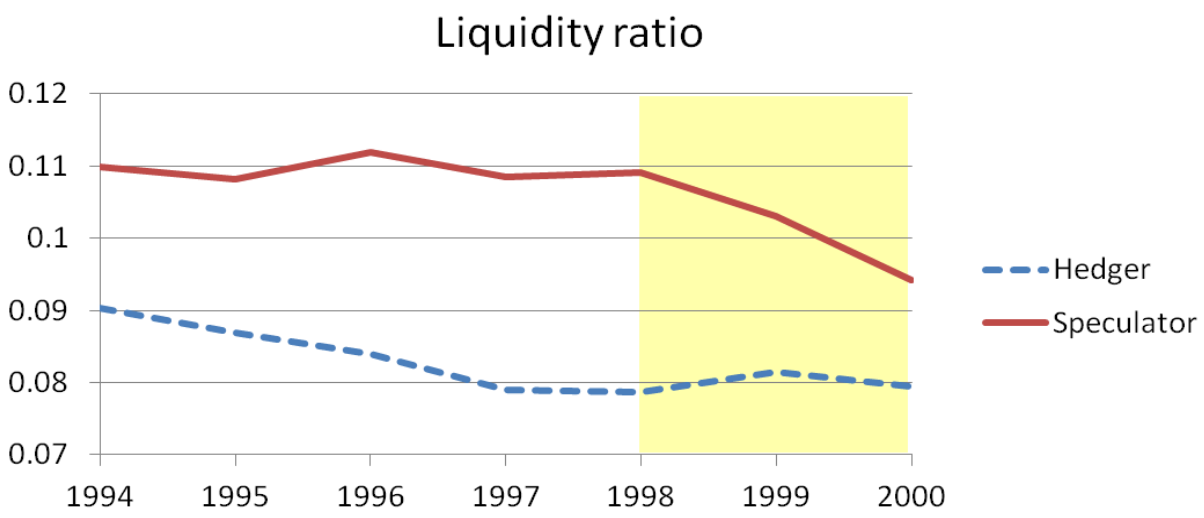

Table 1

Summary statistics

This table provides summary statistics on the sample firms in the year 1998. The entire sample of firms consists of non-utilities (excluding SIC codes 4900–4949) and non-financial firms (excluding SIC codes 6000–6999) covered by both the Compustat and DealScan databases and that have 10-Ks available from the SEC's website between 1998 and 2000. If a firm reports derivatives use in 1998, it is categorized as a user. Otherwise, it is categorized as a non-user. The first column describes the average characteristics of all firms. The other columns separately present the characteristics of users and non-users. Liquidity is the sum of Cash and LC. Cash is cash and short-term investments (CHE) from the Compustat database divided by assets. LC represents lines of credit divided by assets. Assets is total assets of a firm (AT) measured in millions of dollars. MTB is defined as the market-to-book asset ratio ((AT + PRCC_F*CSHO - CEQ)/AT).)/AT), and Leverage is the sum of long-term debt (DLTT) and debt in current liabilities (DLC) scaled by assets. Finally, Cash flows is the ratio of EBITDA over assets. All variables are winsorized at 1% in both tails of the distribution.

	All firms			User			Non-user		
Variable	Mean	stdev	Median	Mean	stdev	Median	Mean	stdev	Median
Liquidity	0.108	0.164	0.043	0.102	0.187	0.033	0.112	0.146	0.050
Cash	0.075	0.102	0.033	0.061	0.080	0.027	0.084	0.115	0.039
LC	0.033	0.128	0.000	0.040	0.159	0.000	0.028	0.100	0.000
Assets	1236.4	2080.5	336.0	2007.3	2466.9	870.3	668.6	1510.4	146.9
MTB	1.710	1.326	1.307	1.629	1.247	1.310	1.770	1.380	1.303
Cash flows	0.133	0.113	0.137	0.145	0.096	0.143	0.124	0.124	0.129
Leverage	0.294	0.220	0.269	0.317	0.209	0.300	0.278	0.226	0.242
No. firms		943			400			543	

Table 2

Baseline test: The effect of SFAS 133 on liquidity holdings

This table presents the results of the baseline empirical test. The dependent variables are the change in liquidity holdings (Liquidity), the change in cash holdings (Cash) and the change in lines of credit (LC) in the period between 1998 and 2000. Liquidity is the sum of Cash and LC. Cash is cash and short-term investments (CHE) from the Compustat database divided by assets. LC is the lines of credit from the Dealscan database divided by assets. User is an indicator variable that is assigned a value of one if the firm reports derivatives use in 1998 and zero otherwise. The control variables include ΔAssets, ΔMTB, ΔCF, and ΔLeverage. ΔAssets is defined as total assets (AT) from 1999 minus total assets from 1997. ΔMTB is defined as the MTB from 1999 minus the MTB from 1997, where MTB is defined as the market-to-book asset ratio ((AT + PRCC_F*CSHO - CEQ)/AT). ΔCF is cash flows from 1999 minus cash flows from 1997, where cash flow is the ratio of EBITDA over assets. ΔLeverage is the book leverage from 1999 minus the book leverage from 1997, where the book leverage is the sum of long-term debt (DLTT) and debt in current liabilities (DLC) scaled by assets. Industry-fixed effects (3-digit SIC) are included in all specifications. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, and the t-statistics are shown in parentheses. All variables are winsorized at 1% in both tails of the distribution.

$$\Delta\ \text{Liquidity}_i|_{2000\,-\,1998} = a_0 + a_1 \cdot \text{User}_i + a_3 \cdot \Delta\text{Controls}_i|_{1999\text{-}1997} + \text{INDs} + \varepsilon_i$$

$$\Delta\ \text{Cash}_i|_{2000\,-\,1998} = a_0 + a_1 \cdot \text{User}_i + a_3 \cdot \Delta\text{Controls}_i|_{1999\text{-}1997} + \text{INDs} + \varepsilon_i$$

$$\Delta\ \text{LC}_i|_{2000\,-\,1998} = a_0 + a_1 \cdot \text{User}_i + a_3 \cdot \Delta\text{Controls}_i|_{1999\text{-}1997} + \text{INDs} + \varepsilon_i$$

Indep. Var.	Δ Liquidity	Δ Cash	Δ LC
User	**-0.017*****	**-0.009****	**-0.008****
	(-2.88)	**(-2.01)**	**(-1.98)**
ΔAssets	0.003	-0.011**	0.014***
	(0.54)	(-2.37)	(3.69)
ΔMTB	0.004	0.005**	-0.001
	(1.44)	(2.26)	(-0.52)
ΔCF	0.049**	0.079***	-0.031*
	(2.02)	(4.17)	(-1.96)
ΔLeverage	-0.172***	-0.104***	-0.068***
	(-8.16)	(-6.24)	(-4.94)
Industry fixed effects	Yes	Yes	Yes
N	943	943	943
R-squared	0.2460	0.2698	0.1531

Table 3

Placebo test

This table presents the results of the placebo test. The dependent variable is the change in liquidity holdings (Liquidity) in the periods 1993–1995, 1995–1997, and 2006–2008 in the first, second, and last columns, respectively. Liquidity is the sum of Cash and LC. Cash is cash and short-term investments (CHE) from the Compustat database divided by assets. LC is lines of credit from the Dealscan database divided by assets. User93 (User95, User06) is an indicator variable that is assigned a value of one if the firm reports derivatives use in 1993 (1995, 2006) and zero otherwise. The control variables include ΔAssets, ΔMTB, ΔCF, and ΔLeverage. ΔAssets is defined as total assets (AT) from 1994 (1996, 2007) minus total assets from 1992 (1994, 2005). ΔMTB is defined as the MTB from 1994 (1996, 2007) minus the MTB from 1992 (1994, 2005), where MTB is defined as the market-to-book asset ratio ((AT + PRCC_F*CSHO - CEQ)/AT). ΔCF is cash flows from 1994 (1996, 2007) minus cash flows from 1992 (1994, 2005), where cash flow is the ratio of EBITDA over assets. ΔLeverage is the book leverage from 1994 (1996, 2007) minus the book leverage from 1992 (1994, 2005), where the book leverage is the sum of long-term debt (DLTT) and debt in current liabilities (DLC) scaled by assets. Industry-fixed effects (3-digit SIC) are included in all specifications. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, and the t-statistics are shown in parentheses. All variables are winsorized at 1% in both tails of the distribution.

$$\Delta\ \text{Liquidity}_i|_{1995\text{ - }1993} = a_0 + \mathbf{a_1 \cdot User93_i} + a_3 \cdot \Delta\text{Controls}_i|_{1994\text{-}1992} + \text{INDs} + \varepsilon_i$$

$$\Delta\ \text{Liquidity}_i|_{1997\text{ - }1995} = a_0 + \mathbf{a_1 \cdot User95_i} + a_3 \cdot \Delta\text{Controls}_i|_{1996\text{-}1994} + \text{INDs} + \varepsilon_i$$

$$\Delta\ \text{Liquidity}_i|_{2008\text{ - }2006} = a_0 + \mathbf{a_1 \cdot User06_i} + a_3 \cdot \Delta\text{Controls}_i|_{2007\text{-}2005} + \text{INDs} + \varepsilon_i$$

Indep. Var.	1993~1995	1995~1997	2006~2008
User	**-0.007**	**0.012**	**0.012**
	(-0.63)	**(1.15)**	**(0.77)**
ΔAssets	-0.053***	0.031**	-0.001
	(-3.77)	(3.23)	(-0.05)
ΔMTB	0.004	0.012**	0.016*
	(0.57)	(2.14)	(1.82)
ΔCF	0.025	-0.093**	0.065
	(0.34)	(-2.33)	(0.88)
ΔLeverage	-0.046	-0.180***	-0.044
	(-0.98)	(-5.91)	(-0.69)
Industry fixed effects	Yes	Yes	Yes
N	350	780	2203
R-squared	0.3348	0.2046	0.1536

Table 4

Pre-trends

This table presents the result of pre-trends analysis. The dependent variable is the change in liquidity holdings (Liquidity) in the periods 1993–1995 and 1995–1997 in the first and second columns, respectively. Liquidity is the sum of Cash and LC. Cash is cash and short-term investments (CHE) from the Compustat database divided by assets. LC is lines of credit from the Dealscan database divided by assets. User is an indicator variable that is assigned a value of one if the firm reports derivatives use in year 1998 and zero otherwise. The control variables include ΔAssets, ΔMTB, ΔCF, and ΔLeverage. ΔAssets is defined as total assets (AT) from 1994 (1996) minus total assets from 1992 (1994). ΔMTB is defined as the MTB from 1994 (1996) minus the MTB from 1992 (1994), where MTB is defined as the market-to-book asset ratio ((AT + PRCC_F*CSHO - CEQ)/AT). ΔCF is cash flows from 1994 (1996) minus cash flows from 1992 (1994), where cash flow is the ratio of EBITDA over assets. ΔLeverage is the book leverage from 1994 (1996) minus the book leverage from 1992 (1994), where the book leverage is the sum of long-term debt (DLTT) and debt in current liabilities (DLC) scaled by assets. Industry-fixed effects (3-digit SIC) are included in all specifications. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, and the t-statistics are shown in parentheses. All variables are winsorized at 1% in both tails of the distribution.

$$\Delta\ \text{liquidity}_i|_{1995(7)\ -\ 1993(5)} = a_0 + \mathbf{a_1 \cdot User_i} + a_2 \cdot \Delta\text{Controls}_i|_{1994(6)-1992(4)} + \text{INDs} + \varepsilon_i$$

Indep. Var.	1993~1995	1995~1997
User	**0.003**	**0.004**
	(0.33)	**(0.46)**
ΔAssets	0.035***	0.043***
	(3.63)	(5.66)
ΔMTB	0.026***	0.021***
	(6.40)	(5.55)
ΔCF	-0.088*	-0.055
	(-1.84)	(-1.53)
ΔLeverage	-0.131***	-0.184***
	(-3.92)	(-6.66)
Industry fixed effects	Yes	Yes
N	752	880
R-squared	0.2874	0.2743

Table 5

Persistence of the effect

This table presents evidence that the effect of SFAS 133 on liquidity holdings persists. The dependent variable is the change in liquidity holdings (Liquidity) in the periods 1998–2001 and 1998–2002 in the first and second columns, respectively. Liquidity is the sum of Cash and LC. Cash is cash and short-term investments (CHE) from the Compustat database divided by assets. LC is lines of credit from the Dealscan database divided by assets. User is an indicator variable that is assigned a value of one if the firm reports derivatives use in year 1998 and zero otherwise. The control variables include ΔAssets, ΔMTB, ΔCF, and ΔLeverage. ΔAssets is defined as total assets (AT) from 2000 (2001) minus total assets from 1998. ΔMTB is defined as the MTB from 2000 (2001) minus the MTB from 1998, where MTB is defined as the market-to-book asset ratio ((AT + PRCC_F*CSHO - CEQ)/AT). ΔCF is cash flows from 2000 (2001) minus cash flows from 1998, where cash flow is the ratio of EBITDA over assets. ΔLeverage is the book leverage from 2000 (2001) minus the book leverage from 1998, where the book leverage is the sum of long-term debt (DLTT) and debt in current liabilities (DLC) scaled by assets. Industry-fixed effects (3-digit SIC) are included in all specifications. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, and the t-statistics are shown in parentheses. All variables are winsorized at 1% in both tails of the distribution.

$$\Delta \text{ Liquidity}_i|_{2001(2)-1998} = a_0 + \mathbf{a_1 \cdot User}_i + a_2 \cdot \Delta\text{Controls}_i|_{2000(1)-1997} + \text{INDs} + \varepsilon_i$$

Indep. Var.	1998~2001	1998~2002
User	**-0.019*****	**-0.017*****
	(-3.12)	**(-2.62)**
ΔAssets	0.015*	0.005
	(1.85)	(1.10)
ΔMTB	0.004	-0.0002
	(1.58)	(-0.06)
ΔCF	0.050**	0.008
	(2.01)	(0.31)
ΔLeverage	-0.178***	-0.134***
	(-8.07)	(-6.49)
Industry fixed effects	Yes	Yes
N	943	886
R-squared	0.2482	0.2133

Table 6

Profits volatility

This table presents the results of profits volatility analysis. The dependent variables are the change in the volatility of the three measures of the profits: cash flows from investing activities, cash flows from operating activities, and cash flows from financing activities around SFAS 133. I define the annual profits volatility of a firm as the firm-level, within-year standard deviation of a quarterly profits measure divided by lagged total assets. Then, I compute the three-year average of the annual profits volatility for the periods before the issuance (1995–1997) and after the adoption (2001–2003) of SFAS 133. Industry-fixed effects (3-digit SIC) are included in all specifications. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, and the t-statistics are shown in parentheses. All variables are winsorized at 1% in both tails of the distribution.

$$\Delta \text{ volatility}_{i|(2001\sim3)\,-\,(1995\sim7)} = a_0 + \mathbf{a_1 \cdot User_i} + \text{INDs} + \varepsilon_i$$

