Essays in Empirical Corporate Finance:

The Impact of Economic Uncertainty on the Financial Markets

by

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Abstract

This thesis consists of three essays studying the impacts of economic uncertainty on the financial markets. The first essay examines the impact of economic uncertainty on firms' decisions to go private. Using an instrumental variable approach, I show that firms are more likely to go private following economic uncertainty shocks. The effect is stronger for firms prone to severe agency conflicts. After going private, the cost of debt decreases. These results are consistent with uncertainty exacerbating agency frictions faced by public companies. Firms go private to alter their capital structures to be less prone to agency frictions: ones with a small number of dominant stakeholders with aligned interests. The agency frictions are mitigated through going private, resulting in a decrease in the cost of debt.

The second essay examines how the money creation function of banks affects the relative cost of firm financing in the bank loan vs. bond market – the loan-bond spread. Using a sample of loans and bonds issued by the same firm, the essay finds a lower loan-bond spread for firms impacted by positive information cost shocks. We call this decline in the relative cost of bank credit induced by firm information cost shock the opacity discount and show that it is consistent with the "money creation" hypothesis in the financial intermediation theory, which suggests that banks need to keep information about their assets secret to produce private money.

The third essay studies how firms use earnout, a contingent payment contract in M&A, to manage valuation risks under uncertainty. I find that the usage of earnouts positively correlates with target uncertainty. The likelihood of deal completion increases significantly with earnouts. Despite the benefits of bridging the valuation gap, an earnout can introduce incentive misalignment problems in the post-transaction period. After the transaction, the acquirer's objective is to maximize firm value, while the target's objective is to maximize earnout payments. Such incentive misalignments can destroy firm value. The essay documents a negative impact on acquirer wealth gains when earnouts are not used to manage valuation risks.

Lay Summary

This thesis contains three essays in empirical corporate finance, with a focus on the impacts of economic uncertainty on the financial markets. The first essay investigates how economic uncertainty affects companies in the equity market. It documents that companies use private equity to opt out of public markets to enhance corporate governance and lower their cost of capital. The second essay studies the impact of uncertainty on firms' relative cost of debt through the money creation function of banks. The essay shows that firms experiencing positive uncertainty shocks receive relatively lower cost of debt from banks than from the bond market. The third essay focuses on the impact of economic uncertainty in the M&A market. The essay finds that firms adopt contingent payment contracts to manage valuation risks during high uncertain periods. The contingent payment contracts help facilitate deal completion while introducing new moral hazard problems in the post-transaction periods.

Preface

Chapters 2 and 4 of this thesis are solely my own work. Chapter 3 is a co-authored project with Professor Jan Bena and Professor Isha Agarwal. We contributed equally to this project.

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Dedication

I would like to dedicate this thesis to my family. I thank my parents, Xue and Mingyang, for their unconditional love and support. Thanks to my husband, Changbo, for always standing by me, believing in me, cheering me up, and going through the ups and downs together with me.

In memory of my grandmother, Guoqing Shi, who has always saved the best for me. I hope you are proud of me.

Chapter 1

Introduction

Economic uncertainty plays a vital role in economic outcomes, especially during economic downturns. This thesis is a collection of three essays studying the impact of economic uncertainty on the financial markets. In particular, it empirically investigates how economic uncertainty affects companies in the equity market, the debt market, and in mergers and acquisitions. In the first essay, I study how economic uncertainty affects companies' choice of public vs. private equity. I show that uncertainty exacerbates the agency frictions faced by public companies. As a response, firms go private to mitigate these agency frictions. They use private equity to opt out of public markets to enhance corporate governance and lower their cost of capital. The second essay focuses on the impact of economic uncertainty on firms' relative cost of debt. We show that firms experiencing positive uncertainty shocks receive relatively lower cost of debt from banks than from the bond market. The results are consistent with the financial intermediation theory: banks offer opacity discounts to firms with high information production costs because lending to such companies reduces banks' cost of private money creation. The third essay focuses on the impact of economic uncertainty in the M&A market. I find that firms adopt contingent payment contracts to manage valuation risks during high uncertain periods. The contingent payment contracts help facilitate deal completion while introducing new moral hazard problems in the post-transaction periods.

In the first essay, "Economic Uncertainty and Going Private Transactions: The Corporate Governance Channel", I investigate how firms change their capital structures to ones that are less prone to agency frictions to alleviate the negative impacts of uncertainty. I show that firms are more likely to go private following economic uncertainty shocks. This effect is stronger for

firms prone to severe agency conflicts: firms with dual-class structure, less institutional ownership, lower asset redeployability, lower loan-to-bond ratio, and for firms in financial distress. After going private, the cost of debt decreases. The results are consistent with the corporate governance hypothesis, where uncertainty exacerbates the agency frictions faced by public companies and increases the agency cost of capital. To alleviate the negative impacts of uncertainty, firms go private to alter their capital structures from dispersed to ones with a very small number of dominant stakeholders with aligned interests. The agency frictions are mitigated through going private, resulting a decrease in the cost of debt.

The second essay, "Relative Pricing of Private and Public Debt: The Role of Money Creation Channel", examines how the money creation function of banks affects the relative cost of firm financing in the bank loan v.s. public bond market. Using economic uncertainty and other measures as proxies for the cost of information production, we show that firms impacted by positive information cost shocks have lower cost of bank loans relative to the cost of corporate bonds. We call this decline in the relative cost of bank credit induced by firm information cost shock the opacity discount. We argue that it is consistent with the "money creation" hypothesis in the theory of financial intermediation: To produce private money, banks need to keep information about their assets secret. Therefore, they offer discounts when lending to opaque firms.

In the third essay, "Earnouts: Managing Valuation Risks in Mergers and Acquisitions Under Uncertainty", I study how firms respond to increased valuation risks following uncertainty shocks in mergers and acquisitions. I find that firms are more likely to use earnouts, a contingent payment contract, when target uncertainty is high. The usage of earnouts increases deal completion rates significantly. Despite the benefits of bridging the valuation gap between buyers and sellers, acquirers announcement returns are insignificantly different from those of the deals without earnout. This suggests that there can be costs associated with the earnout contracts. The contingent payment mechanism can introduce agency conflicts in the post-acquisition period. After the transaction, acquires' objective is to maximize firm value, while

targets' goal is to maximize earnout payments. Such incentive misalignment can destroy firm value. I find that acquirers experience negative cumulative abnormal returns when earnouts are not used to manage the valuation risks.

Since the three essays comprising this thesis are in separate topics, chapters are designed to be self-contained. Each chapter discusses the relevant literature and contains its own introduction and conclusion. A general conclusion of the three chapters is provided at the end of this thesis.

Chapter 2

Economic Uncertainty and Going Private Transactions: The Corporate Governance Channel

2.1 Introduction

Economic uncertainty plays a vital role in economic outcomes, especially during downturns. Uncertainty shocks reduce economic growth, hamper stock market performance, and make firms reduce investment and employment leading to lower sales growth and profitability.[1] The negative impact of economic uncertainty is amplified by the real and financial frictions faced by firms: Alfaro et al. (2021) show that, in the presence of these frictions, uncertainty shocks lead to larger recessions with slower recovery. While prior work documents the negative impact of uncertainty shocks on firms, our understanding of how firms respond to such shocks in order to lessen their impacts is minimal.[2]

In this chapter, I investigate how firms change their capital structures to ones that are less prone to agency frictions to alleviate the negative impacts of uncertainty shocks. Specifically, I study whether going private transactions—events in which firms' capital structures are altered from dispersed to ones with a very small number of dominant stakeholders with aligned interests—is a possible mechanism by which firms respond to uncertainty shocks. The level

[1] Bloom (2009); Mian and Sufi (2010); Pastor and Veronesi (2012); Kahle and Stulz (2013); Alfaro et al. (2021).

[2] Im et al. (2017) and Alfaro et al. (2021) find that firms adopt more conservative corporate policies such as more cash holdings and less dividend payouts.

of economic uncertainty has risen significantly in the wake of the COVID-19 pandemic.[3] In this period, we saw a resurgence of the going private transactions. These transactions receive record-high premiums in the years of 2020-21. The media describe the relationship between uncertainty and going private as follows: "Going-private transactions are cyclical in nature and tend to increase in number during economic downturns, where a variety of factors can cause the share price of a listed company to trade at a discount to its net asset value per share. 2020 is a case in point, as global stock markets saw increased volatility due to the Covid-19 pandemic and macroeconomic uncertainty."[4]

Agency frictions constitute a theoretically important cost for public companies. The separation of ownership and control creates conflicts between managers and shareholders, and between creditors and shareholders (Jensen and Meckling 1976). Conflicts of interest also exist between controlling and minority shareholders. These agency problems can generate financial frictions and increase the cost of external capital. Existing literature documents that investors and lenders require higher rate of returns to compensate for the agency costs (La Porta et al. 2002; Aslan and Kumar 2012).

Uncertainty can exacerbate firms' agency problems through a variety of channels.[5] First, it can aggravate information asymmetry, increasing the costs of signaling and monitoring. Previous studies show that firms increase voluntary disclosure to reduce information asymmetry in response to uncertainty shocks (Balakrishnan et al. 2014; Guay et al. 2016).

Second, moral hazard problems between shareholders and creditors and between managers and shareholders are more severe with high uncertainty. Cash flows become more volatile, creating risk-shifting incentives for shareholders to exploit creditors. Managers may also expropriate more from shareholders when outcomes are uncertain. In addition, firms tend to have more cash holdings following uncertainty (Im et al. 2017), which can be easily turned into pri-

[3] https://voxeu.org/article/economic-uncertainty-wake-covid-19-pandemic

[4] Finanical Times, Oct 2021.

[5] While most agency problems are exacerbated with uncertainty, the underinvestment problem is mitigated following uncertainty shocks. Uncertainty increases the outcome dispersion of investment opportunities, which increases the potential returns to shareholders and reduces their incentives to forego valuable projects.

vate benefits by management. The equity-based incentive mechanism may also become less effective since firm performance is highly volatile despite management efforts.

Third, uncertainty magnifies the coordination frictions among managers, shareholders, and creditors. Garlappi et al. (2017, 2021) find that heterogeneous priors can lead to inefficiencies when decisions are made collectively by a group of agents. The coordination frictions are more severe following uncertainty shocks because agents' beliefs about future outcomes may become more dispersed. Moreover, these coordination frictions make firms less responsive to uncertainty shocks. While uncertainty triggers the need for companies to restructure their assets, disagreements among agencies make the negotiation process difficult. The frictions need to be resolved before firms can implement the changes. Garlappi et al. (2017) show that the inefficiencies due to coordination frictions may be resolved when agents can trade among themselves or collectively trade with outside investors.

Due to these agency frictions, firms experience higher costs of capital during periods of high uncertainty (Pástor and Veronesi 2013; Gilchrist et al. 2014; Ashraf and Shen 2019; Kaviani et al. 2020). Alfaro et al. (2021) show that the financial frictions amplify, prolong, and propagate the negative impact of uncertainty shocks. They argue that even small financial adjustment costs could generate significant impacts. The elevated agency costs following uncertainty shocks create an incentive for firms to address the agency problems. In this chapter, I postulate that one possible way to mitigate the agency frictions is to restructure the capital via going private. In going private transactions, firms alter their capital structure from dispersed to ones with a very small number of dominant stakeholders with aligned interests. Based on these arguments, I hypothesize that firms are more likely to go private following uncertainty shocks. The effects are expected to be stronger for firms that are prone to severe agency problems.