Indep. Var.	Profits measure		
	Cash flows from investing activities	Cash flows from operating activities	Cash flows from financing activities
User	**-0.009***	**-0.002**	**-0.003**
	(-1.75)	**(-0.67)**	**(-0.51)**
Industry fixed effects	Yes	Yes	Yes
N	873	873	872
R-squared	0.2018	0.1914	0.2035

Table 7

Central result: derivatives positions in 2001

This table presents the results of the cross-sectional test in which I separate hedgers from speculators using the ex post measure of speculation. The dependent variables are the change in liquidity holdings (Liquidity), the change in cash holdings (Cash) and the change in lines of credit (LC) in the period between 1998 and 2000. Liquidity is the sum of Cash and LC. Cash is cash and short-term investments (CHE) from the Compustat database divided by assets. LC is lines of credit from the Dealscan database divided by assets. Spec01 is an indicator variable that is assigned a value of one for speculators and zero for hedgers. Among the 1998 derivative users, firms that report any derivatives position that is not designated as a hedge in 2001 and firms that stopped using derivatives in 2001 are categorized as speculators. A firm is categorized as a hedger if it reports only hedging positions in 2001. The control variables include ΔAssets, ΔMTB, ΔCF, and ΔLeverage. ΔAssets is defined as total assets (AT) from 1999 minus total assets from 1997. ΔMTB is defined as the MTB from 1999 minus the MTB from 1997, where MTB is defined as the market-to-book asset ratio ((AT + PRCC_F*CSHO - CEQ)/AT). ΔCF is cash flows from 1999 minus cash flows from 1997, where cash flow is the ratio of EBITDA over assets. ΔLeverage is the book leverage from 1999 minus the book leverage from 1997, where the book leverage is the sum of long-term debt (DLTT) and debt in current liabilities (DLC) scaled by assets. Industry-fixed effects (3-digit SIC) are included in all specifications. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, and the t-statistics are shown in parentheses. All variables are winsorized at 1% in both tails of the distribution.

$$\Delta \text{ liquidity}_i|_{2000-1998} = b_0 + \mathbf{b_1 \cdot Spec01_i} + b_2 \cdot \Delta\text{Controls}_i|_{1999-1997} + \text{INDs} + \varepsilon_i$$

$$\Delta \text{ Cash}_i|_{2000-1998} = b_0 + \mathbf{b_1 \cdot Spec01_i} + b_2 \cdot \Delta\text{Controls}_i|_{1999-1997} + \text{INDs} + \varepsilon_i$$

$$\Delta \text{ Lines of credit}_i|_{2000-1998} = b_0 + \mathbf{b_1 \cdot Spec01_i} + b_2 \cdot \Delta\text{Controls}_i|_{1999-1997} + \text{INDs} + \varepsilon_i$$

Indep. Var.	Δ liquidity	Δ Cash	Δ Lines of credit
Spec01	**-0.021*****	**-0.019*****	**-0.002**
	(-2.39)	**(-2.64)**	**(-0.60)**
ΔAssets	0.020	0.006	0.014
	(1.31)	(0.46)	(2.57)
ΔMTB	0.003	0.002	0.002
	(0.87)	(0.51)	(1.25)
ΔCF	-0.002	-0.003	0.0001
	(-0.11)	(-0.16)	(0.06)
ΔLeverage	-0.000***	-0.000**	-0.000
	(-2.96)	(-2.13)	(-3.32)
Industry fixed effects	Yes	Yes	Yes
N	396	396	396
R-squared	0.2675	0.3025	0.1972

Table 8

Placebo test: derivatives positions in 2001

This table presents the results of the placebo test. The dependent variable is the change in liquidity holdings (Liquidity) in the period 2006–2008. Liquidity is the sum of Cash and LC. Cash is cash and short-term investments (CHE) from the Compustat database divided by assets. LC is lines of credit from the Dealscan database divided by assets. Spec06 (Spec09) is an indicator variable that is assigned a value of one for speculators and zero for hedgers in 2006 (2009). A firm is categorized as a speculator if it reports any derivatives position that is not designated as a hedge. A firm is categorized as a hedger if it reports only hedging positions. The control variables include ΔAssets, ΔMTB, ΔCF, and ΔLeverage. ΔAssets is defined as total assets (AT) from 2007 minus total assets from 2005. ΔMTB is defined as the MTB from 2007 minus the MTB from 2005, where MTB is defined as the market-to-book asset ratio ((AT + PRCC_F*CSHO - CEQ)/AT). ΔCF is cash flows from 2007 minus cash flows from 2005, where cash flow is the ratio of EBITDA over assets. Finally, ΔLeverage is the book leverage from 2007 minus the book leverage from 2005, where the book leverage is the sum of long-term debt (DLTT) and debt in current liabilities (DLC) scaled by assets. Industry-fixed effects (3-digit SIC) are included in all specifications. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, and the t-statistics are shown in parentheses. All variables are winsorized at 1% in both tails of the distribution.

$$\Delta \text{ liquidity}_i|_{2008-2006} = b_0 + \mathbf{b_1 \cdot Spec06_i} + b_2 \cdot \Delta\text{Controls}_i|_{2007-2005} + \text{INDs} + \varepsilon_i$$

$$\Delta \text{ liquidity}_i|_{2008-2006} = b_0 + \mathbf{b_1 \cdot Spec09_i} + b_2 \cdot \Delta\text{Controls}_i|_{2007-2005} + \text{INDs} + \varepsilon_i$$

Indep. Var.	**Spec06**	**Spec09**
Spec##	**0.002**	**-0.001**
	(0.10)	**(-0.14)**
ΔAssets	-0.013	-0.02***
	(-1.54)	(-3.69)
ΔMTB	0.013***	0.007***
	(3.18)	(4.54)
ΔCF	0.124***	0.033**
	(3.73)	(2.22)
ΔLeverage	-0.022	-0.025*
	(-0.90)	(-1.83)
Industry fixed effects	Yes	Yes
N	834	925
R-squared	0.3061	0.3010

Table 9

Pre-trends: derivatives positions in 2001

This table presents the results of the pre-trends analysis. The dependent variable is the change in liquidity holdings (Liquidity) in the periods 1993–1995 and 1995–1997 in the first and second columns, respectively. Liquidity is the sum of Cash and LC. Cash is cash and short-term investments (CHE) from the Compustat database divided by assets. LC is lines of credit from the Dealscan database divided by assets. Spec01 is an indicator variable that is assigned a value of one for speculators and zero for hedgers. Among the 1998 derivative users, firms that report any derivatives position that is not designated as a hedge in 2001 are categorized as speculators. In addition, a firm that stopped using derivatives in 2001 is also categorized as a speculator. A firm is categorized as a hedger if it reports only hedging positions in 2001. The control variables include ΔAssets, ΔMTB, ΔCF, and ΔLeverage. ΔAssets is defined as total assets (AT) from 1994 (1996) minus total assets from 1992 (1994). ΔMTB is defined as the MTB from 1994 (1996) minus the MTB from 1992 (1994), where MTB is defined as the market-to-book asset ratio ((AT + PRCC_F*CSHO - CEQ)/AT). ΔCF is the cash flows from 1994 (1996) minus the cash flows from 1992 (1994), where cash flow is the ratio of EBITDA over assets. Finally, ΔLeverage is the book leverage from 1994 (1996) minus the book leverage from 1992 (1994), where the book leverage is the sum of long-term debt (DLTT) and debt in current liabilities (DLC) scaled by assets. Industry-fixed effects (3-digit SIC) are included in all specifications. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, and the t-statistics are shown in parentheses. All variables are winsorized at 1% in both tails of the distribution.

$$\Delta \text{ liquidity}_i|_{1995(7)-1993(5)} = b_0 + \mathbf{b_1 \cdot Spec01_i} + b_2 \cdot \Delta\text{Controls}_i|_{1994(6)-1992(4)} + \text{INDs} + \varepsilon_i$$

Indep. Var.	1993~1995	1995~1997
Spec01	**-0.001**	**0.019**
	(-0.11)	**(1.48)**
ΔAssets	-0.012	0.022
	(-0.86)	(1.56)
ΔMTB	0.010*	0.012**
	(1.88)	(2.11)
ΔCF	0.001	-0.017
	(0.01)	(-0.21)
ΔLeverage	-0.115**	-0.133***
	(-2.46)	(-3.19)
Industry fixed effects	Yes	Yes
N	392	396
R-squared	0.4931	0.4271

Table 10

Central result: corporate governance

This table presents the results of the test in which I separate hedgers from speculators using the level of corporate governance. The dependent variables are the change in cash holdings (Cash) in the period between 1998 and 2000. Cash is cash and short-term investments (CHE) from the Compustat database divided by assets. User is an indicator variable that is assigned a value of one if the firm reports derivatives use in 1998 and zero otherwise. Weak is an indicator variable that is assigned a value of one for weak governance firms and value of zero otherwise. A firm is considered to have weak governance if its G-index is higher than 9 (first column), its E-index is higher than 2 (second column), and if institutional ownership is lower than 25% (last column). The control variables include ΔAssets, ΔMTB, ΔCF, and ΔLeverage. ΔAssets is defined as total assets (AT) from 1999 minus total assets from 1997. ΔMTB is defined as the MTB from 1999 minus the MTB from 1997, where MTB is defined as the market-to-book asset ratio ((AT + PRCC_F*CSHO - CEQ)/AT). ΔCF is cash flows from 1999 minus cash flows from 1997, where cash flow is the ratio of EBITDA over assets. Finally, ΔLeverage is the book leverage from 1999 minus the book leverage from 1997, where the book leverage is the sum of long-term debt (DLTT) and debt in current liabilities (DLC) scaled by assets. Industry-fixed effects (3-digit SIC) are included in all specifications. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, and the t-statistics are shown in parentheses. All variables are winsorized at 1% in both tails of the distribution.

$$\Delta Cash_i|_{2000-1998} = c_0 + c_1 \cdot Weak_i + c_2 \cdot User_i + \mathbf{c_3 \cdot Weak_i \cdot User_i} + c_4 \cdot \Delta Controls_i|_{1999-1997} + INDs + \varepsilon_i$$

Indep. Var.	Corporate governance measure		
	G-index	E-index	Institution ownership
Weak·User	**-0.022****	**-0.026*****	**-0.027*****
	(-2.19)	**(-2.85)**	**(-2.83)**
Weak	0.026***	0.018***	0.017**
	(3.32)	(2.71)	(2.25)
User	0.007	0.010*	0.011
	(1.04)	(1.77)	(1.45)
ΔAssets	0.001	-0.004	-0.004
	(0.18)	(-0.77)	(-0.65)
ΔMTB	0.002	0.004***	0.006***
	(1.43)	(3.55)	(4.62)
ΔCF	0.044**	0.034**	0.014
	(2.51)	(2.27)	(0.81)
ΔLeverage	-0.083***	-0.076***	-0.081***
	(-4.48)	(-5.14)	(-5.19)
Industry fixed effects	Yes	Yes	Yes
N	640	805	697
R-squared	0.2958	0.2750	0.3069
Weak	G>9 (Median)	E>2 (Median)	IO<25% (Median)
Strong	If not weak	If not weak	If not weak

Table 11

Placebo test: corporate governance

This table presents the results of the placebo test for corporate governance. The dependent variables are the change in cash holdings (Cash) during the period 1993–1995 (1995–1997, 2006–2008) in the first (middle, last) two columns. Cash is cash and short-term investments (CHE) divided by assets. User93 (User95, User06) is an indicator variable that is assigned a value of one if the firm reports derivatives use in 1993 (1995, 2006) and zero otherwise. Weak93 (Weak95, Weak06) is an indicator variable that is assigned a value of one if the firm has weak corporate governance in 1993 (1995, 2006) and zero otherwise. A firm is considered to have weak governance if its G-index is higher than 9 or its E-index is higher than 2. The control variables include ΔAssets, ΔMTB, ΔCF, and ΔLeverage. ΔAssets is defined as the total assets (AT) from 1994 (1996, 2007) minus the total assets from 1992 (1994, 2005). ΔMTB is defined as the MTB from 1994 (1996, 2007) minus the MTB from 1992 (1994, 2005), where MTB is defined as the market-to-book asset ratio ((AT + PRCC_F*CSHO - CEQ)/AT). ΔCF is cash flows from 1994 (1996, 2007) minus cash flows from 1992 (1994, 2005), where cash flow is the ratio of EBITDA over assets. ΔLeverage is the book leverage from 1994 (1996, 2007) minus the book leverage from 1992 (1994, 2005), where the book leverage is the sum of long-term debt (DLTT) and debt in current liabilities (DLC) scaled by assets. Industry-fixed effects (3-digit SIC) are included in all specifications. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, and the t-statistics are shown in parentheses. All variables are winsorized at 1% in both tails of the distribution.

$$\Delta Cash_i|_{1995-1993} = c_0 + c_1 \cdot Weak_i + c_2 \cdot User_i + \mathbf{c_3 \cdot Weak93_i \cdot User93_i} + c_4 \cdot \Delta Controls_i|_{1994-1992} + INDs + \varepsilon_i$$
$$\Delta Cash_i|_{1997-1995} = c_0 + c_1 \cdot Weak_i + c_2 \cdot User_i + \mathbf{c_3 \cdot Weak95_i \cdot User95_i} + c_4 \cdot \Delta Controls_i|_{1996-1994} + INDs + \varepsilon_i$$
$$\Delta Cash_i|_{2008-2006} = c_0 + c_1 \cdot Weak_i + c_2 \cdot User_i + \mathbf{c_3 \cdot Weak06_i \cdot User06_i} + c_4 \cdot \Delta Controls_i|_{2007-2005} + INDs + \varepsilon_i$$

Indep. Var.	1993~1995		1995~1997		2006~2008	
	G-index	E-index	G-index	E-index	G-index	E-index
Weak·User	0.004	-0.015	0.014	0.016*	0.021	0.012
	(0.30)	(-1.28)	(1.08)	(1.68)	(1.35)	(0.82)
Weak	-0.004	0.010	-0.012	-0.012*	-0.021*	-0.022
	(-0.43)	(1.16)	(-1.19)	(-1.88)	(-1.72)	(-2.03)
User	0.008	0.014*	-0.020**	-0.015**	-0.012	-0.007
	(0.78)	(1.69)	(-2.24)	(-2.25)	(-1.09)	(-0.67)
ΔAssets	-0.020*	-0.014	0.001	-0.010	-0.005	-0.008
	(-1.67)	(-1.52)	(0.08)	(-1.17)	(-0.40)	(-0.63)
ΔMTB	0.009	0.010**	0.006	0.008***	0.018**	0.018***
	(1.52)	(2.34)	(1.61)	(2.91)	(3.80)	(3.93)
ΔCF	-0.015	-0.003	-0.022	0.017	0.087	0.045
	(-0.24)	(-0.06)	(-0.52)	(0.57)	(1.33)	(0.91)
ΔLeverage	-0.068*	-0.116***	-0.053*	-0.077***	0.041	0.019
	(-1.68)	(-3.47)	(-1.74)	(-3.98)	(1.16)	(0.60)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	299	419	379	619	557	609
R-squared	0.4949	0.4077	0.4535	0.3336	0.3358	0.3288
Weak	G>9	E>2	G>9	E>2	G>9	E>2
Strong	If not weak	If not weak	If not weak	If not weak	If not weak	If not weak

Table 12

Pre-trends: corporate governance

This table presents the result of pre-trends analysis for corporate governance. The dependent variables are the change in cash holdings (Cash) during the period 1993–1995 (1995–1997) in the first (last) three columns. Cash is cash and short-term investments (CHE) divided by assets. User is an indicator variable that is assigned a value of one if the firm reports derivatives use in 1998 and zero otherwise. Weak is an indicator variable that is assigned a value of one if the firm has weak corporate governance in 1998 and zero otherwise. A firm is considered to have weak governance if its G-index is higher than 9, its E-index is higher than 2, and if institutional ownership is lower than 25%. The control variables include ΔAssets, ΔMTB, ΔCF, and ΔLeverage. ΔAssets is defined as total assets (AT) from 1994 (1996) minus total assets from 1992 (1994). ΔMTB is defined as the MTB from 1994 (1996) minus the MTB from 1992 (1994), where MTB is defined as the market-to-book asset ratio ((AT + PRCC_F*CSHO - CEQ)/AT). ΔCF is cash flows from 1994 (1996) minus cash flows from 1992 (1994), where cash flow is the ratio of EBITDA over assets. ΔLeverage is the book leverage from 1994 (1996) minus the book leverage from 1992 (1994), where the book leverage is the sum of long-term debt (DLTT) and debt in current liabilities (DLC) scaled by assets. Industry-fixed effects (3-digit SIC) are included in all specifications. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, and the t-statistics shown are in parentheses. All variables are winsorized at 1% in both tails of the distribution.

$$\Delta Cash_i|_{1995-1993} = c_0 + c_1 \cdot Weak_i + c_2 \cdot User_i + \mathbf{c_3 \cdot Weak_i \cdot User}_i + c_4 \cdot \Delta Controls_i|_{1994-1992} + INDs + \varepsilon_i$$
$$\Delta Cash_i|_{1997-1995} = c_0 + c_1 \cdot Weak_i + c_2 \cdot User_i + \mathbf{c_3 \cdot Weak_i \cdot User}_i + c_4 \cdot \Delta Controls_i|_{1996-1994} + INDs + \varepsilon_i$$

Indep. Var.	1993~1995			1995~1997		
	G-index	E-index	Institution	G-index	E-index	Institution
Weak·User	**0.013**	**-0.010**	**-0.001**	**-0.001**	**0.010**	**0.009**
	(1.26)	**(-0.98)**	**(-0.09)**	**(-0.14)**	**(1.15)**	**(0.93)**
Weak	-0.009	0.013*	0.004	-0.003	-0.008	-0.014**
	(-1.09)	(1.77)	(0.46)	(-0.40)	(-1.18)	(-2.09)
User	-0.007	-0.001	-0.002	0.002	-0.004	-0.004
	(-1.04)	(-0.11)	(-0.21)	(0.37)	(-0.65)	(-0.53)
ΔAssets	-0.007	-0.014*	-0.011	-0.003	-0.002	-0.004
	(-0.80)	(-1.96)	(-1.35)	(-0.39)	(-0.37)	(-0.58)
ΔMTB	0.010***	0.011***	0.011***	0.006***	0.009***	0.009***
	(4.10)	(5.11)	(4.91)	(2.67)	(4.34)	(4.05)
ΔCF	0.091**	0.077**	0.096***	0.033	0.049*	0.042
	(2.40)	(2.39)	(2.62)	(1.02)	(1.83)	(1.41)
ΔLeverage	-0.096***	-0.087***	-0.101***	-0.064***	-0.062***	-0.068***
	(-3.95)	(-4.18)	(-4.31)	(-2.95)	(-3.39)	(-3.39)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	613	760	663	618	765	667
R-squared	0.2802	0.2485	0.2653	0.2892	0.2876	0.3087
Weak	G>9	E>2	IO<25%	G>9	E>2	IO<25%
Strong	If not weak	If not weak	If not weak	If not weak	If not weak	If not weak

Table 13

Alternative explanation I: Dot-com bubble

Panel A of this table presents the results of the baseline test in which I examine users' liquidity holdings relative to those of non-users. Panel B presents the results of the cross-sectional test in which I use the ex post measure of speculation. Panels C through E provide the results of the cross-sectional test in which I use corporate governance. The dependent variable is the change in liquidity holdings (Liquidity) in 1998–2000 for Panels A and B, and the change in cash holdings (Cash) in 1998–2000 for Panels C through E. Liquidity is the sum of Cash and LC. Cash is cash and short-term investments (CHE) from the Compustat database divided by assets. LC is lines of credit from the Dealscan database divided by assets. In each panel, I exclude firms with the same 4 (3)-digit SIC code as Internet firms in Ofek and Richardson (2003) in the first (second) column and firms in "Business Equipment: Computers, Software, and Electronic Equipment" of the Fama-French 12-industry classification in the last column. User is an indicator variable that is assigned a value of one if the firm reports derivatives use in 1998 and zero otherwise. Spec01 is an indicator variable that is assigned a value of one for speculators and zero for hedgers. Among the 1998 derivative users, firms that report any derivatives position that is not designated as a hedge in 2001 are categorized as speculators. In addition, a firm that stopped using derivatives in 2001 is also categorized as a speculator. A firm is categorized as a hedger if it reports only hedging positions in 2001. Weak is an indicator variable that is assigned a value of one for weak governance firms and zero otherwise. The control variables include ΔAssets, ΔMTB, ΔCF, and ΔLeverage. ΔAssets is defined as total assets (AT) from 1999 minus total assets from 1997. ΔMTB is defined as the MTB from 1999 minus the MTB from 1997, where MTB is defined as the market-to-book asset ratio ((AT + PRCC_F*CSHO - CEQ)/AT). ΔCF is cash flows from 1999 minus cash flows from 1997, where cash flow is the ratio of EBITDA over assets. Finally, ΔLeverage is the book leverage from 1999 minus the book leverage from 1997, where the book leverage is the sum of long-term debt (DLTT) and debt in current liabilities (DLC) scaled by assets. Industry-fixed effects (3-digit SIC) are included in all specifications. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, and the t-statistics are shown in parentheses. All variables are winsorized at 1% in both tails of the distribution.

Panel A	Exclusion criteria		
	4-digit	3-digit	FF
User	**-0.018***	**-0.017***	**-0.019****
	(-1.85)	**(-1.67)**	**(-2.08)**
ΔAssets	-0.019	-0.022**	-0.005
	(-1.44)	(-2.05)	(-0.49)
ΔMTB	0.005	-0.001	0.007
	(0.80)	(-0.23)	(1.39)
ΔCF	-0.040	-0.002	0.006
	(-0.72)	(-0.03)	(0.15)
ΔLeverage	-0.252***	-0.245***	-0.193***
	(-7.16)	(-6.75)	(-5.96)
Industry fixed effects	Yes	Yes	Yes
N	709	665	800
R-squared	0.2540	0.2549	0.2082

Table 13 (con't.)

Panel B	Exclusion criteria		
	4-digit	3-digit	FF
Spec01	**-0.019****	**-0.016***	**-0.021****
	(-2.07)	**(-1.79)**	**(-2.29)**
ΔAssets	0.007	0.017	0.004
	(0.50)	(1.05)	(0.38)
ΔMTB	-0.001	0.003	0.0003
	(-0.19)	(0.70)	(0.09)
ΔCF	0.011	-0.009	0.016
	(0.62)	(-0.37)	(0.91)
ΔLeverage	-0.000	-0.000***	-0.000
	(0.38)	(-3.47)	(-0.29)
Industry fixed effects	Yes	Yes	Yes
N	303	285	346
R-squared	0.3186	0.3725	0.2834

Panel C	Exclusion criteria		
	4-digit	3-digit	FF
Weak·User	**-0.034*****	**-0.032*****	**-0.026*****
	(-3.40)	**(-3.26)**	**(-2.80)**
Weak	0.032***	0.030***	0.026***
	(4.20)	(3.98)	(3.68)
User	0.012*	0.011	0.005
	(1.76)	(1.62)	(0.81)
ΔAssets	-0.005	0.002	0.001
	(-0.60)	(0.26)	(0.16)
ΔMTB	-0.0003	0.0004	-0.001
	(-0.27)	(0.31)	(-0.68)
ΔCF	0.058***	0.037*	0.033**
	(3.06)	(1.89)	(2.06)
ΔLeverage	-0.086***	-0.078***	-0.083***
	(-4.61)	(-4.21)	(-4.97)
Industry fixed effects	Yes	Yes	Yes
N	520	498	556
R-squared	0.3751	0.3767	0.3810
Weak		G-index>9	

Table 13 (con't.)

Panel D	Exclusion criteria		
	4-digit	3-digit	FF
Weak·User	**-0.034*****	**-0.030*****	**-0.023*****
	(-3.74)	**(-3.27)**	**(-2.67)**
Weak	0.020***	0.018***	0.013**
	(2.89)	(2.65)	(1.97)
User	0.015**	0.013**	0.007
	(2.44)	(2.04)	(1.28)
ΔAssets	0.001	-0.0001	-0.001
	(0.08)	(-0.02)	(-0.13)
ΔMTB	0.001	0.001	0.001
	(0.98)	(0.94)	(0.56)
ΔCF	0.062***	0.048**	0.013
	(3.35)	(2.50)	(0.87)
ΔLeverage	-0.088***	-0.075***	-0.081***
	(-5.99)	(-4.53)	(-5.27)
Industry fixed effects	Yes	Yes	Yes
N	651	618	699
R-squared	0.3395	0.3348	0.3261
Weak	E-index>2		
Panel E	Exclusion criteria		
	4-digit	3-digit	FF
Weak·User	**-0.031*****	**-0.029*****	**-0.022****
	(-3.12)	**(-3.02)**	**(-2.43)**
Weak	0.022***	0.022***	0.017***
	(2.95)	(2.97)	(2.34)
User	0.013*	0.011	0.006
	(1.71)	(1.51)	(0.89)
ΔAssets	0.001	0.001	0.001
	(0.15)	(0.13)	(0.13)
ΔMTB	0.002*	0.003*	0.002
	(1.71)	(1.79)	(1.36)
ΔCF	0.048*	0.015	-0.020
	(1.91)	(0.54)	(-1.14)
ΔLeverage	-0.093***	-0.087***	-0.096***
	(-5.79)	(-4.75)	(-5.72)
Industry fixed effects	Yes	Yes	Yes
N	564	534	604
R-squared	0.3660	0.3730	0.3649
Weak	Institutional ownership<25%		

Table 14

Alternative explanation II: A margin requirement channel

This table presents the results of tests that exclude firms using futures or options contracts. Panel A presents the results of the baseline test in which I examine users' liquidity holdings relative to those of non-users. Panel B presents the results of the cross-sectional test in which I use the ex post measure of speculation. Panel C provides the results of the cross-sectional test in which I use corporate governance. The dependent variable is the change in liquidity holdings (Liquidity), in cash holdings (Cash), and in lines of credit (LC) during 1998–2000 for Panels A and B, and the change in cash holdings (Cash) in 1998–2000 for Panel C. Liquidity is the sum of Cash and LC. Cash is cash and short-term investments (CHE) from the Compustat database divided by assets. LC is lines of credit from the Dealscan database divided by assets. User is an indicator variable that is assigned a value of one if the firm reports derivatives use in 1998 and zero otherwise. Spec01 is an indicator variable that is assigned a value of one for speculators and zero for hedgers. Among the 1998 derivative users, firms that report any derivatives position that is not designated as a hedge in 2001 are categorized as speculators. In addition, a firm that stopped using derivatives in 2001 is also categorized as a speculator. A firm is categorized as a hedger if it reports only hedging positions in 2001. Weak is an indicator variable that is assigned a value of one for weak governance firms and zero otherwise. The control variables include ΔAssets, ΔMTB, ΔCF, and ΔLeverage. ΔAssets is defined as total assets (AT) from 1999 minus total assets from 1997. ΔMTB is defined as the MTB from 1999 minus the MTB from 1997, where MTB is defined as the market-to-book asset ratio ((AT + PRCC_F*CSHO - CEQ)/AT). ΔCF is cash flows from 1999 minus cash flows from 1997, where cash flow is the ratio of EBITDA over assets. Finally, ΔLeverage is the book leverage from 1999 minus the book leverage from 1997, where the book leverage is the sum of long-term debt (DLTT) and debt in current liabilities (DLC) scaled by assets. Industry-fixed effects (3-digit SIC) are included in all specifications. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, and the t-statistics shown are in parentheses. All variables are winsorized at 1% in both tails of the distribution.

Panel A	Δ liquidity	Δ Cash	Δ Lines of credit
User	**-0.019*****	**-0.011****	**-0.008****
	(-3.08)	**(-2.20)**	**(-2.00)**
ΔAssets	0.002	-0.012**	0.014***
	(0.27)	(-2.51)	(3.50)
ΔMTB	0.004	0.005**	-0.001
	(1.48)	(2.25)	(-0.49)
ΔCF	0.043*	0.076***	-0.033**
	(1.75)	(3.82)	(-2.01)
ΔLeverage	-0.181***	-0.109***	-0.072***
	(-8.35)	(-6.27)	(-5.08)
Industry fixed effects	Yes	Yes	Yes
N	868	868	868
R-squared	0.2660	0.2903	0.1512

Table 14 (con't.)

Panel B	Δ liquidity	Δ Cash	Δ Lines of credit
Spec01	**-0.023****	**-0.020****	**-0.003**
	(-2.25)	**(-2.36)**	**(-0.82)**
ΔAssets	0.010	-0.000	0.010*
	(0.59)	(-0.02)	(1.76)
ΔMTB	0.004	0.002	0.002
	(0.92)	(0.57)	(1.30)
ΔCF	0.002	0.003	-0.001
	(0.07)	(0.12)	(-0.09)
ΔLeverage	-0.000*	-0.000	-0.000
	(-1.71)	(-1.38)	(-1.61)
Industry fixed effects	Yes	Yes	Yes
N	319	319	319
R-squared	0.3170	0.3480	0.2157

Panel C	G-index	E-index	Institution
Weak·User	**-0.023****	**-0.027*****	**-0.030*****
	(-2.24)	**(-2.85)**	**(-3.04)**
Weak	0.026***	0.019***	0.016**
	(3.34)	(2.80)	(2.16)
User	0.006	0.011*	0.013
	(0.98)	(1.79)	(1.63)
ΔAssets	0.002	-0.003	-0.003
	(0.28)	(-0.57)	(-0.44)
ΔMTB	0.001	0.004***	0.005***
	(1.05)	(3.06)	(4.04)
ΔCF	0.040**	0.031**	0.010
	(2.25)	(1.98)	(0.52)
ΔLeverage	-0.086***	-0.078***	-0.080***
	(-4.47)	(-5.11)	(-4.94)
Industry fixed effects	Yes	Yes	Yes
N	606	759	658
R-squared	0.3129	0.2835	0.3201
Weak	G>9 (Median)	E>2 (Median)	IO<25 (Median)
Strong	If not weak	If not weak	If not weak

2 Selection or Tunneling? An explanation for the agency problems in chaebol firms

2.1 Introduction

Although firms that belong to a business group can benefit from the internal capital market in times of credit constraint (Almeida and Kim (2012)) or in countries where an external capital market is not well developed, the literature generally finds that the agency problems between the controlling shareholders and minority shareholders decrease the value of these firms. Value destruction is primarily attributed to the wedge between the controlling shareholders' cash flow rights and voting rights that is created by pyramidal structures and cross-share holdings between group firms, which are prevalent structures among business groups (Claessens, Djankov, Fan, and Lang (2002), Joh (2003), Bae, Kang and Kim(2002), Bertrand, Mehta, and Mullainathan (2002), Baek, Kang, and Lee (2006)). This wedge enables controlling shareholders to control all of the group firms without owning the majority of equity stakes and thus provides incentive to waste corporate resources at the expense of minority shareholders.