To study the impacts of economic uncertainty on going private, I collect a sample of firms that went private from 1994 to 2017 and compare them with those that remain public. Following DeAngelo et al. (1984), Leuz et al. (2008) and Bharath and Dittmar (2010), I identify the going private sample as those that filed Schedule 13E-3 and delisted from the stock exchange within

two years. A publicly-traded company must file Schedule 13E-3 if the company or an affiliate voluntarily engages in a transaction resulting in the delisting of the company's shares. Figure 2.1 illustrates the number of going private transactions across industries from 1994 to 2017. The period 1994-2006 saw a boom in the going private transactions due to the development of the private equity market and the increase in compliance costs for public companies after the Sarbanes-Oxley (SOX) Act. The number of going private transactions decreased dramatically after the financial crisis because of the contractionary debt market. Going private transactions experienced a resurgence in recent years attributed to the high level of uncertainty.

By reading through the Schedule 13E-3 filings of the going private firms, I find significant changes in firms' capital structures through the going private process. Figure 2.2 illustrates the changes. Panel A and B compare the capital structures of a representative company, American Greetings Corp., before and after it went private. Before going private, the company had dual class shares with a large number of institutional and dispersed shareholders. After going private, the company was owned entirely by management and a private equity investor. The debt structure also became less complex after going private. Existing loans were paid off with new loan facilities arranged by one syndicate with previous lending relationships with the PE investor. Panel C of Figure 2.2 illustrates the capital structure of the average company after going private, demonstrating a similar pattern as in Panel B. Firms alter their capital structures through the going private process. The capital structure before going private is prone to severe agency frictions. After going private, agency problems are mitigated since the management, the PE investor, and the creditors share aligned interests.

I measure firm uncertainty using changes in realized stock return volatility. Using a Cox proportional hazards model, I find that firms are more likely to go private with high uncertainty. An one standard deviation increase in the change of annualized stock return volatility leads to a 14% increase in the hazard rate of going private. One concern with using changes in stock return volatility as a proxy for uncertainty is that firm characteristics can simultaneously affect stock return volatility and the going private decisions. For example, stock liquidity

affects stock return volatility, and firms may choose to delist due to the lack of liquidity. In addition, the decision to go private may affect stock return volatility reversely. To address the endogeneity concern, I employ an instrumental strategy following Alfaro et al. (2021). I construct the instruments exploiting firms' differential exposure to aggregate uncertainty shocks in energy, currency, policy, and U.S. Treasury notes. The instruments, by construction, capture the changes in firm-level stock return volatility which are induced by exogenous uncertainty shocks to macro variables. Using a control function approach with the instrumental variables, I find that firms experiencing high uncertainty which is induced by aggregate economic uncertainty shocks are more likely to go private. The results are robust when I control for macroeconomic conditions such as GDP growth, investor sentiment, indicators for NBER recessions, VIX, or the term premium. The results also hold when I conduct a propensity score matching based on the initial conditions at IPO and firm characteristics three years before going private.

I exploit heterogeneity in firm characteristics to investigate the economic mechanism driving the results. Consistent with the corporate governance hypothesis, I find the positive effects of uncertainty on going private to be stronger for firms subject to severe manager-shareholder conflicts. Masulis et al. (2009) show that the dual-class structure aggravates the agency problems between managers and shareholders. For such firms, incentives to resolve agency conflicts following uncertainty shocks are expected to be higher. I find that the impacts are more prominent for firms with dual class shares. The going private filings indicate that the dual-class structure is eliminated after going private in most cases. For firms which still have dual class shares after delisting, management and PE investors own the same proportions for both share classes. The impacts of economic uncertainty shocks on going private are also stronger for firms with less ownership by institutional blockholders. Literature on corporate governance (Agrawal and Mandelker 1990; Mehran 1995; Core et al. 1999) shows that blockholders provide effective monitoring for public firms. Therefore, the agency problems should be less of a concern for firms with more institutional blockholders.

The positive effects of uncertainty on going private are also more pronounced in companies

with more creditor-shareholder conflicts. Agency problems between creditors and shareholders may be more severe for firms in financial distress. Using Altman Z-Score as a measure for financial distress, I find the effects to be stronger for firms in financial distress. The effects also concentrate in firms with lower asset redeployability, that is, when the collateral value is lower for firms whose assets are more difficult to sell in the secondary market. For such firms, the conflicts are more severe because creditors experience lower recovery rates in bankruptcy. The effects of uncertainty on going private are also stronger for firms with a higher ratio of corporate bonds to bank loans. One advantage of bank loans to corporate bonds is the flexibility of renegotiation (Chemmanur and Fulghieri 1994). Firms' incentives to resolve the agency conflicts of debt are higher if they experience difficulties renegotiating with current debtholders.

I conduct a subsample analysis to further investigate the corporate governance hypothesis by classifying the going private transactions into management buyouts, private equity buyouts, and buyouts with no management or PE participation. Consistent with the corporate governance hypothesis, I find the effects stronger when management and/or private equity investors participate in the going private transactions. Management has a better understanding of the agency frictions faced by the companies, and stronger incentives to resolve the agency frictions following uncertainty shocks. In terms of buyouts by private equity investors, the effects of uncertainty on going private are more substantial because incentive alignment is one of the most important value drivers for PE deals.

If the conflicts between shareholders and creditors are mitigated through going private, the cost of debt is expected to decrease. I conduct a difference-in-differences analysis to examine the impact of going private on the cost of debt. Specifically, I compare the difference in bank loan spreads of the going private firm in the pre- and post-delisting period with that of a group of matched firms that remain public. I find that the costs of debt are significantly lower for going private firms after they delist. Figure 2.3 shows that going private firms pay significantly higher loan spreads relative to the control group before going private, but the loan spreads become comparable after delisting. By realigning the control rights and cash flow rights through going

private, the agency problems are mitigated. As a result, the cost of debt decreases.

Collectively, the evidence suggests that firms go private to resolve the heightened agency frictions following uncertainty shocks. Companies are more likely to go private in the presence of high uncertainty, and the positive effects are more prominent for firms prone to severe agency problems, both between managers and shareholders and between creditors and shareholders. Uncertainty can exacerbate financial frictions and increase the cost of external capital. Going private helps alleviate the problems by aligning incentives of the management, new shareholders, and new creditors. As a result, firm receives lower cost of capital after going private.

I investigate several alternative explanations for the results. One possible explanation is the market timing hypothesis, where managers and private equity investors take firms private when they are undervalued. Undervaluation may be more likely following uncertainty shocks, since it becomes more difficult for investors to evaluate firm fundamentals. Using firm Tobin's Q relative to the industry average as a proxy for undervaluation, I show that impacts of uncertainty on going private are indifferent between undervalued and fairly valued firms.

Another alternative explanation is the market distraction hypothesis. Changes in stock prices in the public market distract controlling shareholders and employees. Managers may decide to take the firm private to enjoy a quiet life. Following Easton and Zmijewski (1989), I construct the earnings response coefficient (ERC) to measure sensitivity of stock returns to earning announcements. Based on the market distraction hypothesis, managers of the companies whose stock returns are more sensitive to earning news should be more likely to take the firm private in uncertain times. However, I find the effects do not vary with ERC.

The positive impacts of economic uncertainty on going private may also be driven by the heightened cost of information production in uncertain times. Subrahmanyam and Titman (1999) discuss the costs of duplication of information production for public companies. It is more costly for investors to produce information during periods of high uncertainty. Using analyst coverage as a proxy for the cost of information production, I show that the results do not

vary across firms with different information production costs. In summary, the results suggest that the positive impacts of economic uncertainty on going private are not driven by undervaluation, market distraction, or higher information production costs following uncertainty.

The chapter is related to two veins of literature. First, it relates to the growing literature on economic uncertainty. A large number of studies document the negative impacts of uncertainty on corporations. They show that uncertainty negatively impacts firm performance and growth (Gulen and Ion 2015; Alfaro et al. 2021). Firms reduce investment and employment (Bernanke 1983; Leahy and Whited 1996; Guiso and Parigi 1999; Bloom 2009; Fernández-Villaverde et al. 2011; Bachmann and Bayer 2013; Stein and Stone 2013; Fernández-Villaverde et al. 2015; Alfaro et al. 2021), and adopt conservative corporate policies (Chen et al. 2014; Chen 2016; Im et al. 2017; Alfaro et al. 2021) following uncertainty shocks. As for financial consequences, studies show that higher uncertainty leads to higher cost of bank loans (Ashraf and Shen 2019), corporate bond spreads (Kaviani et al. 2020) and the cost of equity (Pástor and Veronesi 2013). Alfaro et al. (2021) show that financial frictions amplify the impacts of uncertainty in the real economy. This chapter contributes to this literature by reporting novel evidence of how economic uncertainty can directly exacerbate financial frictions. To the best of my knowledge, this is the first chapter providing empirical evidence on the impacts of economic uncertainty on corporate governance. In addition, this chapter documents new findings that firms alter their capital structures via going private to moderate the high agency frictions following uncertainty.

Second, the chapter relates to the large body of literature investigating the choice between public and private ownership structure (Shah and Thakor, 1988; Zingales, 1995, Chemmanur and Fulghieri, 1999; Boot et al., 2006). Studies show that firms choose the public status when the benefits outweigh the costs. The benefits as a public company include liquidity, easy access to capital (Brav, 2009), risk sharing (Chemmanur and Fulghieri, 1999), etc. The costs of listing include the agency costs due to dispersed ownership and the separation of ownership and control (Jensen and Meckling, 1976), loss of control in decision making (Boot et al., 2006), and the compliance and disclosure costs (Engel et al., 2007). Within this literature, the chapter is closely

related to the studies on going private decisions. Jensen (1986) argue that delisting can be used to reduce agency problems between managers and shareholders. Maupin et al. (1984), Lehn and Poulsen (1989) and Opler and Titman (1993) supports this argument by showing that firms with more free cash flows are more likely to go private. Bolton and Von Thadden (1998) and Bharath and Dittmar (2010) show that firms use private equity to opt out public markets for information and liquidity considerations. Mehran and Peristiani (2009) finds that firms go private when they lack financial visibility and fail to attract investor attention. Engel et al. (2007) argue that firms go private to avoid compliance costs. Firm characteristics that affect the going private decision include size, market to book ratio, growth prospects, performance, and leverage. (Kim and Lyn, 1991; Kieschnick, 1998; Caprio et al., 2011; Martinez and Serve, 2011; Thomsen and Vinten, 2014;). The chapter contributes to the literature by identifying economic uncertainty as a missing factor that can help explain going private transactions. In addition, the chapter finds that going private can not only resolve agency problems between managers and shareholders, but also the conflicts between shareholders and creditors.