In general, two difficulties arise in studying the causal effects of the wedge between the controlling shareholders' cash flow rights and voting rights (hereafter, wedge) on firm value. First, the cash flow rights and voting rights are difficult to compute due to the complex ownership structure of business groups and/or the lack of detailed data on ownership structure. Second and more importantly, the ownership structure arises endogenously rather than being determined exogenously. Therefore, even if one finds a negative relationship between the wedge and firm value, there are at least two explanations: tunneling and selection (Almeida and Wolfenzon (2006)). Tunneling refers to the transfer of resources of a group firm in which the controlling shareholder has low cash flow rights to group firms in which the controlling shareholder has high cash flow rights. As a result, the value of the firm in which the controlling shareholder has low (high) cash flow rights would be low (high). That is, the value of group firms is determined by the ownership structure. In contrast, the selection hypothesis predicts the opposite causality: the ownership structure is determined by the value of group firms. Specifically, it states that the controlling shareholder considers the value of group firms in selecting their positions in the group

structure. According to the model provided by Almeida and Wolfenzon (2006), the controlling family chooses a pyramidal structure (direct ownership structure) when acquiring firms with lower (higher) pledgeability and net present value. Therefore, firms of lower (higher) value result in a larger (smaller) wedge. Under the selection hypothesis, the negative association between the cash flow rights of the controlling shareholder and the value of group firms arises without a transfer of resources among group firms. These two possibilities suggest that it could be misleading to draw a causal relationship from a cross-sectional or time-series association between firm value and ownership structure. The goal of this study is to carefully examine the causal relationship between the ownership structure of business groups and the value of group firms.

First, to mitigate the inaccuracy in computing cash flow rights and voting rights, I take advantage of the detailed ownership dataset for Korean business groups, so-called chaebols, that are managed by a controlling family (hereafter, family) and apply the information to formulas for cash flow rights and voting rights that address the issues of inaccuracy of commonly used measures. Specifically, I employ the ultimate cash flow rights and the critical control threshold provided by Almeida, Park, Subrahmanyam, and Wolfenzon (2011) as measures of cash flow rights and voting rights, respectively. The ultimate cash flow rights is defined as the fraction of the dividend originally paid by a particular group firm that is eventually received by the family, and the critical control threshold is the maximum control threshold for which the firm belongs to the set of firms that are controlled by the family. Both of these measures can address the problems of alternative measures that are commonly used in the literature.

To establish an association between the ownership structure and firm value, I first examine how a pre-determined ownership structure of a chaebol affects the family's managerial decision making. In particular, I analyze the change of firm value on the announcement of mergers of firms that belong to chaebols. Because a merger is a significant investment for a firm, managerial objectives will play an important role and be reflected in stock price responses upon its announcement. If agency problems between families and minority shareholders exist in chaebol firms, then the NPV of a merger investment by a bidder firm in which the family has high cash flow rights would be higher than that of a bidder firm

in which the family has low cash flow rights because the cash flow rights of the family align the value of a firm to their wealth. Because the family likely uses other mechanisms to acquire enough voting rights in a bidder firm in which they have low cash flow rights, the wedge would be larger for these firms. In addition, these mergers will generally be lower NPV investments than those of non-chaebol bidders.

The empirical results are consistent with the existence of agency problems between controlling families and minority shareholders. By comparing the merger announcement returns of chaebol bidders to those of non-chaebol bidders, I find that the merger announcement returns of chaebol bidders are significantly lower than those of non-chaebol bidders. Specifically, I find that the merger announcement returns of non-chaebol firms are significantly positive, as in most studies on Korean mergers, whereas those of chaebol firms are, on average, insignificantly negative.

In addition, to examine the effects of the cash flow rights and voting rights of the family on merger decisions, I employ ultimate cash flow rights and the critical control threshold and further analyze their relationship with merger announcement returns. I find that the effect of the family's voting (cash flow) rights on merger announcement returns is negative (positive). In addition, the larger the wedge, the lower the merger announcement return is. These results are consistent with the two distinct traditional explanations for the effect of managerial ownership on firm value: interest-alignment effects and management-entrenchment effects. The former emphasizes the cash flow rights of a manager and claims the positive effects of managerial ownership on firm value. In contrast, the latter focuses on the voting rights of a manager and argues that managerial ownership has a negative effect on firm value. Thus, my finding that the cash flow (voting) rights are positively (negatively) associated with the merger announcement return is consistent with both hypotheses. However, when I use internal equity, a rough proxy for voting rights that is commonly used in studies of chaebols, I do not find such results. This finding emphasizes the importance of using accurate measures.

To address the possibility that the same effects exist in non-chaebol firms, I examine the effects of ownership structure on the merger announcement returns for non-chaebol firms. However, ultimate cash flow rights and the critical control threshold cannot be computed for non-chaebol firms due to the

lack of a detailed ownership dataset. Thus, I employ a simplified measure of voting rights used by Bae, Kang and Kim (2002), controlling ownership, which is defined as the sum of the equity ownership by the largest shareholder and equity ownership by affiliated firms. As in Bae, Kang and Kim (2002), I find the positive (negative) relationship between controlling ownership and the merger announcement returns for non-chaebol (chaebol) bidders. These results again suggest the existence of agency problems in chaebol firms. Subsequently, I separate controlling ownership into equity ownership by the largest shareholder and equity ownership by affiliated firms because the former is associated with both cash flow rights and voting rights, whereas the latter is associated with only voting rights. When I repeat the regression test, I find that the effect of the equity ownership by affiliated firms is negative, whereas the effect of the equity ownership by the largest shareholder is positive for chaebol firms. For non-chaebol firms, however, both rights have positive effects on merger announcement returns. These results confirm that the largest shareholder's voting rights have different effects in chaebol firms and non-chaebol firms, whereas cash flow rights have the same incentive-alignment effect.

The afore-mentioned findings can be explained by both tunneling and selection hypothesis. The tunneling hypothesis predicts that resources will be transferred out of the new firm, i.e., the bidder plus the target, after the merger if the family's cash flow rights in the bidder firm are low, resulting in a lower merger announcement return. If investors anticipate tunneling activities, then the merger announcement return of a bidder firm in which the family has low (high) cash flow rights would be low (high) even if the NPV of the merger investment itself is high (low). That is, the value of the new group firm will be determined by the ownership structure of the bidder firm. Thus, the ownership structure determines firm value.

In contrast, the selection hypothesis predicts that the family chooses group firms in which they have higher (lower) cash flow rights to conduct value-enhancing (-destroying) mergers. Specifically, if the target is underpriced, i.e., a positive NPV target, then the family will choose a firm in which they have high cash flow rights to do the merger. Meanwhile, if the target is overpriced relative to its value, i.e., a negative NPV target, then the family will choose a firm in which they have low cash flow rights to be the

bidder. To pursue this value-destroying merger, however, the family has to raise enough voting rights, which would create a large wedge. Thus, firm value determines the ownership structure.

To distinguish between the tunneling and the selection hypotheses as explanations for the negative association between voting rights (wedge) and merger announcement returns, I examine the stock price responses of non-bidder group firms to the merger announcements of a bidder firm in the same chaebol group. Although both hypotheses predict the same result for bidder firms, they have different predictions for non-bidder group firms. If the investors' anticipation of the tunneling activities drives the result, then the value of the non-bidder group firms that are expected to benefit (be worse off) from the tunneling activity will rise (decline) upon the announcement of the bidder firm's merger. Therefore, the value of non-bidder group firms in which the family has high (low) cash flow rights will increase (decrease). In contrast, the selection hypothesis predicts that the value of non-bidder group firms would not be particularly affected by a bidder firm's merger announcement other than through the equity ownership they have in the bidder firm.

The empirical results do not support tunneling hypothesis. First, I find that the stock price responses of non-bidder group firms are not explained by the ownership structure of a chaebol. Specifically, I find that non-bidder group firms' CARs cannot be explained by the family's cash flow rights in the firm, by the family's wealth invested in the firm (in Korean won), by the difference between the family's cash flow rights in the bidder firm and in the firm, by the difference between the family's wealth invested in the bidder firm and in the firm, by whether the family's cash flow rights are larger in the firm than in the bidder firm, or by whether the family's wealth is invested more in the firm than in the bidder firm. In addition, I analyze the change in the wealth of the controlling family and find that the family's wealth does not increase through their equity ownership in non-bidder group firms. Although the change in the family's wealth is not statistically significant, it increases from the enhanced value of bidder firms rather than non-bidder group firms. This result is contrary to what the tunneling hypothesis predicts: the controlling family's wealth increases from the enhanced value of the non-bidder group firms in which they have high cash flow rights.

Lastly, I examine the possibility that a controlling family pursues a merger to increase the aggregate value of the group rather than to increase their private benefit, e.g., to satisfy empire-building motives or to directly diverge resources to themselves, with the agency problem arising in choosing the bidder firm that pays the cost of the merger investment. For example, the family may decide to merge a target firm if having the target firm's assets in the group is beneficial to all group firms but have a group firm in which they have low cash flow rights be the bidder and pay for all the costs. If this is the case, the merger decision itself is efficient from the entire business group's perspective despite the agency motives in choosing the bidder firm. In fact, it could be an appropriate goal for people who manage a business group to maximize the aggregate value of the portfolio of group firms. To examine this possibility, I analyze the change in the aggregate value of public group firms upon a merger announcement of a bidder firm and find that the value of the group decreases, albeit statistically insignificantly. The mergers conducted by chaebols do not appear to be efficient managerial decisions, suggesting that agency motives may have driven them.

This study is directly related to Almeida and Wolfenzon (2006)'s selection theory of the ownership structures of business groups. In their model, the ownership structure of a business group arises endogenously as the controlling family chooses the optimal ownership structure of a new firm that is to be added to the group. Specifically, they can choose either a pyramidal structure, whereby the family uses the equity of an existing group firm to finance the investment in the new firm, or a direct ownership structure, whereby the investment is paid for with the family’s personal wealth. The theory generates predictions regarding the characteristics of new firms that are added as a pyramidal structure and those that are directly owned by the controlling family. For example, firms that have cash flows and/or assets that are difficult to pledge to outside investors are more likely to be placed in a pyramidal structure because the family can use group equity to finance the acquisition when the family is financially constrained. In addition, firms with lower net present values should be placed in a pyramid. In contrast, a family will prefer direct ownership when the NPV of the new firm is higher because the family must share the NPV of the new firm with minority shareholders under a pyramidal structure.

Almeida, Park, Subrahmanyam, and Wolfenzon (2011) empirically examine Almeida and Wolfenzon's (2006) selection theory. To distinguish between the selection and tunneling explanations, they examine chaebol firms' acquisition of new firms into a chaebol group. Throughout the study, they provide evidence that is consistent with the selection of firms into different positions in the chaebol. Specifically, they find that chaebols use pyramidal structure when the controlling family uses well-established group firms to acquire firms with low pledgeable income and high acquisition premiums, whereas families directly acquire firms with high pledgeable income and low acquisition premiums. My study differs from their study in that that I study merger events in which the target firms do not survive and become merged into the bidder firms; Almeida, Park, Subrahmanyam, and Wolfenzon (2011) use acquisition events in which the target firm survives as an entity separate from the acquiring firm. Studying merger events has certain advantages over studying acquisition events for Korean firms. First, it allows for more accurate estimation of the value of the merger transactions to the bidder firm because merger events are announced to the public immediately after the merger decisions are made, and thus, allow for examination of the stock price response on the announcement day. Announcements of acquisition events are not made immediately to the public in Korea and, moreover, the exact date of an acquisition event is unavailable even post-acquisition because it generally takes several steps. Therefore, the value of the acquisition to the bidder firm cannot be estimated using the stock price response of the bidder firm. For this reason, Almeida, Park, Subrahmanyam, and Wolfenzon (2011) use the book value of the target firm's equity as a fair price for acquisition and compare it to the amount paid for the acquisition by the acquiring firm to compute the NPV of an acquisition. However, this method could be misleading because the book value of equity does not necessarily equal the market value of equity and the synergy between the two firms could influence the fair price of the acquisition. Another benefit of using merger events is that it enables examination of the stock price responses of non-bidder group firms to the merger announcement of the bidder firm, and thus, presents a better test for the tunneling hypothesis. Furthermore, the overall change in the aggregate value of the public chaebol firms can be examined; thus,

whether the merger is an efficient investment business decision from the perspective of the entire business group can be examined as well.

This study is also related to studies examining the tunneling activities of business groups. Before the introduction of the selection hypothesis, most studies on business groups take their ownership structures as exogenously given and examine the relationship between the controlling family's ownership and firm value or profitability. A number of studies find negative associations between the two and ascribe the negative effect of families' ownership on firm value to tunneling incentives. For example, Bae, Kang and Kim (2002) also study chaebol firms' mergers from 1981 to 1997 and find a family's ownership has a negative effect on merger announcement returns, which they attribute to tunneling activities. Using a sample of 18,600 Indian firms during the period of 1989 to 1999, Bertrand, Mehta, and Mullainathan (2002) also find that the owners of business groups expropriate minority shareholders by tunneling resources from group firms in which they have low cash flow rights to group firms in which they have high cash flow rights primarily via the non-operating components of profit. Baek, Kang, and Lee (2006) claim that equity-linked private securities offerings are used as a mechanism for tunneling among firms that belong to Korean chaebols. By identifying another possible mechanism through which the agency problems between the controlling family and minority shareholders arise, this study suggests that attributing the entirety of the negative effect of the controlling family's voting rights to tunneling would be misleading.

2.2 Measures for cash flow rights and voting rights

A common concern of studies on business groups that address cash flow rights and voting rights is the difficulty in computing these rights due to the complexity of and/or the lack of data on the ownership structure of business groups. As a result, most studies use somewhat inaccurate measures for cash flow rights and/or voting rights. Studies on chaebols are no exception because both pyramidal structures and circular equity ownership (i.e., where a group firm A has equity ownership in another group firm B and B in turn has equity ownership in another group firm C and C in turn has equity ownership in A) severely complicate the ownership structure. However, I take advantage of a detailed ownership dataset for

chaebols and apply this information to formulas that address the problems of commonly used measures for cash flow rights and voting rights. These formulas are the ultimate cash flow rights and critical control threshold (Almeida, Park, Subrahmanyam, and Wolfenzon (2011)) for cash flow rights and voting rights, respectively.

The definition of cash flow rights is less controversial than that of voting rights. It is simply the fraction of the dividend originally paid by a firm A that is eventually received by the family. The ultimate cash flow rights take into account both the direct and indirect dividends that the family receives to arrive at accurate cash flow rights. In addition, the detailed ownership data enable incorporation of the equity ownership of not only the largest shareholder but also his family members and relatives. As a result, I can obtain fairly accurate cash flow rights of the controlling family.

The voting rights in a complex business group are difficult to define because it is not clear what fraction of the votes held by intermediate firms is ultimately controlled by the family. Thus, several methods with different assumptions have been used in the literature to measure voting rights. For example, La Porta, Lopez-de-Silanes, and Shleifer (1999) investigate ultimate voting rights by tracing the chain of ownership to find who has the most voting rights. In doing so, they calculate direct and indirect voting rights and regard that a corporation has a controlling shareholder if a shareholder's direct and indirect voting rights in the firm exceed 20 percent. Claessens, Djankov, and Lang (2000) define the weakest link in the chain of ownership as voting rights, which has become the most frequently used measure in the literature. Because a controlling shareholder generally has several chains through which to control the votes in a company, they trace all of those chains individually and then sum the control rights to yield the ultimate voting rights. Subsequently, Lang, and Young (2001), Faccio and Lang (2002), Claessens, Djankov, Fan, and Lang (2002) also use the weakest link to define voting rights. However, a number of drawbacks of this measure are indicated by Almeida, Park, Subrahmanyam, and Wolfenzon (2011). First, the intuition for adding the minimums over all the chains that are used to control a firm is unclear. Second, this definition can generate numbers above 100% when there are multiple chains leading to a group firm. Lastly, the weakest link is not well defined for firms that belong to a circular equity ownership structure,

which is a commonly used ownership structure for chaebol firms. Therefore, this measure is difficult to apply to chaebol firms.

Therefore, to the best of my knowledge, there have been no studies on chaebols employing the weakest link methodology. Bae, Kang and Kim (2002), in another study on the merger announcement returns of chaebol firms, for example, define controlling ownership as the sum of the equity ownership by the largest shareholder and the equity ownership by affiliated firms. Meanwhile, a number of Korean studies define internal equity as the sum of the equity ownership by the controlling shareholder, relatives, non-profit affiliated firms, corporate officials and other group firms to proxy for voting rights. The Korean Fair Trade Commission (KFTC), which was established with the purpose of regulating competition, especially the excessive concentration of economic power in a small number of large companies, regards internal equity divided by (1-treasury stock) as voting rights. However, this method lacks internal consistency because it makes the unrealistic assumption that the voting rights of all other group firms are 100%. Equity ownership in the bidder firm by a non-bidder group firm that is not controlled by the family should not be added as voting rights.

The critical control threshold does not suffer from this problem and can be applied to the complex ownership structure of chaebols. This formula gives the highest control threshold that is consistent with family control of a group firm. If the actual control threshold is higher than the critical control threshold, then the firm would not be part of the set of firms controlled by the family. Therefore, the higher the critical control threshold, the more likely the firm is to be controlled by the family. This measure is equivalent to the weakest link when cross-shareholdings and multiple links are absent. In calculating the voting rights of the controlling family, I include equity ownership by corporate officials because it is common to deposit the firm's equity to corporate officials while they stay in the firm, which is likely to be under the control of the family.

2.3 Data and summary statistics

2.3.1. Data

My sample consists of non-financial bidder firms that are listed in the KOSPI or KOSDAQ between 2000 and 2008. I identify a sample of bidder firms from merger announcements reported to the Financial Supervisory Service's website (DART, Data Analysis, Retrieval and Transfer system). Out of 537 such bidder firms, I eliminate 127 cases in which the bidder firm owns all of the shares of the target firm prior to the merger and 5 cases in which more than two mergers by one firm are announced on the same day. In addition, firms without sufficient stock price data to estimate parameters are excluded. Of the 382 final samples, 45 are chaebol bidders and 337 are non-chaebol bidders.

Because identifying the exact date of the initial public announcement of a merger is crucial in measuring merger announcement returns, I search both news media coverage and merger announcement reports on the Financial Supervisory Service's webpage and select the earlier date as the merger announcement date. If the announcement is made after trading closes, I choose the next trading day as the announcement date.

Detailed data on the ownership structure of chaebol firms and the controlling family are from the Korean Fair Trade Commission (KFTC). Since the mid-1990s, the KFTC requires chaebol firms to report complete ownership structures as of April 1 of each year, including the status of affiliate shareholders and persons with special interest. The ownership data used in this study are panel data from 1999 to 2006.

My definition of chaebols is the same as that of the KFTC. The KFTC first defines business groups and then applies further criteria to designate chaebols. A firm belongs to a business group if ownership by the controlling shareholder and related persons (relatives and other affiliated companies of the same business group) is larger than 30%, excluding preferred shares, or the controlling shareholder exercises controlling influence over it. Certain business groups are designated as chaebols based on the size of the group, which is the combined value of the total assets of all group firms. From 1987 to 2001, the 30 largest business groups were defined as chaebols, whereas from 2002 onwards, the KFTC provides

a cutoff in size as criteria for chaebols every year (Almeida, Park, Subrahmanyam, and Wolfenzon (2011)). I only focus on family business groups and exclude government-controlled business groups.

Financial and stock price data are collected from KIS-VALUE provided by the National Information & Credit Evaluation Inc. (NICE). Lastly, non-chaebol firm data on the ownership of the largest shareholder and affiliated corporations are collected from merger announcement reports on the Financial Supervisory Service's website.

2.3.2 Summary statistics

Panel A of Table 15 provides annual distribution of announcement of mergers for chaebols and non-chaebol firms, respectively. Of the 382 cases of merger announcement, 45 cases are by chaebol bidders, and 337 cases are by non-chaebol bidders. There appears to be an increasing trend in the frequency of merger announcements. Panel B shows the industrial relatedness of the mergers. A merger is categorized as a related merger if the industry of the bidder and that of the target are in the same narrow industry category and as an unrelated merger otherwise. Of all of the mergers, 38.7% are between bidders and targets of related industries, whereas 61.3% are between unrelated industries.

Table 16 shows characteristics of chaebol and non-chaebol bidders. Asset, debt, book value of equity, and market value of equity are measured in billions of won (approximately millions of dollars). The accounting variables are values from the most recent financial statements as of the time of the merger announcement. Market value of equity is the market value of the equity of the firm on the last trading day before the merger announcement. Debt ratio is defined as the ratio of the book value of debt to the book value of equity. Lastly, foreign ownership is the equity ownership by foreign investors at the end of the month prior to the merger announcement. Foreign ownership is included in the regressions because it is known to enhance corporate governance. Other than debt ratio and ROE, all of the variables are significantly larger for chaebol bidders than for non-chaebol bidders, consistent with other studies on Korean firms. It is well documented in previous studies that public chaebol firms are significantly larger than public non-chaebol firms, and chaebol firms can use higher debt through cross-guarantees.

2.4 Empirical results

I conduct an event study to examine stock price responses to the announcements of mergers for chaebol bidders and non-chaebol bidders separately. To do so, daily abnormal stock returns are calculated from the market model. The estimation period for the market model is 220 days before the announcement to 21 days before the announcement of mergers. After calculating daily abnormal returns, I define the cumulative abnormal return, i.e., CAR(t1,t2), as the sum of daily abnormal returns from t1 to t2, where the day of the first merger announcement to the public is set as t=0.

2.4.1 Merger announcement returns of chaebol firms and non-chaebol firms

I first compare the merger announcement returns of chaebol bidders and non-chaebol bidders to examine if chaebol bidders, on average, make undesirable merger decisions. If agency problems between the controlling family and the minority shareholders cause chaebol firms to engage in merger activities that are less desirable from the perspective of minority shareholders, then chaebol firms' merger announcement returns will be lower than those of non-chaebol firms.

Table 17 shows cumulative abnormal returns around merger announcements. Consistent with most studies on mergers of Korean firms, non-chaebol bidders experience significantly positive returns for periods around merger announcements. For example, from day -1 to +1, their cumulative abnormal return is 2.63%. However, chaebol bidders experience cumulative abnormal returns of -0.95% in the same period. CAR(-2,+2)s are also significantly positive for non-chaebol bidders but insignificant for chaebol bidders. The differences in CAR(-1,+1)s and CAR(-2,+2)s between chaebol bidders and non-chaebol bidders are statistically significant. Although they lose statistical significance, non-chaebol bidder' CARs are positive (approximately 3%) for all five CARs; those of chaebol bidders are lower than 0.5% in all cases. I define CAR(-1,+1)s to be merger announcement returns throughout the remainder of the paper.

2.4.2 Effects of the wedge between cash flow rights and voting rights

The empirical results in the previous section suggest that the mergers of chaebol firms are less efficient than those of non-chaebol firms. In this section, I focus on chaebol firms and study how ownership structure affects merger performance. That is, I study how a controlling family's merger decisions are

affected by their cash flow rights and voting rights. To do so, I use formulas for the ultimate ownership and the critical control threshold provided by Almeida, Park, Subrahmanyam, and Wolfenzon (2011) to calculate cash flow rights and voting rights, respectively, and analyze their effects on merger announcement returns. In addition, I employ internal equity, which is a frequently used proxy for voting rights in studies on chaebols. I define wedge to be a family's voting rights minus cash flow rights, and examine how wedge is associated with merger announcement returns.

In table 18 of panel A, I present the critical control threshold, internal equity and ultimate ownership of the controlling family for bidders and all of the groups firms. All of the group firms include both public and private group firms. Due to limited access to data on detailed ownership structures, for this analysis, my sample is restricted to 33 chaebol bidders between the years 2000 and 2006. The voting rights are measured by the critical control threshold in the first two rows and by internal equity in the last two rows. It appears that the critical control threshold and internal equity are fairly different measures for voting rights. Because the internal equity method assumes that all equity ownership by group firms is under the control of the family, internal equity is larger than the critical control threshold.

The results for the regression tests of the CAR(-1,+1)s of chaebol bidders on cash flow rights and voting rights are presented in panel B. I control for the relative size of the bidder to the target (bidder's book value of equity/target's book value of equity), the bidder's debt ratio, return on equity, equity ownership by foreign investors, and size of assets (defined as the log of assets). Equity ownership by foreign investors is included because foreign investors play an important role in monitoring companies in Korea. I also include three indicator variables. First, KOSPI is an indicator variable assigned a value of one if a bidder is listed in the KOSPI market and a value of zero if the bidder is listed in the KOSDAQ market. The second indicator variable is Industry relatedness, which is assigned a value of one for mergers in which the bidder and the target operate in the same industry and zero otherwise. The last indicator variable, Public target, equals one if the target is a public firm and zero otherwise. In the first column, where the critical control threshold is used, the coefficient on voting rights is negative and significant (-0.239), and the coefficient on cash flow rights is positive and significant (0.234). This

finding means that a one standard deviation increase in the critical control threshold leads to a 3.13% lower merger announcement return, whereas a one standard deviation increase in cash flow rights leads to a 3.44% higher merger announcement return. This result confirms the expectation that cash flow rights increase interest-alignment effects, whereas voting rights increase management entrenchment effects. For comparison, I also provide results for a regression in which internal equity is used as a proxy for voting rights in the second column. In this case, I do not find such results. The coefficient of cash flow rights is still positive (0.135) and marginally significant, but that of voting rights is negative (-0.014) and insignificant. This result emphasizes the importance of using accurate measures.

Next, I define wedge as voting rights minus cash flow rights and examine the relationship between wedge and merger announcement returns. As a wedge between voting rights and cash flow rights implies smaller interest-alignment effects relative to management entrenchment effects, the merger announcement return is expected to be lower for a bidder firm with a larger wedge. Panel C shows results on regressions of CAR(-1,+1)s on wedge. Consistent with the expectation that a larger wedge causes more severe agency problems, the coefficient on wedge is significantly negative when the critical control threshold is used as a proxy for voting rights. For comparison, I replace the critical control threshold with internal equity in column 2 and find that the coefficient on wedge is still negative but economically and statistically insignificant.

2.4.3 Do the same effects exist for non-chaebol firms?

In this section, I examine the possibility that the same effects exists in non-chaebol firms: the largest shareholder's cash flow rights are positively associated with firm value, whereas voting rights are negatively associated with firm value. To examine this possibility, I compare the effects of ownership structure on the merger announcement returns of chaebol firms to those of non-chaebol firms. However, computation of the same measures of cash flow rights and voting rights for non-chaebol firms is hindered by the lack of a detailed ownership dataset. Thus, I employ a simplified measure of voting rights used by Bae, Kang and Kim (2002), the controlling ownership, which is defined as the sum of the equity ownership by the largest shareholder and the equity ownership by affiliated firms. Using merger events

from 1981 to 1997, they find a negative (positive) effect of controlling ownership for chaebol (non-chaebol) bidders.

The regression results of CAR(-1,+1) on the controlling ownership are presented in table 19. As in Bae, Kang and Kim (2002), the coefficient on controlling ownership is significantly negative for chaebol bidders (-0.149), as shown in the first column. That is, the higher the controlling ownership, the lower the merger announcement return is. Evaluating the estimated coefficient at the mean indicates that, all else being equal, a one standard deviation increase in the controlling ownership, which is approximately 19%, results in an approximately 1.5% decrease in CAR(-1,+1)s for chaebol bidders. In contrast, the coefficient on controlling ownership is significantly positive for non-chaebol firms (0.134). To put this result into perspective, a one standard deviation increase in controlling ownership, which is approximately 16%, results in an approximately 1.1% increase in CAR(-1,+1)s.

In the previous regression, controlling ownership was calculated assuming that both the equity ownership by the largest shareholder and the equity ownership by affiliated firms affect the controlling shareholder's incentive in the same direction. However, they likely play different roles in managerial decisions because the equity ownership by the largest shareholder is associated with both cash flow rights and voting rights, whereas the equity ownership by affiliated firms is associated only with voting rights. To further analyze their differential effects, I separate these two components and conduct regression tests. The regression results are presented in panel B of table 19. In the regression of chaebol bidders, presented in the first column, the coefficient on equity ownership by the largest shareholder is positive but not significant (0.035), whereas the coefficient on the equity ownership by affiliated firms is negative and significant (-0.125). In the regression of non-chaebol bidders, both coefficients are positive, but they lose statistical significance. Although the employed measures are not accurate, these results confirm that the largest shareholder's voting rights have different effects in chaebol firms and non-chaebol firms, whereas cash flow rights have the same incentive-alignment effect.