The chapter is organized as follows. Section 2.2 presents the sample and data. Section 2.3 describes the empirical methodology. Section 2.4 summarizes the main results. Section 2.5 discusses the alternative explanations and the robustness tests. Section 2.6 concludes.

2.2 Data

This section describes the data used to study the impacts of economic uncertainty on going private transactions. I first describe the sample construction process. I then discuss summary statistics of the going private sample and the deal structure of the going private transactions.

2.2.1 Going Private Sample

I follow SEC's legal definition of going private to construct the going private sample. According to Rule 13E-3 of the Securities Exchange Act of 1934, a public company must file Schedule 13E-3

if the company or an affiliate is engaged in the transactions which will cause a class of equity securities to become eligible for deregistration or delisting. I follow the SEC rule because there is no ambiguity with this definition. In practice, going private transactions can be quite heterogeneous. A broad range of transactions can fall into this definition, including management buyouts (MBO), non-leveraged or leveraged buyouts (LBO) by private equity firms, or strategic buyouts by private operating companies. Schedule 13E-3 filings have also been used to identify going private transactions by other studies (DeAngelo et al., 1984; Engel et al., 2007; Leuz et al., 2008; Mehran and Peristiani, 2009; Bharath and Dittmar, 2010)

To construct the going private sample, I retrieve all Schedule 13E-3 filings from 1994 to 2017. To ensure the transactions are completed, I cross-check with SEC Form 15 and Form 25 filings, which are filed when the securities are officially delisted. In addition, I check CRSP to ensure companies are no longer publicly traded within two years after they filed Schedule 13E-3. I also screen the sample firms to ensure they are not traded on the pink sheets or over-the-counter. By doing so, I exclude the firms that "go dark", which refers to the action to deregister from SEC, but continue to trade on the pink sheets or over-the-counter. According to Leuz et al. (2008), going dark and going private are very different corporate events with different economic consequences. Firms usually go dark due to poor prospects and high compliance costs. Controlling insiders may also deregister the firm to extract private benefits and escape from public scrutiny. Therefore, going dark is usually associated with negative cumulative abnormal returns. Going private, on the other hand, is mostly associated with positive cumulative abnormal returns. In this chapter, I exclude the going dark firms and focus purely on the going private transactions.

1,453 firms filed Schedule 13E-3 from 1994 to 2017. Among these deals, 188 deals were withdrawn (voluntarily or rejected by shareholders). 1,265 firms delisted within two years after the initial filing. Companies from financial and utilities industries are excluded from the sample, decreasing the sample size to 935 companies. To calculate firm-level uncertainty shock, firms need to have two consecutive years of stock return data available before delisting. The sample size drops to 525 firms due to data availability. The control sample in the main analysis is the

firms that remain public until the end of 2017. I also conduct a matching analysis to account for the selection bias of the going private sample. Details of the matching process are discussed in Section 2.3.4. The final sample consists of 525 going private firms and 2,659 control firms, with 48,060 firm-year observations.

Table A.2.1 Panel A illustrates the industries in which the going private firms operate, based on Fama-French twelve industry classifications.[6] Industries that experience most going private transactions are business equipment, which includes computers, software and electronic equipment, and shops including wholesale, retail, and some services. Table A.2.1 Panel B describes the sample composition by year. The year of going private is identified by the year firms file for going private, rather than the year they delist. Most firms delist at the same year or within one year after they file Schedule 13E-3. Figure 2.1 illustrates the time series trend of the going private transactions across industries[7] from 1994 to 2017. The period 1994-2006 saw a boom in the going private transactions due to the development of the private equity market. The Sarbanes-Oxley Act of 2002, which increases the compliance costs of public companies, also contributes to this trend. The number of going private transactions decreased after the financial crisis in 2007-2009, since the debt markets have become more cautious in participating in leveraged buyout deals. The number of going private transactions has increased again in recent years due to the heightened level of uncertainty. The going private trend also varies across industries. While the manufacturing and hi-tech companies experienced steady growth in the going private transactions from 1994 to 2006, the number of going private transactions fluctuated in the consumer, healthcare, and other industries over the years. Figure 2.4 demonstrates the cumulative abnormal return (CAR) of the going private companies at the announcement date. On average, the going private companies receive a 25% cumulative abnormal return over the announcement period.

Deal-specific information on the going private transactions is retrieved from Schedule 13E-3 filings. Accounting variables are from Compustat and variables in the stock market are from

[6] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_12_ind_port.html

[7] The industries are classified based on Fama-French five industry classifications.

CRSP. IPO dates are from SDC New Issues database. The going private deal announcement dates and deal classifications are from SDC M&A database. Data on currency exchange rates, crude oil prices and Treasury returns are from Bloomberg. Measurement of economic political uncertainty is from Baker et al. (2016). Asset redepoyability measures are from Kim and Kung (2017). Information on institutional ownership is from SEC 13F holdings. Information on the firm's debt structure is from Capital IQ. All variables are winsorized at the 1% and 99% levels. Detailed definitions of the variables are discussed in Appendix A.1.

2.2.2 Descriptive Statistics

Table 2.1 Panel A compares firm characteristics of the going private sample and a control sample of surviving firms over their entire public life cycle. The control sample constitutes firms that remain public until the end of 2017. There are 525 going private firms and 2,659 surviving firms. The going private sample experiences lower but more volatile stock returns. Firms that go private are significantly smaller in size and have lower Tobin's Q. However, performance measured by return on assets is similar between the two groups. The going private sample has higher leverage, possesses fewer intangible assets, and demonstrates a higher tax to assets ratio on average.

To better understand the going private transactions, I read the Schedule 13E-3 filings of the going private transactions in detail. The going private company is required to discuss the purposes of the transaction, any alternatives that the company considered, and whether the transaction is fair to unaffiliated shareholders in the Schedule 13E-3 filings. Most companies also disclose the source of deal financing, the ownership structure before and after the transaction in the Schedule 13E-3 filings.

Since the study focuses on the capital restructuring process, I focus on the Schedule 13E-3 filings of a subset of going private firms with outstanding bank loans before the going private transaction. Within the 252 firms with non-missing control variables in the main analysis, 120 firms had bank loans outstanding before they went private. I go through their Schedule 13E-

3 (13E-3, DEF13E-3, PRE13E-3) filings and obtain detailed descriptions of 84 transactions. I also go through the Schedule TO filings, which are filed if the going private transactions are completed through tender offers. Panel B of Table 2.1 reports summary statistics of these transactions. The deal value is $544.6 million on average. Bidders pay an average takeover premium of 34.5% to the pre-deal share price. Deals are usually financed by a combination of bank loans, cash on the company's balance sheet, and equity contributions by a PE firm and the management. On average, 61% of the deal is financed by debt. 84% of that debt comes from bank loans, usually a term loan facility and a revolving credit facility. The bank loans are usually arranged by a syndicate of banks with lending relationships with the PE investors. Sometimes, the going private company also issues corporate bonds to finance the deal, accounting for the remaining 16% of the debt. The remaining 39% of the deal is financed by cash on the company's balance sheet (16%), and equity contributed by a PE firm (63%) and the management (21%). After delisting, the PE firm owns 64% of the company on average. Management owns 35% of the company, with the remaining 1% owned by other existing shareholders before going private.

Figure 2.2 illustrates the changes in the companies' capital structures through the going private process. Panel A and B compare the capital structures of a representative company, American Greetings Corp., before and after it went private. The company was held by the management, several institutional investors, and many dispersed shareholders with dual-class shares before going private. After going private, the company was entirely held by the management and a private equity investor. The existing debts, which included four different loan facilities arranged by two syndicates, were paid off with newly issued debts. The new debts were arranged by a loan syndicate that had previous lending relationships with the private equity investor. Panel C of Figure 2.2 illustrates the capital structure of the average company after going private, which demonstrates a similar pattern as in Panel B.

2.3 Empirical Methodology

In this section, I describe the empirical methodology used to study the impacts of economic uncertainty on going private. First, I describe the Cox proportional hazards model. Second, I discuss how I measure economic uncertainty and the identification strategy. Then I describe the control function approach to instrument economic uncertainty in the Cox proportional hazards model. I also discuss the matching analysis to address the sample selection bias, and the difference-in-differences analysis to study the impact of going private on the loan rate in this section.

2.3.1 Cox Proportional Hazards Model

Following Mehran and Peristiani (2009) and Bharath and Dittmar (2010), I use a hazards model to study firms' decisions to go private. Hazards models are widely applied in survival analysis. Shumway (2001) shows that they are more appropriate to analyze survival data compared to static models. A hazards model is suitable to analyze going private decisions in the following two ways.

First, hazard models trace down firms' decisions over their entire life cycles. In hazard models, each firm is treated as one observation during its entire life span. The time-varying firm characteristics allow me to study both cross-sectional and time-series effects of uncertainty on going private. Second, hazards models can handle censored data, which is a crucial feature of the going private sample. The sample period ends in 2017. Firms are still at risk of going private after the sample period ends. Instead of treating these firms as surviving as done by static models, hazards models treat all firms as being dropped out of the sample at the end of the sample period.

I use a Cox proportional hazards model because it does not impose any restriction on the baseline hazard rate. The model to estimate is

$$h(t, X_{t-1}) = h(t,0) exp(\beta' X_{t-1} + \xi) \tag{2.1}$$

where $h(t)$ is the hazard rate for a firm with covariates X_{t-1} to go private at time t. $h(t,0)$ is the baseline hazard rate. The coefficient vector to be estimated is β. Cox proportional hazards model allows me to estimate β without estimating the baseline hazard rate $h(t,0)$. A positive β means that the hazard rate of going private is higher when x is higher. The hazard ratio $exp(\beta)$ indicates the increase in the hazard rate when there is one unit change in the independent variable.

2.3.2 Measuring Uncertainty

Following the uncertainty literature, I measure firm-level uncertainty using realized stock return volatility $\sigma_{i,t}$, which is the standard deviation of daily dividend cumulative stock returns within a fiscal year. Uncertainty shock is defined as the change in annualized stock return volatility $\Delta\sigma_{i,t} = (\sigma_{i,t} - \sigma_{i,t-1})/(\frac{1}{2}\sigma_{i,t} + \frac{1}{2}\sigma_{i,t-1})$ for firm i at a given year t.

Stock return volatility is an endogenous variable that can be related to various aspects of a firm. First of all, it may correlate with other omitted variables which drive firms' going private decisions. For example, stocks of firms with less analysts coverage can be very volatile. Meanwhile, firms with less analysts coverage may decide to go private due to their lack of financial visibility in the public market. Second, if investors anticipate the firm to go private soon, its stock prices can move dramatically within a short period. This generates an issue of reverse causality. Indeed, previous literature finds contradictory effects of stock return volatility on going private, indicating that stock return volatility contains various aspects of information, which affects the going private decisions in different directions. Therefore, to study the impacts of economic uncertainty on going private, it is crucial to identify the component in changes of stock return volatility due to exogenous uncertainty shocks.