2.4.4 Tunneling or Selection?

In this section, I examine whether tunneling or selection drives the negative association between merger announcement returns and wedge. However, looking solely at the stock price response of the bidder firm, it is not possible to distinguish between the two hypotheses. For example, if investors anticipate a transfer of resources out of a bidder firm in which the family has low cash flow rights into other group firms in which the family has high cash flow rights after the merger, i.e., tunneling, then the bidder firm's stock price will not increase on the announcement of the merger even if the merger itself is a positive NPV investment. In contrast, the same results can arise if a controlling family chooses group firms in which they have higher cash flow rights to conduct value-enhancing mergers and group firms in which they have lower cash flow rights to be involved in value-destroying mergers. Specifically, if the target is overpriced relative to its value, i.e., a negative NPV merger, then the family will choose a group firm in which they have low cash flow rights but high enough voting rights to be the bidder. Meanwhile, if the target is undervalued, i.e., a positive NPV merger, then the family will choose a group firm in which they have high cash flow rights to merge the target.

To distinguish between the two hypotheses, I examine the stock price responses of non-bidder group firms upon the merger announcement because tunneling and selection hypotheses' predictions on non-bidder group firms differ. If a tunneling motive is driving the results, then the value of non-bidder group firms that are expected to benefit from tunneling activities will rise along with the wealth of the controlling family that is invested in group firms. In contrast, if selection is occurring, then the value of non-bidder group firms would not be particularly affected by a bidder firm's merger announcement other than through the equity ownership they have in the bidder firm.

First, I conduct a number of regression tests of the CAR(-1,+1)s of non-bidder group firms on the bidder firm's merger announcement to examine whether these firms' stock price responses are explained by the ownership structure of the chaebol. In calculating CAR(-1,+1)s, I subtract the mechanical change in the market value of non-bidder firms that is attributed to non-bidder group firms' equity ownership (both direct and indirect) in the bidder firm. The independent variables are the family's cash flow rights in

the firm, the family's wealth invested in the firm (in Korean won), the difference between the family's cash flow rights in the firm and in the bidder firm, the difference between the family's wealth invested in the firm and in the bidder firm, whether the family's cash flow rights are larger in the firm than in the bidder firm, and whether the family's wealth is invested more in the firm than in the bidder firm. I control for the relative size of the firm to the bidder (=the firm's equity/bidder's equity), debt ratio (=liability/equity), return on equity, equity ownership by foreign investors, and size of assets. I also include three indicator variables. First, Industry relatedness b/w firm & bidder is an indicator variable assigned a value of one if the firm and the bidder belong to the same industry and a value of zero otherwise. Second, Industry relatedness b/w firm &target is an indicator variable assigned a value of one if the firm and the target belong to the same industry and a value of zero otherwise. Lastly, Industry relatedness b/w bidder & target is an indicator variable assigned a value of one if the bidder and the target belong to the same industry and a value of zero otherwise.

The regression results of CAR(-1,+1)s are presented in the table 20. The independent variable is the family's cash flow rights in the firm in the first column. Because it is likely that a family may care more about their absolute wealth than the fraction of the firm's value that is accounted for by their wealth, I have the family's wealth invested in the non-bidder group firm as the independent variable in the second column. Next, I examine the effect of a family's cash flow rights and wealth in non-bidder group firms relative to those in a bidder firm. Thus, the independent variable is a family's cash flow rights in the group firm less the cash flow rights in the bidder firm in the third column and the amount of the family's wealth invested in the non-bidder group firm in excess of that invested in the bidder firm in the fourth column. In both tests, the coefficients of interest are not significant. Lastly, I present regression results with an indicator variable assigned a value of one if the cash flow rights of the family in the firm are larger than those in the bidder firm and a value of zero otherwise in the fifth column and with an indicator variable assigned a value of one if the wealth of the family is invested more in the firm than in the bidder firm and a value of zero otherwise in the last column. None of the coefficients are statistically or economically

significant. In conclusion, the tunneling hypothesis does not appear to drive the results found in previous tests, and the selection hypothesis better explains the empirical results.

2.4.5 Effects of the merger on aggregate value of group firms

In this section, I examine the possibility that a controlling family pursues a merger because it is expected to increase the aggregate value of the group rather than to increase their private benefit, with the agency problem arising in choosing the bidder firm that pays the cost of purchasing the target firm. For example, a family decides to merge a target firm because the target firm's assets can increase the value of all the group firms. However, the family selects a group firm in which they have low cash flow rights to be the bidder and pay for the cost. If this is the case, the merger decision is efficient from the perspective of the business group despite the agency problem between the controlling family and minority shareholders. In fact, it could be an appropriate goal for those who manage a business group to maximize the aggregate value of the portfolio of group firms. If this is the case, the consequences of chaebol bidders' mergers to the economy are quite different than when a family pursues value-destroying mergers for private benefits, for example, to satisfy empire-building motives.

To examine this possibility, I calculate the merger announcement returns of group firms on the announcement of a merger by a bidder firm in the same group. The simple average CARs of group firms excluding the bidder firm are presented in panel A of table 21. With the exception of CAR(-2,+2), all the CARs are negative and insignificant. Furthermore, it is shown in the panel B that the CAR(-1,+1)s of the value-weighted portfolios of all group firms is, on average, -0.37% (presented in the last column of table 24, will be discussed in the following section), although statistically insignificant. It appears that the value of non-bidder group firms is, on average, not significantly affected by the bidder firms' merger, but if any effect exists, it is negative. These results suggest that the controlling family does not engage in merger activities to increase the aggregate value of the group firms.

I further analyze the change in the aggregate value of group firms upon the merger announcement of a bidder firm by computing CAR(-1,+1)s of a portfolio of group firms and of a family's wealth, respectively. The results are presented in panel B of table 21. The first row shows the average CAR of the

value-weighted portfolios of group firms. The value weighted CAR of bidder firms in the first column is the mean of the CAR(-1,+1)s of bidder firms multiplied by their own weight in the group to which they belong. The value-weighted CAR(-1,+1)s of non-bidder group firms in the second column is the mean of the sum of CAR(-1,+1)s of non-bidder group firms in a group multiplied by their own weight. The weight for the value-weighted portfolio is the ratio of the market value of the firm to the sum of the market value of all public group firms at the beginning of the day prior to the merger announcement (t=-1). Although none of the results are statistically significant, it appears that there has been a decrease in the value of both the bidder firm (-0.29%) and non-bidder group firms (-0.40%) on the announcement of the merger, resulting in 0.69% of the aggregate value loss. It therefore does not appear that the controlling family's ultimate goal is to maximize the aggregate value of the entire group.

In the second row, I repeat the same analysis for the family's wealth rather than the market value of a group. That is, in calculating the weight, I replace the market value of each group firm with the family's wealth invested in each group firm. The family's wealth increases by 0.38% around the merger announcement of the bidder firm, although this value is statistically not significant. This result suggests that even though the value of a group decreases on average, the controlling family's wealth does not decrease through a merger. In addition, this increase in value comes from the enhanced value of bidder firms rather than non-bidder group firms. This result is contrary to what the tunneling hypothesis predicts: the controlling family's wealth increases from the enhanced value of the non-bidder group firms in which they have high cash flow rights. The change in wealth of the controlling family from a bidder firm is, on average, 71,432,425 won, whereas that from non-bidder group firms is -29,769,017 won for each merger. That is, controlling families gain approximately 41,663,408 won, which is approximately $37,415, per merger from the equity ownership. In conclusion, it does not appear that the controlling family conducts mergers to increase the aggregate value of the group firms.

2.5 Conclusion

This study is not intended to exclude tunneling as a possible mechanism for agency problems between the controlling family and minority shareholders of chaebols or other business groups. There could be circumstances where tunneling activities occur, especially once the group structure is determined. In addition, there could be other mechanisms through which controlling families pursue private benefits. However, this study contributes to the literature by providing empirical evidence that the design of the group structure is one mechanism through which agency problems arise. Specifically, I examine the effects of controlling family's cash flow rights and voting rights in a bidder firm on merger announcement returns. In doing so, I employ the measures for cash flow rights and voting rights provided by Almeida, Park, Subrahmanyam, and Wolfenzon (2011), which take care of the problems of previous measures. Through empirical analysis, I find that the merger announcement returns of chaebol firms are, on average, lower than those of non-chaebol firms and that the wedge between controlling shareholders' voting rights and cash flow rights negatively affects merger announcement returns, suggesting the existence of agency problems between the family and minority shareholders. To distinguish between the tunneling and selection explanations, I examine the merger announcement returns of non-bidder group firms and conclude that selection of firms into different positions, rather than tunneling, appears to be an important mechanism. Lastly, I provide evidence that chaebol firms' mergers are not motivated by value maximization of group value, suggesting that these mergers are driven by agency motives.

Although business groups controlled by families are not pervasive in the U.S., this study has an important implication for the parent-subsidiary structure with minority shareholders in the subsidiary firm. Because the shareholders of the parent firm have an incentive to have the subsidiary take the low NPV projects, the value of subsidiary may be lower as firms in a pyramidal ownership structure. This scenario will be more prevalent when the equity ownership of the parent firm in the subsidiary firm is far from 100% because the wedge between cash flow rights and voting rights of the parent firm will be larger. Such selection will cause a discount of subsidiary firms with larger wedges. It is of interest to examine if selection exists in U.S. firms, for example, when merging with or acquiring firms.

2.6 Figures and Tables

Table 15

Annual distribution of merger announcements and industry relatedness

Panel A presents the annual distribution of merger announcements between the years 2000 and 2008 for chaebols and non-chaebol firms. Merger announcements are collected from merger announcement statements reported to the Financial Supervisory Service's website (DART, Data Analysis, Retrieval and Transfer system). Panel B presents the industrial relatedness of mergers. A merger is categorized as a related merger if the industry of the bidder and that of the target are in the same narrow industry code and as an unrelated merger otherwise.

Panel A. Annual distribution of merger announcements for chaebols and non-chaebol firms

Year	Chaebol	Non-chaebol	Total
2000	6	12	18(4.71%)
2001	7	26	33(8.64%)
2002	6	17	23(6.02%)
2003	2	21	23(6.02%)
2004	4	29	33(8.64%)
2005	3	41	44(11.52%)
2006	5	55	60(15.71%)
2007	9	66	75(19.63%)
2008	3	70	73(19.11%)
	45(11.78%)	337(88.22%)	382(100%)

Panel B Industrial relatedness

Relatedness	Chaebol	Non-chaebol	Total
Related mergers	15	134	149(39.01%)
Unrelated mergers	30	203	233(60.99%)
Total	45(11.78%)	337(88.22%)	382(100%)

Table 16

Characteristics of chaebol and non-chaebol bidders

This table presents characteristics of chaebol and non-chaebol bidders. Asset is the amount of assets of the bidder firm in billion won. Liability is the amount of liability of the bidder firm in billion Korean won (approximately million USD). Equity is the book value of the equity of the bidder firm in billion Korean won. Net income is also presented in billion Korean won. Debt ratio is defined as liability/equity. Foreign ownership is the equity ownership by foreign investors at the end of the month prior to the merger announcement. Market cap is the market value of the firm on the day before the merger announcement, also presented in billion Korean won. ROE is calculated as net income divided by book equity. Accounting variables are values from the most recent financial statements as of the time of the announcement. t-statistics are in parentheses. Standard deviations are in square brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.

	Chaebol	Non-chaebol	Difference (Chaebol minus non-chaebol)
Asset	3,075	127.9	2,948***
	[2,916]	[454.04]	(6.77)
Debt	1,841	68.93	1,772***
	[1,744]	[287.48]	(6.81)
Book value of equity	1,235	59.02	1,176***
	[1,448]	[190.87]	(5.44)
Market value of equity	5,039	716.71	4,322***
	[16,441]	[4,629.36]	(3.85)
Debt ratio (=Debt/ book value of equity)	2.12	1.02	1.10
	[1.63]	[22.74]	(0.87)
Foreign ownership(%)	11.82	3.67	8.15***
	[14.84]	[9.36]	(3.59)
ROE	0.11	0.11	0.00
	[0.15]	[1.83]	(0.03)
Controlling ownership(%)	24.86	24.28	0.57
	[19.28]	[16.08]	(0.17)
Equity ownership by the largest shareholder (%)	4.18	12.67	-8.49***
	[6.31]	[13.78]	(-6.49)
Equity ownership by affiliated firms (%)	20.67	11.61	9.06**
	[19.51]	[16.35]	(2.68)
No. Obs	45	337	

Table 17

Cumulative abnormal returns around merger announcements

This table shows cumulative abnormal returns around merger announcements. I define cumulative abnormal return, CAR(t1,t2), as the sum of daily abnormal returns from t1 to t2, where the day of the first merger announcement to the public is set as t=0. Daily abnormal stock returns are calculated from the market model. The estimation period for the market model is 220 days before the announcement to 21 days before the announcement of mergers. t-statistics are in parentheses. The numbers are in %. * significant at 10%; ** significant at 5%; *** significant at 1%.

CAR(t1,t2), %	All bidders	Chaebol Bidders	Non-chaebol bidders	Difference (Chaebol minus non-chaebol)
CAR(-1,+1)	2.0223*	-0.9525	2.6318**	-3.5843**
	(1.68)	(-0.93)	(2.23)	(-2.30)
CAR(-2,+2)	3.3784**	0.1924	3.8089**	-3.6165*
	(2.21)	(0.17)	(2.22)	(-1.77)
CAR(-3,+3)	3.5235	0.4023	2.839	-2.4367
	(1.38)	(0.39)	(0.77)	(-0.64)
CAR(-4,+4)	2.9113	0.0052	3.2009	-3.1957
	(0.82)	(0.00)	(0.79)	(-0.76)
CAR(-5,+5)	3.2077	0.4525	3.0941	-2.6416
	(0.80)	(0.37)	(0.63)	(-0.52)

Table 18

Relationship between CAR(-1,+1)s and control rights, cash flow rights, and wedge

Panel A presents the critical control threshold, internal equity and cash flow rights of the controlling family, for bidders and all of the groups firms. Due to the limited access to the data on detailed ownership structures, my sample is restricted to 33 chaebol bidders between the years 2000 and 2006. Panel B presents the regression results of CAR(-1,+1)s on voting rights and cash flow rights, and panel C presents the regression results of CAR(-1,+1)s on the wedge. Wedge is defined as the voting rights minus the cash flow rights of the controlling family. In the first column of panel B, the critical control threshold is used as voting rights, whereas internal equity is used as a proxy for voting rights in the second column in both regression tests. The control variables are the relative size of the bidder to the target (=bidder's equity/target's equity), debt ratio (=liability/equity), return on equity, equity ownership by foreign investors, and the size of assets. In addition, three indicator variables are included. First, KOSPI is an indicator variable assigned a value of one if the bidder is listed in the KOSPI market and zero if the bidder is listed in the KOSDAQ market. The second indicator variable is Industry relatedness, which is assigned a value of one for mergers where the bidder and the target operate in the same industry and zero otherwise. The last indicator variable, Public target, equals one if the target is a public firm and zero otherwise. Standard deviations are in square brackets. t-statistics are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Panel A. Summary statistics

Proxy for voting rights	Control rights %	Cash flow rights %	Wedge %
CCT	31.21	21.41	9.8
	[13.09]	[14.71]	[9.40]
Internal equity	38.71	21.41	17.29
	[15.65]	[14.71]	[15.32]

Table 18 (con't.)

Panel B. Regression of CAR(-1,+1)% on voting rights and cash flow rights

Variable	CCT	Internal equity
Voting rights	-0.239**	-0.014
	(-2.10)	(-0.17)
Cash flow rights	0.234**	0.135
	(2.31)	(1.65)
Relative size	0.000	0.000
	(0.99)	(0.09)
Debt ratio	0.017	0.004
	(1.85)	(0.35)
KOSPI	-0.158	0.993
	(-0.06)	(0.29)
ROE	1.059	-2.937
	(0.39)	(-0.88)
Foreign ownership	-0.108	-0.304***
	(-1.01)	(-3.73)
Industry	2.554	1.302
relatedness	(1.41)	(0.55)
Public target	-5.044**	-3.838
Dummy	(-2.31)	(-1.41)
Size	0.750	1.557
	(1.55)	(3.88***)
R^2	0.586	0.640
Observations	33	33

Table 18 (con't.)

Panel C. Regression of CAR(-1,+1)% on wedge

Variable	CCT	Internal equity
Wedge	-0.235**	-0.078
	(-2.41)	(-1.16)
Relative size	0.000	0.000
	(1.03)	(0.42)
Debt ratio	0.016*	0.003
	(1.89)	(0.27)
KOSPI	-0.128	0.379
	(-0.05)	(0.11)
ROE	1.008	-1.919
	(0.40)	(-0.59)
Foreign ownership	-0.107	-0.350***
	(-1.04)	(-4.81)
Industry	2.550	1.736
relatedness	(1.44)	(0.74)
Public target	-5.004**	-4.992*
Dummy	(-2.45)	(-1.95)
Size	0.760	1.388***
	(1.63)	(3.65)
R^2	0.586	0.616
Observations	33	33

Table 19

Regression of CAR(-1,+1)% on Controlling ownership

Panel A presents the regression result of CAR(-1,+1)% on controlling ownership, where controlling ownership is defined as the sum of the equity ownership by the largest shareholder and the equity ownership by affiliated firms. Panel B presents the regression of CAR(-1,+1)% on the equity ownership by the largest shareholder and the equity ownership by affiliated firms separately. The control variables are the relative size of the bidder to the target (=bidder's equity/target's equity), debt ratio (=liability/equity), return on equity, equity ownership by foreign investors, and the size of the assets. In addition, three indicator variables are included. First, KOSPI is an indicator variable assigned a value of one if the bidder is listed in the KOSPI market and zero if the bidder is listed in the KOSDAQ market. The second indicator variable is Industry relatedness, which is assigned a value of one for mergers where the bidder and the target operate in the same industry and zero otherwise. The last indicator variable, Public target, equals one if the target is a public firm and zero otherwise. t-statistics are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Panel A. Regression of CAR(-1,+1)% on controlling ownership

Variable	Chaebol	Non-chaebol
Controlling ownership	-0.149***	0.134*
	(-2.77)	(1.86)
Relative size	-0.002	-0.0002
	(-0.92)	(-0.15)
Debt ratio	0.020**	-0.0007
	(2.28)	(-1.35)
KOSPI	5.762	3.039
	(1.59)	(1.04)
ROE	1.349	-0.055
	(0.49)	(-0.48)
Foreign ownership	-0.140	0.034
	(-1.21)	(0.24)
Industry relatedness	0.331	3.384
	(0.20)	(1.33)
Public target	-3.408**	-0.448
	(-2.16)	(-0.08)
Size	4.659	-1.595
	(1.07)	(-0.55)
adjusted R^2	0.453	0.029
Observations	45	337

Table 19 (con't.)

Panel B. Regression of CAR(-1,+1)% on the equity ownership by the largest shareholder and the equity ownership by affiliated firms

Variable	Chaebol	Non-chaebol
Equity ownership by the largest shareholder	0.035 (0.29)	0.123 (1.37)
Equity ownership by affiliated firms	-0.125** (-2.34)	0.150 (1.55)
Relative size	-0.003 (-1.44)	-0.0003 (-0.18)
Debt ratio	0.021** (2.60)	-0.0007 (-1.25)
KOSPI	6.448* (1.83)	2.979 (0.99)
ROE	1.571 (0.59)	-0.053 (-0.46)
Foreign ownership	-0.149 (-1.33)	0.024 (0.17)
Industry relatedness	0.930 (0.56)	3.469 (1.35)
Public target	-3.954** (-2.53)	-1.297 (-0.44)
Size	0.661 (1.52)	0.088 (0.01)
R^2	0.505	0.030
Observations	45	337

Table 20 Tunneling or Selection?

This table presents the regression result of non-bidder group firms' CAR(-1,+1)s on a number of variables associated with a controlling family's cash flow rights and wealth. In calculating CAR(-1,+1)s, mechanical changes in the market value through the firm's equity ownership in the bidder firm are subtracted. Independent variables are the family's cash flow rights in the firm (in the first column), the family's wealth invested in the firm (in the second column), the difference between the family's cash flow rights in the firm and in the bidder firm (in the third column), the difference between the family's wealth invested in the firm and in the bidder firm (in the fourth column), whether the family's cash flow rights are larger in the firm than in the bidder firm (in the fifth column), and whether the family's wealth is invested more in the firm than in the bidder firm (in the last column). I control for the relative size between the firm and the bidder firm, the debt ratio, ROE, the foreign ownership, and the size (defined as the log of asset) of the firm. I also include dummy variables that equal 1 if the firm and the bidder firm belong to the same industry (Industry relatedness b/w firm & bidder), if the firm and the target firm belong to the same industry (Industry relatedness b/w firm & target), and if the bidder firm and the target firm belong to the same industry (Industry relatedness b/w bidder & target). t-statistics are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 20 (con't.)

Variable	Independent variable					
	Cash flow rights in the firm	Wealth invested in the firm	CF in the firm - in bidder	Wealth in the firm - in bidder	Dummy if CF in the firm>bidder	Dummy if wealth in the firm>bidder
Independent variable	0.000 (0.03)	0.000 (0.23)	0.000 (0.16)	0.000 (-0.39)	0.019 (0.31)	0.023 (0.35)
Relative size	0.000 (0.2)	0.000 (0.25)	0.000 (0.23)	0.000 (0.25)	0.000 (0.23)	0.000 (0.14)
Debt ratio	0.000 (-0.04)	0.000 (-0.06)	0.000 (-0.04)	0.000 (-0.03)	0.000 (-0.03)	0.000 (-0.03)
ROE	-0.023 (-0.39)	-0.022 (-0.38)	-0.023 (-0.40)	-0.020 (-0.34)	-0.022 (-0.37)	-0.022 (-0.39)
Foreign ownership	0.000 (0.11)	0.000 (0.15)	0.000 (0.12)	0.000 (0.14)	0.000 (0.14)	0.000 (0.11)
Industry relatedness b/w firm & bidder	0.043 (0.52)	0.049 (0.58)	0.042 (0.51)	0.041 (0.50)	0.042 (0.52)	0.041 (0.50)
Industry relatedness b/w firm &target	-0.021 (-0.19)	-0.023 (-0.20)	-0.022 (-0.20)	-0.018 (-0.16)	-0.022 (-0.20)	-0.022 (-0.20)
Industry relatedness b/w bidder & target	0.031 (0.45)	0.029 (0.43)	0.033 (0.48)	0.03. (0.49)	0.033 (0.49)	0.036 (0.53)
Size	0.025 (1.10)	0.027 (1.11)	0.025 (1.09)	0.025 (1.10)	0.024 (1.05)	0.023 (0.99)
adjusted R^2	0.013	0.013	0.013	0.014	0.013	0.013
Observations	127	127	127	127	127	127

Table 21

Effects of the merger on the aggregate value of group firms and the family's wealth

Panel A. CAR(-1,+1)s of chaebol group firms excluding the bidder firm

The simple average CAR of group firms excluding the bidder firm are presented in the table. Cumulative abnormal returns, CAR(t1,t2)s, are defined as the sum of daily abnormal returns from t1 to t2, where the day of the first merger announcement to the public is set as t=0. Daily abnormal stock returns are calculated from the market model. The estimation period for the market model is 220 days before the announcement to 21 days before the announcement of mergers. The numbers are in %. t-statistics are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

	CAR %
car(-1,+1)	-0.4207
	(-1.22)
car(-2,+2)	0.2428
	(0.54)
car(-3,+3)	-0.2608
	(-0.51)
car(-4,+4)	-0.8788
	(-1.13)
car(-5,+5)	-3.5685
	(-1.50)

Panel B. CAR of portfolios of group firms and of the family's wealth

The average CAR(-1,+1) of bidder firms, the simple average CAR(-1,+1) and value-weighted portfolio's CAR(-1,+1) of all public group firms excluding the bidder firm, and those of all group firms are presented in the first and the second rows. In the last row, the average CAR(-1,+1) of portfolios of the family's wealth is presented. t-statistics are in parentheses. The numbers are in %. * significant at 10%; ** significant at 5%; *** significant at 1%.

CAR(-1,+1)%	Bidder firm	Non-bidder group firms	Total
CAR of value-weighted	-0.2893	-0.4035	-0.6928
portfolios of group firms	(-0.05)	(-0.08)	(-0.07)
CAR of portfolios of the	0.6486	-0.2703	0.3783
family's wealth	(0.14)	(-0.06)	(0.02)

3 The effect of CEOs' prior performance on risk taking

3.1 Introduction

Consider a CEO who suffered a loss of $1 M under her administration. Among given sets of projects, which project would she choose today? If this CEO instead made a gain of $1 M under her administration, would her choice of project be different than if she had suffered a loss? If a CEO is rational, then she should only consider incremental outcomes and her decision today should be made irrespective of her past performance. However, if a CEO is influenced by prior performance, then the projects she chooses after making a gain could be different than the ones she chooses following a loss. In this study, I examine how a CEO's prior gain/loss affects her managerial decision making. In particular, I study how a CEO's attitude toward risk is affected by her prior gain/loss.

A number of studies find the existence of behavioral biases that are associated with an individual's risk taking. For example, Thaler and Johnson (1990) find through experiments that under some circumstances a prior gain can increase subjects' willingness to accept gambles, which they call the "house money effect". If a CEO is subject to this cognitive bias, then she will take more risk following good performance. Meanwhile, another strand of literature finds an increase in risk aversion when gains are present. For instance, under the prospect theory developed by Kahneman and Tversky (1979), the value function is defined by gains and losses, rather than levels of wealth, and people behave as if maximizing an "S"-shaped value function. That is, the function is concave in the domain of gains and convex in the domain of losses. If a CEO's value function is "S"-shaped, as in prospect theory, then she will take less (more) risk following a gain (loss). For example, after making a gain, she feels relaxed and wants to work on easy and safe projects because she is in a more concave, more risk-averse, part of her value function.

On the other hand, it is also possible that a CEO, as a decision maker of a firm, tries to avoid such biases and make rational decisions and succeeds. If this were the case, a CEO's prior gain/loss would not affect her current managerial decision making. Therefore, whether CEOs' risk taking is affected by prior

gain/loss, and if so, whether the effect on the risk taking is positive or negative are the empirical questions that this study will explore.

A critical issue in studying the relationship between a CEO's prior gain/loss and risk taking is how to define a CEO's gain/loss and risk taking. First, in defining a CEO's gain/loss, I assume that a CEO sets a reference point and then considers lesser outcomes as losses and greater ones as gains, as in prospect theory. I set two reference points for each CEO. The first reference point is the median value of industry firms' performance, where performance is measured by either net income or EBITDA normalized by total asset. I define relative performance as a CEO's performance minus the median of industry firms' performance. If the CEO's relative performance is positive (negative), then the CEO is considered to have made a gain (loss) in that year.

The second reference point is the average of the CEO's relative performance since she has become the CEO of the firm. This reference point is adopted to take into account a CEO's expectation about her current performance based on her past performance. In this case, a CEO's gain/loss in year t is determined relative to the average of her relative performance up to year t-1, which I call average relative performance$_{t-1}$. If a CEO's relative performance$_t$ is better (worse) than average relative performance$_{t-1}$, then she is regarded as having made a gain (loss) in year t. I define a CEO's abnormal relative performance $_t$ as relative performance$_t$ minus average relative performance$_{t-1}$. If abnormal relative performance is positive (negative), then the CEO is regarded as having made a gain (loss) in that year.

To distinguish these two reference points, consider a CEO that has been making more net income than industry firms by \$1 M on average since she has become the CEO of the firm until year t-1. In year t, she makes net income that is \$0.4 M above the industry median. Applying the first reference point, she has made a gain this year because her relative performance is positive (\$0.4 M). However, she has experienced a loss of \$0.6 M using the second reference point because her relative performance$_t$ (\$0.4 M) is lower than her average relative performance$_{t-1}$ (\$1 M).

Another variable to define is risk taking. Because this is not directly observable, I employ two measures of a firm's asset volatility as proxies for risk taking. It is reasonable to assume that the value of a

firm will be less (more) volatile when a CEO take less (more) risk. I use two measures of the asset volatility of a firm: unlevered equity volatility and Choi's asset volatility. To obtain unlevered equity volatility, I first estimate equity volatility from historical stock returns of a firm, then multiply it by the ratio of market value of equity to the sum of market value of equity and book value of debt, assuming non-volatility of debt value. I use unlevered equity volatility rather than equity volatility because higher leverage mechanically makes a firm's equity more volatile. Choi's asset volatility is calculated by mapping out significant portions of a firm's capital structure using a dataset that includes prices and other information on equities, publicly traded debt and syndicated loans. Unlike unlevered equity volatility, the assumption of non-volatility of debt value is not required in computing Choi's asset volatility.

Controlling for CEO fixed effects, I find that a CEO's prior gain/loss affects her risk taking. Specifically, a CEO take more risk following gains. That is, relative performance_{t-1} and abnormal relative performance_{t-1} are negatively associated with unlevered equity volatility_t.

An alternative explanation against CEOs' bias is that CEOs' compensation structure causes such behavior. Because many CEOs, especially ones with good performance, have stock options in their compensation package, and the value of these stock options increase with volatility of firms (Coles, Daniel, and Naveen(2006), Agrawal and Mandelker(1987), Low (2009)), CEOs with stock options may take risky projects. To test this possibility, I repeat the test using a sample of CEOs that do not have stock options in their compensation package. The result suggests that even CEOs without stock options compensation follow take more risk after making gains.

I examine what types of CEOs exhibit stronger results. First, I separate each CEO to first half and second half. For example, if he stayed in a firm for 10 years, I separate into first 5 years and second 5 years. And the dummy Early is one for first 5 years and zero for the last 5 years. I find that CEOs in earlier stages respond more sensitively to prior performance. Next, I separate CEOs based on the age they started at the firm as a CEO. Young is one for CEOs that started before the age of 50. I find that they respond more sensitively to prior performance.