Identification

I follow the identification strategy in Alfaro et al. (2021) to construct instruments for uncertainty shocks. To be more specific, I employ firms' differential exposure to aggregate macroeconomics

uncertainty shocks to capture shocks to firm-level uncertainty. The identification strategy is similar to Bartik (1991), which utilizes local industry share and overall industry growth of the country to measure local development. In this chapter, I use uncertainty shocks to oil prices, economic political uncertainty, US 10-year treasury notes and seven major currency exchange rates defined by the Federal Board[8]. In the following of the chapter, I refer to these ten macroeconomic factors as commodities. The intuition is as follows. Suppose there are two firms, one operates in an industry which is highly government-dependent, such as health care or defense, while the other is a local retailer. When political uncertainty rises, the first company will be affected significantly while the latter will be barely affected. Similarly, firms operating in energy industries will experience high uncertainty following an uncertainty shock to oil prices.

Construction of the instruments follows two steps. First, I estimate firms' exposure to aggregate macroeconomic conditions. Second, I calculate firm-level uncertainty shocks as the product of firm exposure and aggregate uncertainty shocks.

Exposure to Aggregate Uncertainty Shocks

Firm exposure to currencies, energy, treasury and policy is obtained by regressing risk adjusted stock returns on the changes in prices of the 10 commodities:

$$r_{i,t} = \alpha_{j,t} + \sum_{c} \beta_j^c \cdot r_t^c + \epsilon_{i,t} \tag{2.2}$$

$r_{i,t}$ is the daily risk-adjusted stock return of firm i, which is the residual, $\varepsilon_{i,t}$, of Equation (2.3). r_t^c is the daily change in prices of commodity c. Firm exposure to commodity c is the coefficient β_j^c, which measures the sensitivity of stock price to commodity c. β_j^c is estimated at SIC 3-digit level, on a rolling basis with daily stock returns in the past ten years[9].

The daily risk-adjusted return of firm i is the Carhart (1997) four factor risk adjusted return,

[8]The seven "major" currencies defined by the Federal Board includes the euro, Canadian dollar, Japanese yen, British pound, Swiss franc, Swedish krona and the Australian dollar

[9]β_j^c is estimated at SIC 3-digit level to reduce idiosyncratic noise in firm-level stock returns, which increases estimation precision.

which is the residual of the following equation:

$$r_{i,t}^{excess} = \alpha_i + \beta_{i,MKT} \cdot MKT_t + \beta_{i,HML} \cdot HML_t + \beta_{i,SMB} \cdot SMB_t + \beta_{i,UMD} \cdot UMD_t + \varepsilon_{i,t}, \quad (2.3)$$

where $r_{i,t}^{excess}$ is firm i's daily stock return in excess of risk free rates. MKT is the value weighted market index in excess of risk free rate. HML is the book to market factor. SMB is the size factor, and UMD is the momentum factor. Risk adjusted returns are used to estimate sensitivities so that β_j^c captures firm exposure to commodities rather than systematic risks. I also estimate the sensitivities using raw returns and returns adjusted by other risk models. The results are similar and discussed in section 2.5.2.

Construction of Instrument Variables

Firm-level uncertainty shocks are constructed using the sensitivities of stock returns to factor prices and aggregate uncertainty shocks:

$$IV_{j,t}^c = |\beta_{j,t-2}^{c,weighted}| \cdot \Delta\sigma_t^c, \quad (2.4)$$

where $\beta_{j,t-2}^{c,weighted}$ is a weighted value of sensitivity estimated in the first step (discussed below). σ_t^c is the standard deviation of daily changes in the price of commodity c within a year. $\Delta\sigma_t^c$ is the change of σ_t^c, which is calculated in a similar way as $\Delta\sigma_{i,t}$. I adjust each β_j^c by its significance level to obtain the significance weighted sensitivities. To be more specific, $\beta_j^{c,weighted} = \omega_j^c \cdot \beta_j^c$, where $\omega_j^c = \frac{|t_j^c|}{\sum^c |t_j^c|}$ and $|t_j^c|$ is the absolute value of t-statistics estimated in (2.2) for commodity c. ω_j^c is calculated as the ratio of $|t_j^c|$ to the sum of absolute t-statistics for all commodities. The significance weighted sensitivities capture both economic and statistical significance of firms' exposure to the commodities.

To ensure the instruments capture the effects of uncertainty shocks other than economic conditions, I also include the first moment variables as control variables in the regressions. The first moment variables are calculated as $\beta_j^{c,weighted} \cdot r_t^c$, where r_t^c is the annual growth of the 10

commodity prices.

Figure 2.5 demonstrates how oil, interest rate, exchange rate, and economic policy uncertainty vary across industries from 1994 to 2017[10]. Panel A, B, C, and D show the value-weighted average of the instruments for each industry constructed based on oil, interest rate, exchange rate, and economic policy uncertainty shocks respectively. Figure 2.5 Panel A shows that manufacturing and energy companies experience the highest level of oil uncertainty shocks among the five sectors, while companies operating in hi-tech and healthcare industries experience a very low level of oil uncertainty shocks. Panel B and C illustrate that interest rate and exchange rate uncertainty are highly correlated across sectors. Companies experience very high interest rate and exchange rate uncertainty shocks during the financial crisis. Panel D shows that the hi-tech industry demonstrates the highest economic policy uncertainty level, while the healthcare industry experiences the lowest level of economic policy uncertainty.

The instruments satisfy the exogeneity condition for the following two reasons. First, aggregate uncertainty shocks are very unlikely to be driven by firm characteristics. Second, sensitivities are estimated two years ahead of time to capture the pre-shock exposure and avoid any looking forward bias. Table A.2.2 illustrates the first stage results of IV regressions. The dependent variable is the changes in stock return volatility and the independent variables are the ten instruments. Column (1) shows the results without any control variable. Column (2) reports the results with firm characteristics and the ten first moment variables as controls. Columns (3) and (4) report the results with industry fixed effects, and with industry and year fixed effects respectively. All the coefficients are positive and statistically significant except for instruments of the British pound. Results of the test statistics indicate that the instruments pass both the underidentification tests and the overidentification tests.

[10]The industries are classified based on Fama-French five industry classifications.

2.3.3 Control Function Approach

The standard two-stage least squares (2SLS) estimations cannot be applied in non-linear models like the Cox proportional hazards model. To instrument for uncertainty shocks in the Cox proportional hazards model, I use a control function approach. The control function approach follows a two-step estimation procedure. First, I regress firm-level uncertainty shocks on the 10 instruments and obtain the residuals.

$$\Delta\sigma_{i,t} = \alpha_0 + \alpha_1 X_{i,t} + \alpha_2 Z_{1,j,t} + \alpha_3 Z_{2,j,t} + \zeta_{i,t} \tag{2.5}$$

$X_{i,t}$ are the control variables of firm characteristics. $Z_{1,j,t}$ are the first moment effects at SIC 3 digit level discussed in the identification section. $Z_{2,j,t}$ are the 10 instruments constructed at SIC 3-digit level.

The residual has two components:

$$\zeta_{i,t} = \delta\xi_{i,t} + \eta'_{i,t} \tag{2.6}$$

The first component $\delta\xi_{i,t}$ contains the endogenous part in $\Delta\sigma_{i,t}$, while the second component $\eta'_{i,t}$ is orthogonal to it. Rewrite Equation (2.6), we get:

$$\xi_{i,t} = \lambda\zeta_i + \xi'_i \tag{2.7}$$

where $\lambda = 1/\delta$ and $\xi'_i = -\eta'_{i,t}/\delta$. By running the Cox hazard proportional model with the residual $\zeta_{i,t}$ obtained from Equation (2.5) as an explanatory variable:

$$h(t, \Delta\sigma_i, X_i, Z_{1,j}) = h(t,0)exp(\beta_1\Delta\sigma_i + \beta_2 X_i + \beta_3 Z_{1,j} + \lambda\zeta_i + \xi'_i) \tag{2.8}$$

The new error term ξ'_i is orthogonal to the change in stock return volatility. Therefore, β_1 is an unbiased estimator of the effects of uncertainty shocks on going private.

2.3.4 Matching Analysis

Comparison between the going private companies and the surviving companies in Table 2.1 Panel A indicates that firm characteristics are significantly different between the two groups. To address the concern that the going private companies are fundamentally different from the surviving firms, I investigate the effects of uncertainty on going private through a matching analysis. The matched control samples are constructed based on firm characteristics one year after IPO and three years before going private. Bharath and Dittmar (2010) finds that firm characteristics at the time of IPO are important determinants for the decision to go private. Therefore, I construct alternative control samples based only on IPO characteristics as a robustness test. The variables to match include industry, firm size, Tobin's Q, and annual stock returns. Among all the companies that remain public until the end of 2017, I first restrict the matched group to those that went public in the same year as the going private firm. For each going private firm, I then construct different control samples by selecting the firms operate in the same 2 digit SIC industry, whose log sales, Tobin'Q or annual stock return is within +/- 10% of the delisted firm. I also conduct a propensity score matching based on these characteristics. For each going private company, I select up to five companies that remain public at the end of 2017, and operate in the same Fama-French 12 industry and went public in the same year as the going private company. 105 going private companies are matched with 410 control companies. Panel A and B of Table 2.3 present the at-IPO and pre-delisting comparisons of the delisted firms and the control sample based on the propensity score matching. The summary statistics in Panel A and Panel B of Table 2.3 indicate that the differences in firm characteristics between the going private sample and the matched control group are insignificant, both at the time of IPO and in the year before going private.

2.3.5 Difference-in-differences Analysis of the Impacts of Going Private on Loan Rate

If agency problems between creditors and shareholders are mitigated through going private, the agency cost of debt should decrease after going private. To further investigate the economic mechanism driving the results, I conduct a difference-in-differences analysis to investigate the impact of going private on loan rates. The sample construction process of the difference-in-differences analysis is as follows.

I select the subsample of going private companies which have loan facilities both before and after the going private transaction. To minimize changes in firm fundamentals between the two loans, I restrict the loan facilities to those within two years of the going private date. If more than one loan facility satisfies the criteria, I select the one closest to the delisting date. Loans used to finance the going-private transaction are excluded from the sample. The loan pair allows me to compare the cost of two bank loans with little change in the firm's fundamentals except for the public status.

For each pre-delisting and post-delisting loan pair issued by the going private firm, loan pairs issued by public firms operating in the same 2-digit SIC industry are matched. The loan pairs must start within one year of the loan pair of the going private firm so that the loan rates are not affected by market conditions. Among all the matched firms with available loan pairs, I conduct a propensity score matching based on firm size, stock return, and stock return volatility. Due to the restrictive criteria, the number of matched control companies is much smaller compared to the matching analysis in Section 2.3.4. To have a balanced sample, I select up to two control companies for each going private firm in this difference-in-differences analysis. Panel A of Table 2.6 reports summary statistics of the going private firms and the control firms with matched loan pairs. The going private sample demonstrates lower stock returns and higher stock return volatility before going private. However, the differences are statistically insignificant.

I estimate the effect of going private on the loan rate using the following difference-in-

differences regression:

$$LoanRate_{i,t} = \beta_1 + \beta_2 GoingPrivate_i \times Post_t + \beta_3 GoingPrivate_i + \beta_4 Post_t + \beta_5 Loan_{i,t} + \theta_p + \psi_t + \epsilon_{i,p,t} \tag{2.9}$$

where $GoingPrivate_i$ is an indicator variable that equals one for going private firms, and zero otherwise. $Post_t$ is a dummy variable that equals one if the loan facility starts after delisting, or is matched to a post-delisting loan. I include year fixed effects, ψ_t, to control for any macroeconomic factors affecting the loan spread. I also include fixed effects for each matched pair, θ_p, to control for unobserved matched pair characteristics that might affect the loan spread. Loan characteristics are also included in the regression to control for heterogeneity in loan facilities.

2.4 Results

I discuss the results in this section. First, I discuss the main results of impacts of uncertainty shocks on going private transactions. After that, I provide evidence of the corporate governance mechanism exploiting heterogeneity in the level of agency problems firms face. Lastly, I discuss how going private affects firms' cost of bank loans.

2.4.1 Main Results

Table 2.2 reports the results of Cox proportional hazards model for time to go private. The major independent variable is economic uncertainty shock, which is measured as the year-on-year change in stock return volatility. The dependent variable is the hazard rate of going private. Columns (1) and (2) show results of the baseline Cox proportional hazards estimations. Column (1) shows the univariate results, and column (2) reports the results with control variables. Both coefficients of the change in stock return volatility and volatility are positive and statistically significant, indicating that firms are more likely to go private following uncertainty shocks. Regarding economic magnitudes, results in column (2) indicate that a one standard deviation

increase in uncertainty shocks increases the hazard rate of going private by 14%.

Columns (3) to (6) report the IV results of the Cox proportional hazards models for time to go private, using a control function approach. Column (3) reports the univariate results. Column (4) includes additional firm characteristics and first moment macroeconomic variables as control variables. Column (5) includes Fama-French 12 industry fixed effects, and column (6) includes industry and year fixed effects. The impacts of uncertainty shocks on going private are positive and statistically significant at 1% level for all specifications. Results in column (6) indicate that a one standard deviation increase in the ΔVolatility induced by macro uncertainty shocks increases the hazard rate of going private by 22.8%.

Firms with lower stock returns are more likely to go private. The coefficient on log sales is negative, meaning that smaller firms are more likely to go private. It is easier for larger firms to amortize fixed costs, and smaller firms go private to avoid compliance costs. The coefficient on Tobin's Q is negative, showing that firms with fewer growth opportunities are more likely to go private. It also suggests that undervalued companies are more likely to become going private targets. Asset intangibility positively affects the likelihood of going private. Firms with more intangible assets may be more likely to be misvalued. Alternatively, there may be more disagreement between public investors and firm insiders in these companies, creating incentives to go private. Consistent with Mehran and Peristiani (2009), firms that went private demonstrate higher return on assets before delisting.

2.4.2 Estimation Results Based on Matched Control Samples

Table 2.3 Panel C reports the matching results of the Cox proportional hazards models with the control function. The control sample constitutes public firms that went public in the same year as the going private firms, and matched on various firm characteristics at the time of IPO and three years before delisting. The control firms in column (1) operate in the same SIC 2-digit industries as the going private firms. Control firms in columns (2) and (3) are matched on log sales and Tobin's Q respectively. Firms with characteristics +/- 10% of the going private firms

are included in the matched sample. The control sample in column (4) is constructed based on a one-to-five propensity score matching on SIC 2-digit industry, log sales, Tobin's Q, and annual stock returns. Control variables and first moment macro variables are included in all specifications. Year and Fama-French 12 industry fixed effects are included to account for the time varying effects and heterogeneity across industries. The effects of uncertainty shocks on the hazard rates of going private are positive and significant, consistent with Table 2.2. Results of the propensity score matching in column (4) indicate that one standard deviation increase in uncertainty induced by macro uncertainty shocks increases the likelihood of going private by 13%.

2.4.3 Agency Problems and Going Private Transactions

Based on the agency hypothesis, incentives for firms to go private should be higher when there are more agency problems associated with the firms' capital structures. Therefore, the likelihood of going private should be higher for firms with more agency problems, both among shareholders, and between shareholders and creditors. To investigate this hypothesis, I exploit heterogeneity in firms' agency problems associated with their capital structures, and test whether firms with more agency problems are more likely to go private under uncertainty shocks. Specifically, I re-estimate Equation (2.1) by including the interaction terms of economic uncertainty shocks and various proxies for agency frictions.

Shareholder Conflicts and Going Private Transactions

I first study firms' ownership structures and investigate whether firms are more likely to go private with uncertainty shocks when there are more agency conflicts between managers/controlling shareholders and minority shareholders.

Masulis et al. (2009) show that the dual-class structure aggravates the agency problems between managers/controlling shareholders and minority shareholders. The divergence between control rights and cash flow rights allows managers and controlling shareholders to extract pri-

vate benefits without bearing the financial consequences. Because of these agency frictions, firms with dual-class structure bear higher cost of capital (Masulis et al. 2009), and experience lower firm value and stock returns (Claessens et al. 2002; Lemmon and Lins 2003). Therefore, the incentives to go private under uncertainty shocks to resolve the agency conflicts are expected to be higher for the firms with dual-class structure. I also investigate whether the impacts of uncertainty on going private vary for firms with different levels of institutional ownership. Literature on corporate governance (Shleifer and Vishny 1986; Agrawal and Mandelker 1990; Shleifer and Vishny 1997) suggests that institutional blockholders provide effective monitoring for public firms. Therefore, the agency problems should be bigger for firms with fewer institutional blockholders, increasing the incentives for firms to go private following uncertainty shocks.

Table 2.4 reports the results on shareholder conflicts and going private transactions. Panel A shows results on dual-class structure and going private transactions. Dual class is an indicator variable that equals to one if the company has dual class shares that year. Consistent with the results in Table 2.2, I find that the coefficients of uncertainty shocks on going private are positive and statistically significant across all specifications. The effects are stronger for firms with dual class shares. The Schedule 13E-3 filings indicate that the dual-class structure is usually eliminated after delisting. For the firms with dual class shares after delisting, management and the PE firm usually own the same proportions for both classes. Panel B presents results on institutional ownership and going private transactions. Institutional investor is the percentage ownership by institutional blockholders. Consistent with Table 2.2, firms are more likely to go private under uncertainty shocks. The impacts are stronger for firms with less ownership by institutional blockholders. Results in Table 2.4 suggest that firms with potential agency problems between managers/controlling shareholders and minority shareholders are more likely to go private under uncertainty shocks, consistent with the agency hypothesis.

Shareholder-creditor Conflicts and Going Private Transactions

I also investigate whether the effects of uncertainty on going private concentrate on firms with more agency costs of debt. The agency problems between shareholders and creditors are particularly costly when firms are in financial distress. Therefore, incentives to resolve the agency conflicts of debt are higher for the firms in financial distress. I also exploit heterogeneity in firms' asset redeployability to investigate the economic mechanism. Theories suggest that collateral alleviates financial frictions of debt. Creditors bear significantly fewer risks if the assets are easy to resell in the secondary markets. Benmelech and Bergman (2009) shows that the ability to pledge redeployable collateral lowers the cost of external financing and increases debt capacity. Based on this argument, firms with less redeployable assets should demonstrate higher agency costs of debt and therefore have larger incentives to go private under uncertainty shocks. I also investigate how a firm's debt structure affects the impact of uncertainty on going private. Specifically, I investigate whether the positive impacts of uncertainty on going private vary with the ratio of bank loans to corporate bonds. Chemmanur and Fulghieri (1994) show that bank loans are more flexible for renegotiation in the event of financial distress. Firms' incentives to resolve the agency conflicts of debt are higher if they experience difficulties in the renegotiation process.

Table 2.5 reports the results on shareholder-creditor conflicts and going private transactions. Consistent with the main results, the positive impacts of uncertainty on going private are positive and statistically significant in all the results. Panel A reports results on asset redeployability and going private transactions. Asset redeployability is the standardized value-weighted asset redeployability index from Kim and Kung (2017) times minus one. The results suggest that firms with less redeployable assets are more likely to go private under uncertainty shocks. Panel B reports the results of financial distress and going private transactions. Financial distress is an indicator variable if the Altman Z-Score is lower than 1.8. Results in Panel B indicate that the positive impacts of uncertainty on going private are stronger for firms in financial distress. Panel C of Table 2.5 reports the debt structure and going private transactions. Loan to bond

ratio is the ratio of outstanding bank loans to corporate bonds of the firms. Results in Table 2.5 Panel C indicate that firms are more likely to go private under uncertainty when they have more corporate bonds than bank loans. Overall, the results in Table 2.5 suggest that firms are more likely to go private when they face more shareholder-creditor conflicts.

2.4.4 Impacts of Going Private on Loan Rate

Figure 2.3 illustrates the comparisons of loan rates between going private firms and control firms before and after delisting. Before delisting, going private firms pay significantly higher costs for bank credit compared to the control group. After delisting, the difference becomes insignificant. Panel B of Table 2.6 summarizes the differences in loan rates. The difference is close to zero when we compare the loan rate residuals, which are residuals from the regression of loan rates on year and matched pair fixed effects, in the post-delisting period.

Panel C of Table 2.6 reports regression results of the difference-in-differences analysis from Equation (2.9). Year fixed effects are included in all specifications. Columns (2) to (4) include matched pair fixed effects. On average, going private firms pay more for bank credit compared to matched control firms. However, their relative cost of bank credit decreases after delisting, because they had worse ex-ante credit quality, which was improved through going private. The difference-in-differences coefficient in column (4) suggests that, compared to the matched sample, going private firms pay 230 bps less for bank credit after they delist—a significant decrease in economic terms. This result provides further support to the agency hypothesis that going private resolves the agency conflicts of debt. As a result, the cost of bank loans decreases.

2.4.5 Subsample Analysis

To further investigate the economic mechanism, I classify the going private deals into management buyouts and the buyouts by private equity investors and investigate whether the effects vary when management or private equity investors participate. Based on the corporate governance hypothesis, companies go private to resolve the heightened agency frictions following

uncertainty shocks. The effects are expected to be stronger when management is involvement, because management has a better understanding of the agency frictions faced by the company. If the agency frictions are exacerbated following uncertainty shocks, management should be more likely to take the company private to resolve the issues. The effects are also expected to be stronger for private equity buyouts since incentive alignment is one of the most important value drivers for the deals. The buyout classifications are from SDC M&A database.

Table 2.7 reports the results of the subsample analysis. The going private sample in Panel A and B involve management buyouts and deals without management participation respectively. The going private sample in Panel C and D constitute the buyouts with and without private equity investors respectively. The control sample includes the companies that remain public until the end of 2017. Results are estimated based on the Cox proportional hazards model with a control function approach. Results in Panel A and B indicate that the effects of uncertainty on going private are slightly stronger when there is management participation. Panel C and D suggest that the effects are more prominent when the buyouts involve private equity investors. A comparison of the results in column (6) shows that the positive impacts of uncertainty on going private are 60% higher when there is PE participation. Overall, the results are consistent with the corporate governance hypothesis.

2.5 Alternative Explanations and Robustness Tests

This section investigates three alternative explanations, which may drive the positive impacts of uncertainty shocks on going private: undervaluation, market distraction, and the cost of information production. It also presents several robustness tests.