This study is related to the literature that proposes behavioral theories to account for asset pricing anomalies. Basing on the prospect theory of Kahneman and Tversky (1979), a number of studies in the finance literature suggest evidence of individual investors' cognitive biases in decision making. For instance, Coval and Shumway (2005) document that Chicago Board of Trade proprietary traders regularly assume above-average afternoon risk to recover from morning losses. This result is consistent with prospect theory, in which utility functions are derived as convex in loss regions and concave in gain regions; therefore, an investor would exhibit risk-seeking behavior in the loss region. Studies on disposition effects are another example of such literature. Studies on investors' inattention also take a behavioral approach to explain stock price anomalies (Huberman and Regev (2001), Barber and Odean (2008), DellaVigna and Pollet (2006), Hou (2007), Menzly and Ozbas (2006), Hong, Torous, and Valkanov (2007), Cohen and Frazzini (2008), and Cohen and Lou (2012)). However, few studies examine the behavioral biases of CEOs. This study contributes to the literature by showing that not only individual investors but also CEOs are subject to behavioral biases.

One exception to the scarcity of studies on CEOs' behavioral biases is a strand of literature on CEOs' overconfidence. These studies examine how managerial overconfidence can account for corporate investment distortions. Heaton (2002), for instance, argues that overconfidence in the form of managerial optimism is unambiguously bad, causing either over- or underinvestment. In contrast, Gervais, Heaton, and Odean (2009) present a model in which overconfidence can increase value by mitigating moral hazard and aligning incentives. Empirically, Malmendier and Tate (2005) show that overconfident managers overestimate the returns on their investment projects and view external funds as unduly costly. Thus, they overinvest when they have abundant internal funds, but curtail investment when they require external financing. To conduct empirical tests, these studies classify CEOs as overconfident if they persistently fail to reduce their personal exposure to company-specific risk and compare their managerial decision making with those of non-overconfident CEOs. Graham, Harvey, and Puri (2012) provide additional empirical evidence that CEO behavior is related to measures of overconfidence, optimism and

risk aversion. Malmendier, Tate, and Yan (2011) show that measurable managerial characteristics have significant explanatory power for corporate financing decisions. For example, they find that CEOs who grew up during the Great Depression are averse to debt and lean excessively on internal finance and that CEOs with military experience pursue more aggressive policies. However, these studies rarely try to describe how such overconfidence changes for a given CEO. My study is different from these empirical studies in that I investigate how bias develops as a CEO works on projects and realizes outcomes.

3.2 Definition of variables

3.2.1 Asset volatility

Although the riskiness of projects is not directly observable, it will be reflected in the volatility of a firm's assets. For example, if a CEO chooses only safe projects, then the uncertainty surrounding the projects is small, and thus the value of the firm will be less volatile. However, if a CEO chooses risky projects, then higher uncertainty about the outcomes of the projects makes the value of the firm more volatile. Therefore, I use the asset volatility of a firm as a proxy for the riskiness of projects a CEO chooses. In doing so, I employ a measure of a firm's asset volatility, unlevered equity volatility. I use unlevered equity volatility rather than equity volatility because higher leverage mechanically makes a firm's equity more volatile to the extent that the value of debt is less volatile than that of equity. In calculating unlevered equity volatility, I assume that the value of debt is fixed and thus its volatility is zero. I first estimate equity volatility from historical stock returns of the last 12 months, and then multiply it by the ratio of market value of equity to the sum of market value of equity and book value of debt following Acharya, Almeida, and Campello (2013). The face value of debt for each firm is computed as the firm’s total book value of short-term debt plus one-half of the book value of long-term debt.

3.2.2 Relative performance, gains and losses

The main independent variable is prior gain/loss of CEOs. As in prospect theory, I assume that a CEO sets a reference point and then considers lesser outcomes to be losses and greater ones to be gains. In doing so, I define a reference point which is the median performance of industry firms. I choose this

reference point because a CEO is likely to compare herself to other CEOs in the same industry. Applying this reference point, the CEO is considered to have made a gain (loss) if the CEO's performance is better (worse) than the median of industry firms' performance. Throughout the paper, I regard a CEO's performance relative to the median of industry firms' performance as relative performance.

However, some CEOs may constantly exceed the industry median performance. These CEOs' goals may be higher than achieving the median of the industry performance. Therefore, even if these CEOs do as well as median CEOs, they will consider themselves to have suffered a loss. To take a CEO's own expectations from her past performance into account, I employ the second reference point: the CEO's average relative performance since she has been the CEO of the firm up to year t-2, average relative $performance_{t-2}$. Applying this reference point, a CEO's gain or loss in year t-1 is determined relative to average relative $performance_{t-2}$. Specifically, if a CEO's relative performance in year t-1 is better (poorer) than average relative $performance_{t-2}$, then she is considered to have made a gain (loss) in year t-1. To examine how risk taking in year t is influenced by the gain or loss of year t-1, I subtract average relative $performance_{t-2}$ from the relative $performance_{t-1}$, which I call abnormal relative $performance_{t-1}$ of a CEO. Positive (negative) abnormal relative $performance_{t-1}$ indicates that the CEO has made a gain (loss) in year t-1. To test how a CEO's prior performance affects her risk taking, I define cumulative abnormal relative $performance_{t-1}$ as a sum of the abnormal relative performance of a CEO since she has become a CEO in the firm until year t-1. If it increases (decreases) in year t-1 compared to year t-2, then the CEO is regarded as having made a gain (loss) in year t-1. This variable allows me to examine how a CEO's risk taking in year t is affected by her gain/loss up to year t-1.

3.3 Data and summary statistics

3.3.1 Data

I analyze a sample of 3,109 CEOs of large publicly traded U.S. firms from the years 1992 to 2007. I first start with the Execucomp database, which provides yearly data on salaries, bonuses, stock options

and restricted stock grants, and managerial stock and option holdings for the top executives of firms in the S&P 500, S&P Midcap 400, and S&P Smallcap 600, or that once belonged to these indices. To be included in the sample, the CEO must be in the Execucomp database for at least three consecutive years. In addition, data on firm characteristics and stock returns should be available from Compustat and CRSP. Consistent with previous literature, I exclude firms in the financial service industries where liquidity is difficult to assess (SIC codes 6000-6999), and in the utility sector because of their special regulatory environment (SIC codes 4900-4999). Firm-specific accounting variables are obtained from Compustat and stock returns are obtained from CRSP to calculate unlevered equity volatility. I exclude firm years with missing observations for any of the dependent, independent, or control variables. Choi's asset volatility is kindly provided by Jaewon Choi.

3.3.2 Summary statistics

Summary statistics are presented in table 22. The sample includes 3109 CEOs and 1992 firms. On average, a firm has 1.56 CEOs during the sample period, and each CEO stays in the firm as CEO for an average of 5.36 years. The proportion of equity-based compensation is defined as equity compensation (RSTKGRNT) plus stock options compensation (BLK VALUE) divided by total compensation. Book leverage is defined as long-term debt plus debt in current liabilities divided by total assets (DLTT+DLC)/AT). Tobin's Q is defined as the ratio of total assets plus market capitalization minus common equity minus deferred taxes divided by total assets ((AT+PRCC_F*CSHO-CEQ-TXDB)/AT) and investment is defined as capital expenditure divided by total assets (CAPX/AT). In the regressions, size is defined as the log of total assets (AT). I winsorize variables at the top and bottom 0.5 percentiles.

3.4 Empirical results

3.4.1 Within CEO test

In this Section, I examine the relationship between a CEO's prior gain (loss) and her risk taking by controlling for CEO fixed effects. In the first set of tests, I run regressions of unlevered equity volatility on the prior performance variables. The independent variable is relative performance$_{t-1}$ in the

first column, average relative performance$_{t-1}$ in the second column, and abnormal performance$_{t-1}$ in the third column. In these regressions, a negative (positive) coefficient on cumulative relative performance implies that a CEO takes less (more) risky projects in year t if her performance was better than the median of industry firms' performance in year t-1.

The results are presented in table 23. CEO fixed effects and year fixed effects are controlled in all regressions. In addition, leverage, cash flows, size of the firm, Tobin's Q, and investments of the previous year are included as control variables. The dependent variable is unlevered equity volatility. In all cases, the coefficient on performance variable is significantly positive. These results suggest that CEOs, on average, increase risk taking following good performance.

An alternative explanation against CEOs' bias is that CEOs' compensation structure causes such behavior. Because many CEOs, especially ones with good performance, have stock options in their compensation package, and the value of these stock options increase with volatility of firms (Coles, Daniel, and Naveen(2006), Agrawal and Mandelker(1987), Low (2009)), CEOs with stock options may take risky projects. To test this possibility, I repeat the test using a sample of CEOs that do not have stock options in their compensation package. The empirical results are presented in the last column of table 23. The result suggests that even CEOs without stock options compensation follow take more risk after making gains.

3.4.2 Cross-sectional test

I examine what types of CEOs exhibit stronger results. First, I separate each CEO to first half and second half. For example, if he stayed in a firm for 10 years, I separate into first 5 years and second 5 years. And the dummy Early is one for first 5 years and zero for the last 5 years. The result is presented in the first column of table 24. I find that CEOs in earlier stages respond more sensitively to prior performance.

Next, I separate CEOs based on the age they started at the firm as a CEO. Young is one for CEOs that started before the age of 50. The result is presented in the last column of table 24. I find that CEOs that became CEO before the age of 50 respond more sensitively to prior performance.

3.5 Conclusion

In this paper, I examine how a CEO's prior performance affects her managerial decision making. Specifically, I test whether and how a CEO's risk taking is influenced by her prior gain/loss relative to potential reference points. Using a sample of CEOs in the Execucomp dataset, I find that CEOs, on average, choose more risky projects after making gains.

Understanding the types of biases a CEO suffers is not only of interest for corporate finance researchers but also important for owners of firms. My findings provide new evidence that CEOs are also subject to behavioral biases that individual investors suffer. More broadly, my study suggests that there could be other potential cognitive biases that CEOs and other executives may exhibit. As such, this study is intended to motivate future research to identify executives' irrational behaviors and determine potential correction mechanisms.

3.6 Figures and Tables

Table 22

Summary statistics

The sample includes 3109 CEOs of large publicly traded U.S. firms from the years 1992 to 2007. In order to be included in the sample, the CEO should be in Execucomp database for at least three consecutive years. In addition, data on firm characteristics and stock return should be available from Compustat and CRSP. I exclude firms in the financial service industries where liquidity is hard to assess (SIC codes 6000-6999), and in the utility sector due to their special regulatory environment (SIC codes 4900-4999). The proportion of equity-based compensation is defined as equity compensation(RSTKGRNT) plus stock options compensation(BLK VALUE) divided by total compensation. Book leverage is defined as long term debt plus debt in current liabilities divided by asset(DLTT+DLC)/AT). Tobin's Q is defined as the ratio of total assets plus market capitalization minus common equity minus deferred taxes((AT+PRCC_F*CSHO-CEQ-TXDB)/AT) and investment is defined as capital expenditure divided by total asset (CAPX/AT). unlevered equity volatility is an estimated equity volatility from historical stock returns of a firm multiplied by the ratio of market value of equity to the sum of market value of equity and book value of debt assuming non-volatility of debt value. Choi's asset volatility is calculated by mapping out significant portions of the firm's capital structure, using a dataset that includes prices and other information on equities, publicly traded debt and syndicated loans.

		Mean	Std dev	Median
CEO	number of sample CEOs		3446	
	number of years as a CEO	5.36	3.24	5.00
	Proportion of equity-based compensation	0.37	2.41	0.29
Firm	number of sample firms		1992	
	number of CEOs in a firm	1.56	0.76	1.00
	book leverage	0.24	0.19	0.23
	asset	5533	17406	1214
	Tobin's Q	1.98	1.43	1.52
	investment	0.06	0.06	0.05
	Net income/asset	0.03	0.17	0.05
	EBITDA/asset	0.14	0.13	0.14
	unlevered equity volatility	0.10	0.07	0.09
	Choi's asset volatility	0.08	0.06	0.06

Table 23

Effect of a CEO's prior performance on risk taking

The sample includes 3109 CEOs of large publicly traded U.S. firms from the years 1992 to 2007. In order to be included in the sample, the CEO should be in Execucomp database for at least three consecutive years. In addition, data on firm characteristics and stock return should be available from Compustat and CRSP. I exclude firms in the financial service industries where liquidity is hard to assess (SIC codes 6000-6999), and in the utility sector due to their special regulatory environment (SIC codes 4900-4999). Dependent variable, unlevered equity volatility, is an estimated equity volatility from historical stock returns of a firm, multiplied by the ratio of market value of equity to the sum of market value of equity and book value of debt assuming non-volatility of debt value. The independent variable is relative performance$_{t-1}$ in the first column, average relative performance$_{t-1}$ in the second column, and abnormal performance$_{t-1}$ in the last column. Leverage is defined as long term debt plus debt in current liabilities divided by asset(DLTT+DLC)/AT). Size is defined as the log of total assets(AT). Tobin's Q is defined as the ratio of total assets plus market capitalization minus common equity minus deferred taxes((AT+PRCC_F*CSHO-CEQ-TXDB)/AT) and investment is defined as capital expenditure divided by total asset (CAPX/AT). CEO fixed effects and year fixed effects are controlled in all specifications. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, and t-statistics are in parentheses.

	Annual performance	Average performance	Abnormal performance	CEOs with no option
Performancet-1	0.004***	0.009***	0.003***	0.007***
	(5.08)	(4.84)	(4.97)	(3.17)
invest	0.034***	0.032***	0.036***	0.064**
	(3.06)	(2.87)	(3.24)	(2.05)
CF	-0.077***	-0.073***	-0.076***	-0.032***
	(-16.61)	(-15.89)	(-16.54)	(-3.10)
Leverage	-0.029***	-0.028***	-0.029***	0.049***
	(-7.81)	(-7.52)	(-7.95)	(5.69)
Q	0.003***	0.003***	0.003***	0.002
	(7.22)	(7.52)	(7.23)	(1.20)
Size	-0.001	-0.001	-0.001	-0.017***
	(-0.65)	(-0.60)	(-0.43)	(-3.95)
tenure	-0.0004	-0.0004	-0.0004	0.006*
	(-0.69)	(-0.68)	(-0.69)	(1.85)
CEO fixed effects	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes
observations	15532	15620	15524	3139
R-square	0.7223	0.7224	0.8111	0.8112

Table 24

Cross-sectional tests

First half effect		Young CEO effect	
Performance*Early	0.005***	Performance*Young	0.004**
	(3.16)		(2.33)
Performance	0.002*	Performance	0.002**
	(1.77)		(2.32)
Early	0.002**	Young	.
	(2.57)		.
invest	0.033***	invest	0.034***
	(2.96)		(3.11)
CF	-0.076***	CF	-0.076***
	(-16.46)		(-16.55)
Leverage	-0.030***	Leverage	-0.029***
	(-7.98)		(-7.86)
Q	0.003***	Q	0.003
	(7.11)		(7.10)
Size	-0.00034	Size	-0.00079
	(-0.29)		(-0.68)
tenure	-0.0003	tenure	-0.00038
	(-0.56)		(-0.69)
CEO fixed effect	Yes	CEO fixed effect	Yes
Obs	15532	Obs	15532
R squared	0.7547	R squared	0.7545

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