2.5.1 Alternative Explanations

Undervaluation

When firms experience uncertainty shocks, it may become more difficult for investors to evaluate the fundamentals of the firms. Firms are more likely to be misvalued. Previous studies show that managers and private equity investors are more likely to take firms private when they believe the firms are undervalued. If undervaluation is the primary channel that drives the results, the impacts should be stronger for firms that are undervalued. I use relative Tobin's Q, which is firm Tobin's Q divided by industry Tobin's Q at SIC 3-digit level, as a proxy for undervaluation.

Column (1) in Table 2.8 reports the results with relative Tobin's Q as an additional control variable in the regression. The coefficient on uncertainty shock is similar compared to the main results in Table 2.2. The negative coefficient on relative Tobin's Q indicates that firms are more likely to go private when they are undervalued. Column (2) adds an interaction term of relative Tobin'Q and uncertainty shock into the regression. The coefficient on the interaction term is insignificant, indicating that the effects are indifferent between undervalued and fairly priced firms. The results suggest that undervaluation is a major reason for firms to go private. However, undervaluation does not drive the impacts of uncertainty on going private.

Market Distraction

Another possible explanation of the results is market distraction. Uncertainty increases the volatility of stock prices, which can be a distraction to controlling shareholders and employees. Following Easton and Zmijewski (1989) in the accounting literature, I construct the earnings response coefficient (ERC) to measure the sensitivity of stock returns to earning announcements. ERC is estimated as the coefficient of regressing size-adjusted abnormal returns around the announcement date on unexpected earnings at SIC 3-digit level. ERC measures market responsiveness to earning news. The underlying reasoning is as follows. Managers of the companies whose stock returns are more sensitive to earning news are more likely to take the firm private

to enjoy a quiet life. When stock return volatility increases due to uncertainty, the need to take the firm private becomes higher.

Column (3) in Table 2.8 shows the results with log ERC as an additional control variable. The coefficient of log ERC on the hazard rate of going private is insignificantly different from zero. Column (4) adds the interaction term to the regressions. The results indicate that the effects of uncertainty on going private are indifferent for firms with high and low ERC.

Cost of Information Production

Another possible explanation is the elevated cost of information production under uncertainty. Subrahmanyam and Titman (1999) highlights the cost of duplication of information production by dispersed investors of public firms. Their paper suggests that more firms would go private if the cost of information production increases. With economic uncertainty shocks, investors' costs of information production are higher. Therefore, the positive effect of economic uncertainty on going private may be attributed to the increased cost of information production under uncertainty. When a large number of analysts follow the company, the cost of duplication of information production is mitigated because the analysts produce more publicly available information. If the effects of uncertainty on going private are driven by the cost of information production, the effects should concentrate in the firms followed by fewer analysts.

Column (5) and (6) in Table 2.8 shows the results investigating the cost of information production hypothesis. Column (5) includes analyst coverage of the firm as an additional control variable, and column (6) includes the interaction term in the regression. Results indicate that analyst coverage negatively affects the hazard rate of going private. Analyst coverage represents financial visibility of the company. Mehran and Peristiani (2009) finds that firms with a lack of financial visibility choose to go private since they have fewer benefits of being public. The interaction term of analyst coverage with uncertainty shock is insignificantly different from zero, suggesting that the cost of information production is not driving the results. In conclusion, results in Table 2.8 indicate that the alternative explanations do not drive the positive effects of

uncertainty shocks on going private.

2.5.2 Robustness Tests

This section investigates robustness of the findings. The effects are re-estimated controlling for macroeconomic conditions. I also re-examine Equation (2.1) using alternative factor models for risk-adjusted returns.

Effects of Macroeconomic Conditions

Studies show that uncertainty is counter-cyclical. Therefore, the results may be driven by business cycles rather than uncertainty shocks. To ensure the results are not driven by business cycles, I include the 10 first moment variables on changes in commodity prices as controls. To further address the concern, I add macroeconomic variables in the regressions. Table A.2.3 reports the impacts of macroeconomic factors on the hazard rate of going private. The hazard rate of going private is higher when investor sentiment is high. The hazard rate of going private is lower when yield curve is steeper. Supply of debt in the credit is an important determinant for going private since many going private transactions are completed through leveraged buyouts. Consistent with the main results, VIX positively affect the hazard rate of going private. Results in column 5 show that recessions do not play a role in the probability of going private. The positive effect of GDP growth on going private is somehow surprising. The result may be an artifact since changes in prices of the 10 commodities, which are highly correlated with GDP growth, are already included as controls in the regressions. Results in OA3 suggest that the positive effects of uncertainty shocks on going private are not driven by business cycles.

Different Factor Models for Risk Adjusted Return

The risk factors may be correlated with macroeconomic uncertainty. To ensure the effects are not driven by different risk factors, I re-construct the instruments using risk-adjusted returns estimated based on different factor models. Table A.2.4 demonstrates the results using different

risk-adjusted returns to estimate firm exposure to aggregate uncertainty shocks. Panel A shows the first stage results. Similar to Table A.2.2, the 10 instruments positively predict firm-level uncertainty shocks. All of the specifications pass the Kleibergen-Paap underidentification test and Hansen-Sargan J overidentification test. Panel B shows the main results of Cox proportional hazards models with risk adjusted returns by different factor models. Column (1) shows the results with raw returns. Column (2)-(4) report results with CAPM, Fama-French 3-factor model and Fama-French 5-factor model respectively. The coefficients of uncertainty on going private are significantly positive across all specifications. The economic magnitudes are similar to the main results.

2.6 Conclusion

In this chapter, I investigate the effect of economic uncertainty on going private. I find that firms are more likely to go private following uncertainty shocks. The positive correlation between uncertainty and going private is robust to controlling for firm and macroeconomics characteristics such as GDP growth, investor sentiment, indicators for NBER recession, VIX or the term premium. Moreover, the results are not sensitive to sample composition, or to controls for endogeneity problems using a control function analysis with instrumental variables.

In additional analyses, I find the positive effects of uncertainty on going private concentrate on firms with more agency conflicts. Specifically, the effects are more substantial for firms with dual-class structure and with less institutional ownership. Also, the effects are more prominent for firms with more credit-shareholder conflicts: firms with lower asset redeployability, firms in financial distress, and firms with low loan-to-bond ratio. Results of the subsample analysis indicate that effects are stronger when management and/or private equity investors participate in the going private transactions. A difference-in-differences analysis indicates that the cost of debt decreases after going private. The results are consistent with the corporate governance hypothesis. Uncertainty exacerbates the agency frictions faced by public companies. It gen-

erates more information asymmetry, and amplifies moral hazard problems and coordination frictions among managers, shareholders and creditors. As a response, firms alter their capital structures via going private to address the financial frictions and lessen the negative impacts of uncertainty. After agency frictions are mitigated through going private, firms obtain lower costs of debt.

The chapter documents uncertainty as a missing factor which can explain going private transactions. More importantly, the chapter provides novel evidence on the impacts of uncertainty on corporate governance. The chapter proposes one possible response by firms to address the impacts of uncertainty shocks. The impacts of uncertainty on firms are well documented in the literature, while firms' responses to uncertainty shocks are less studied. Im et al. (2017) and Alfaro et al. (2019) find that firms adopt more conservative corporate policies such as more cash holdings and fewer dividend payouts. This chapter, on the other hand, documents a different kind of response: capital restructuring through going private. Studying firms' responses to the uncertainty shocks helps us better understand economic uncertainty and how to recover from the negative impacts of uncertainty.

Figure 2.1 Going Private Transactions by Industry: 1994-2017

The figure plots the percentage of going private companies across industries in the sample over the period 1994-2017. The industries are classified based on Fama-French five industry classifications. The shaded vertical bars represent NBER recessions.

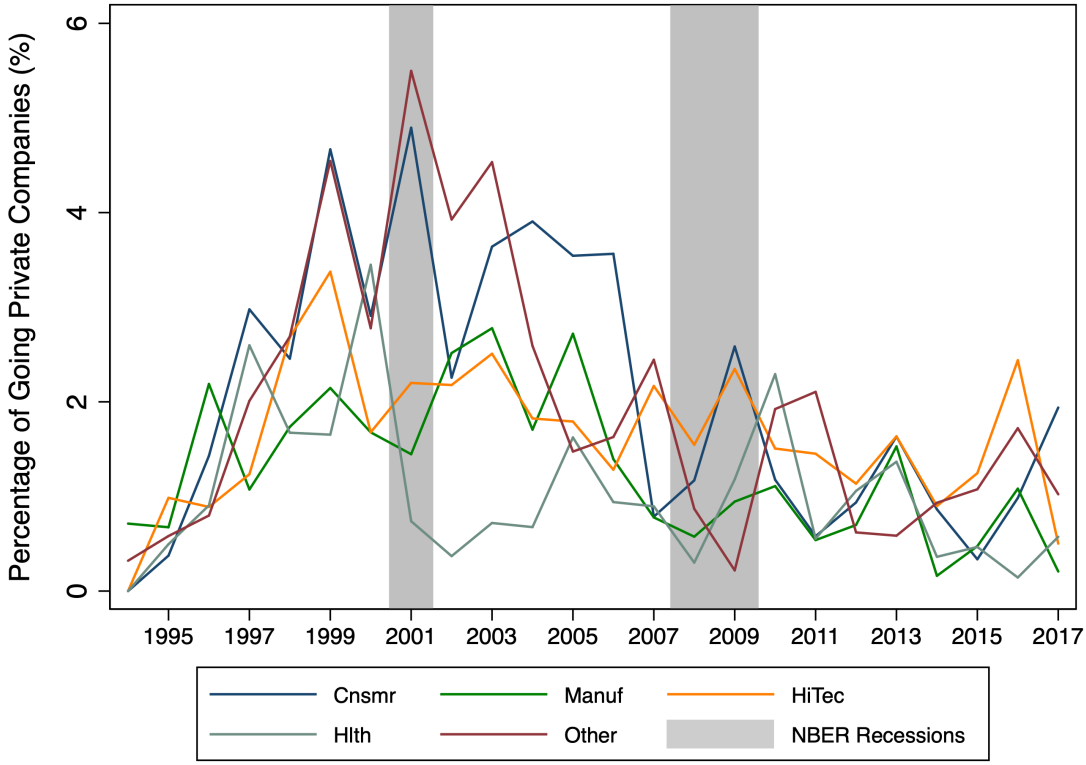
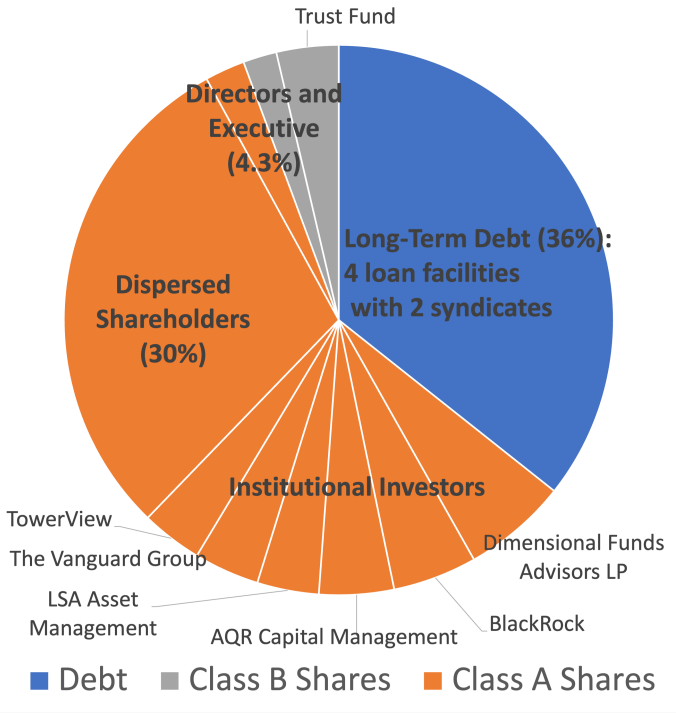


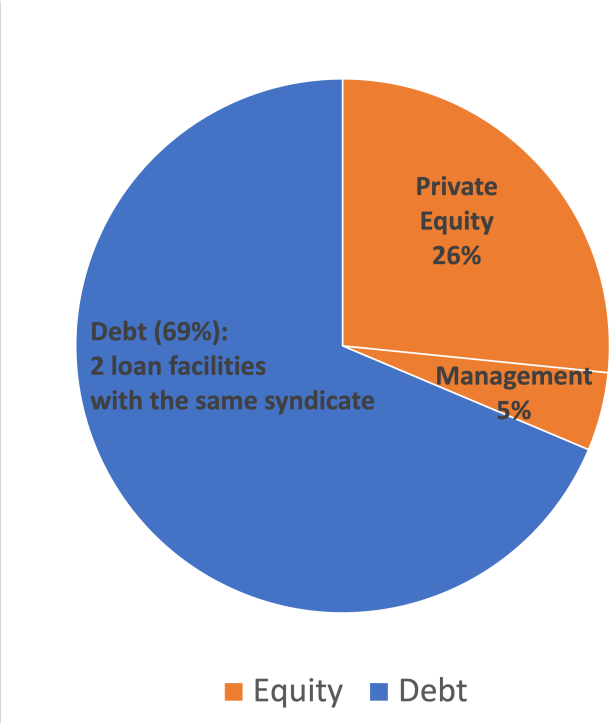
Figure 2.2 Capital Structure before vs. after Going Private

The figure compares capital structures of the company before and after going private. Panel A and Panel B illustrate the capital structures of American Greetings Corp. before and after it went private in 2013. Panel C illustrates the average post-delisting capital structure of the going private firms.

Panel A. Capital Structure of American Greetings Corp. on Dec 31, 2012



Panel B. Capital Structure of American Greetings Corp. after Going Private



Panel C. Capital Structure of the Average Company after Going Private

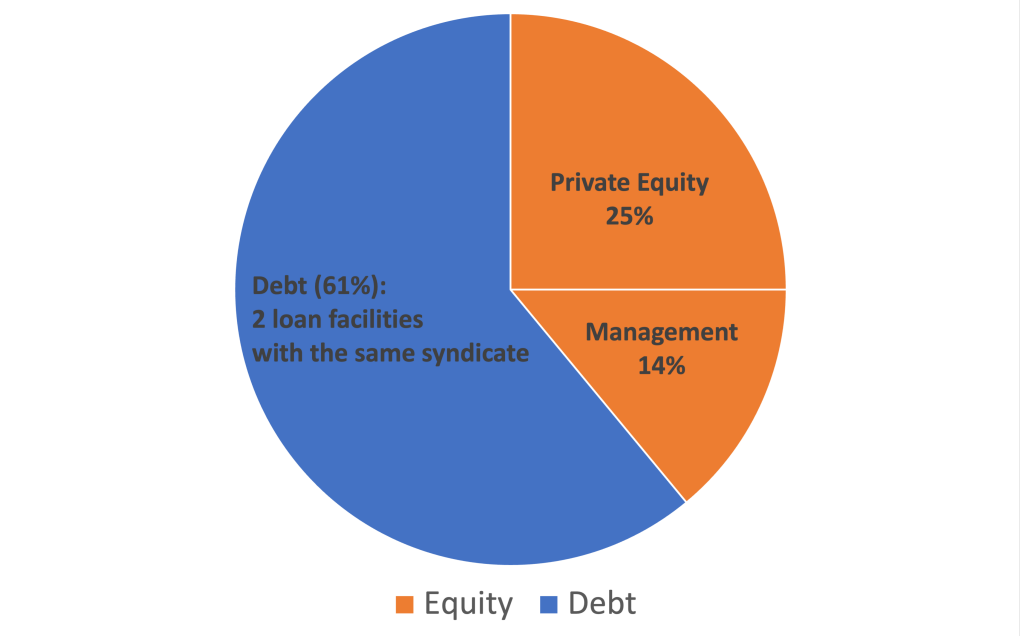


Figure 2.3 Differences in Loan Rates Between Going Private Firms and Control Firms

The figure illustrates the differences in loan rates between going private firms and matched control firms that remain public, in the pre-delisting period and the post-delisting period. The control firms are selected based on a propensity score matching on firm size, stock return, and stock return volatility of the year before a firm goes private.

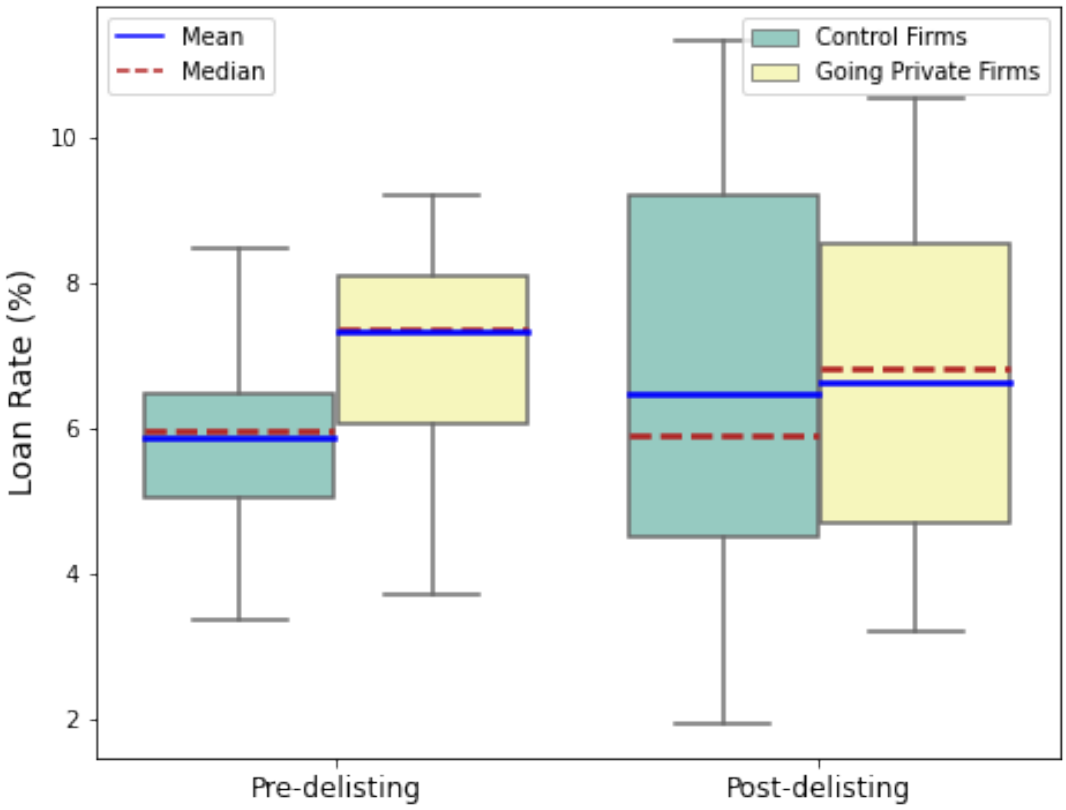


Figure 2.4 Cumulative Abnormal Returns of the Going Private Companies

The figure plots the cumulative abnormal returns of the going private companies within the [-30d,+30d] period relative to the going private announcement date. The sample constitutes a subsample of the going private transactions which can be identified in the SDC M&A Database.

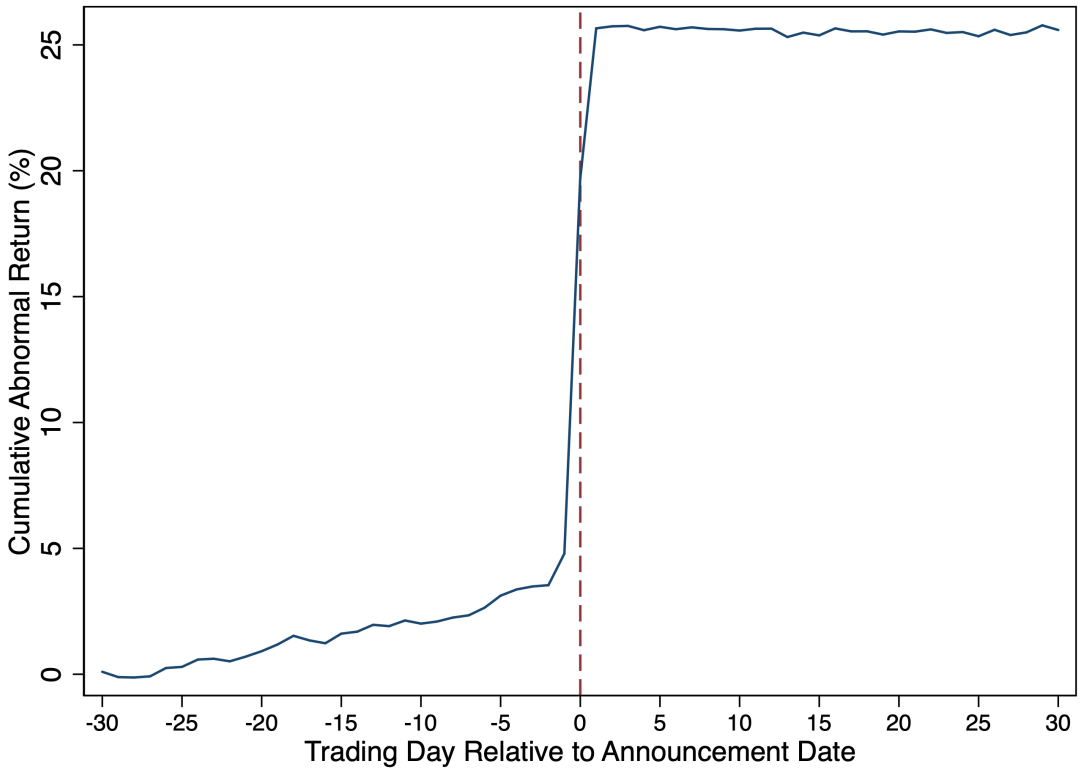
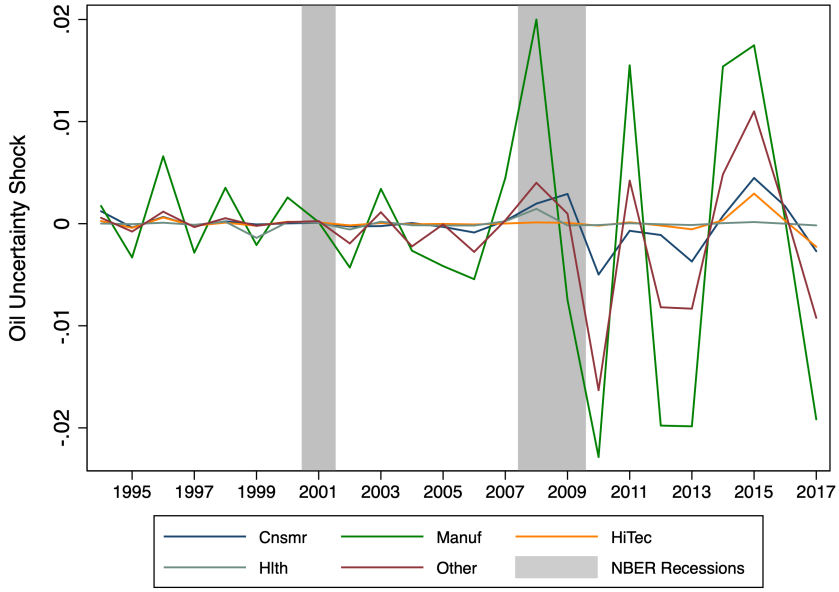


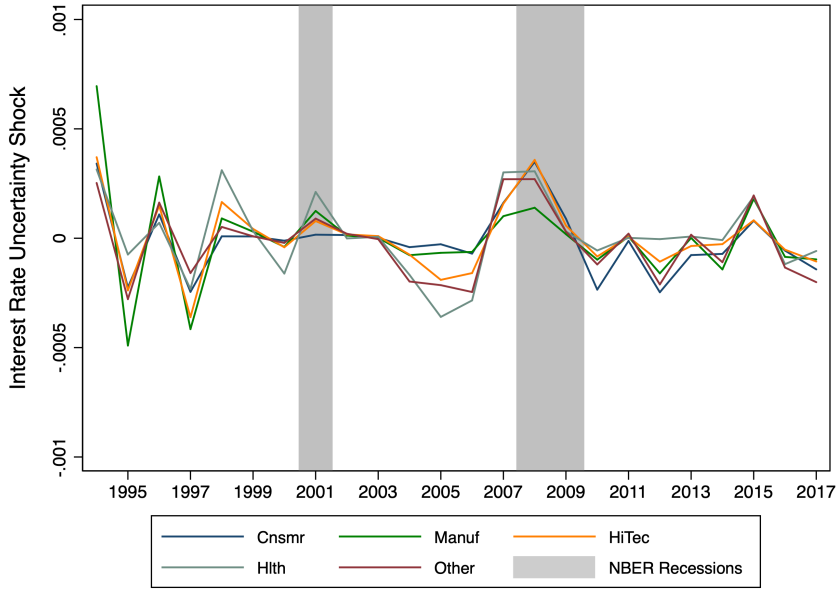
Figure 2.5 Uncertainty Shocks by Industry: 1994-2017

The figure plots the oil, interest rate, exchange rate, and economic policy uncertainty across industries from 1994 to 2017. Panel A, B, C, and D show the industry value-weighted average of the instruments constructed based on oil, interest rate, exchange rate, and economic policy uncertainty shocks respectively. The industries are classified based on Fama-French five industry classifications. The shaded vertical bars represent NBER recessions.

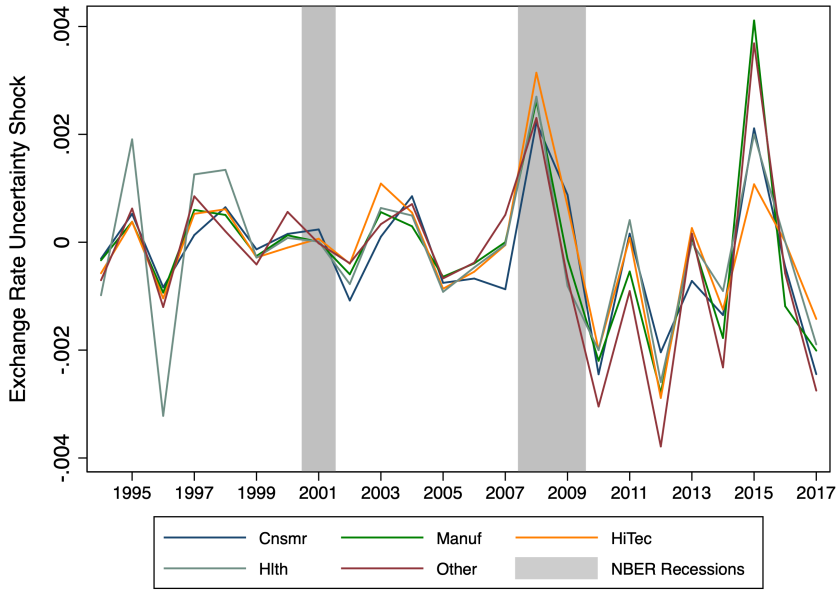
Panel A. Oil Uncertainty Shocks



Panel B. Interest Rate Uncertainty Shocks



Panel C. Exchange Rate Uncertainty Shocks



Panel D. Economic Policy Uncertainty Shocks

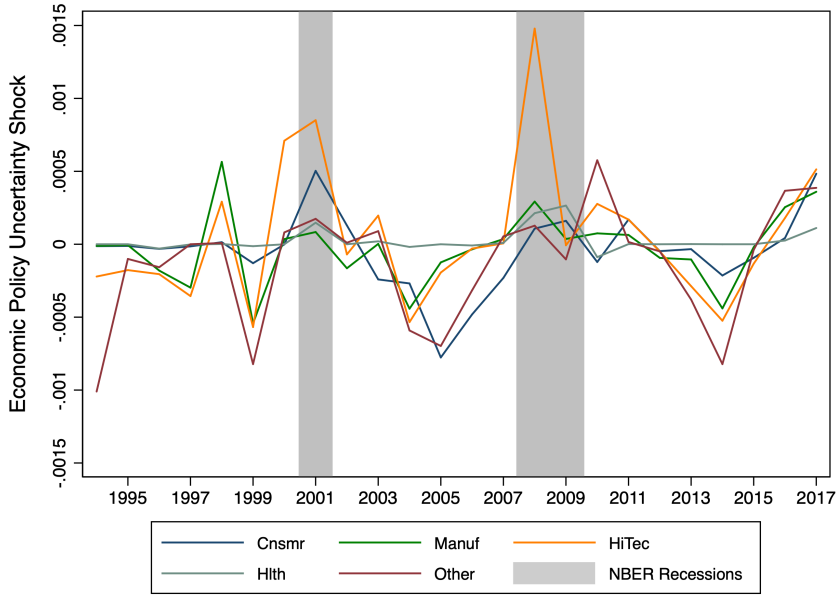


Table 2.1 Descriptive Statistics

Panel A. Comparison of Firm Characteristics between Going Private Firms and the Firms Remaining Public

This table compares going private firms with a control sample of surviving firms over the period of 1994-2017. The going private sample is the firms that filed for a Schedule 13E-3 (the going private statement) and delisted within two years after the filing. The control sample constitutes the firms that remain public at the end of 2017. Companies from financial and utility industries are excluded from the sample. The summary statistics summarize firm characteristics over the entire public life cycle. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variables are defined in Appendix A.1.

	Going Private Firms		Control Firms		
	Mean	SD	Mean	SD	Difference
Stock Return Variables					
ΔVolatility	0.001	0.284	-0.005	0.267	0.006
Volatility	0.616	0.435	0.476	0.353	0.140***
Stock Return	0.120	0.634	0.178	0.614	-0.058***
Control Variables					
Log Sales	4.777	1.792	5.946	2.341	-1.168***
Tobin's Q	1.537	1.848	2.101	2.494	-0.563***
Leverage	0.201	0.199	0.174	0.181	0.028***
Intangible Assets	0.114	0.158	0.140	0.177	-0.026***
Return on Assets	-0.014	0.197	-0.013	0.238	-0.001
Tax Ratio	0.024	0.042	0.021	0.031	0.003***
Other Firm Characteristics					
Dual Class	0.026	0.160	0.033	0.179	-0.007**
Institutional Ownership	0.113	0.140	0.173	0.144	-0.059***
Asset Redeployability	0.421	0.102	0.402	0.101	0.018***
Financial Distress	0.408	0.492	0.263	0.440	0.145***
Loan to Bond Ratio	0.581	0.415	0.461	0.425	0.121***
Log Relative Tobin's Q	-0.109	0.871	0.088	0.795	-0.197***
Log ERC	-0.328	1.688	-0.264	1.865	-0.065*
Analyst Coverage	5.109	5.166	8.711	7.450	-3.602***
No. of Firms	525		2,659		3,184
Firm-year Observations	4,915		43,145		48,060

Panel B. Summary Statistics of Going Private Transactions

The table reports summary statistics of the going private transactions. The sample includes a subsample of going private transactions for firms with debt outstanding before delisting, and with available information in the going private filings (13E-3, DEF13E-3, PRE13E-3 and Schedule TO). Variables are defined in Appendix A.1.

	Mean	SD	P10	P50	P90	Obs.
Deal Characteristics						
Deal Value ($MM)	544.6	767.8	77.7	188	1500	84
Premium (%)	34.5	14.9	19.2	32.1	68	84
Post-delisting Equity Structure						
Management Ownership	0.35	0.33	0.08	0.20	1	84
Private Equity Ownership	0.64	0.33	0	0.78	0.90	84
Other Existing Shareholder Ownership	0.01	0.04	0	0	0.06	84
Source of Deal Financing						
Leverage	0.61	0.20	0.31	0.66	0.81	84
Bank Loan/Total Debt	0.84	0.25	0.43	1	1	84
Corporate Bond/Total Debt	0.16	0.25	0	0	0.57	84
Private Equity/Total Equity	0.63	0.37	0	0.75	1	84
Equity by Management/Total Equity	0.21	0.31	0	0.06	0.95	84

Table 2.2 Uncertainty Shocks and Going Private Transactions

This table reports results of the Cox proportional hazards models for time to go private, estimated using Equation (2.1). The sample includes going-private firms over the period of 1994-2017 and a group of control firms that remain public. The dependent variable is the hazard rate of going private. In the Cox proportional hazards models, the firm-year observations are treated as recurring censored events until the firm goes private or the end of 2017. Columns (1) and (2) report estimates from the Cox proportional hazards models, assuming that ΔVolatility is exogenous. Columns (3)-(6) present control function estimates of the Cox proportional hazard models treating ΔVolatility as endogenous. Standard errors (in parentheses) are clustered at SIC 3-digit level. Columns (3)-(6) report bootstrapped standard errors with 300 replications. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variables are defined in Appendix A.1.

	Cox Proportional Hazards Model		Cox Proportional Hazards Model with Control Function			
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta\text{Volatility}_{i,t\text{-}1}$	0.41***	0.40**	1.79***	1.80***	1.55***	1.34***
	(0.15)	(0.20)	(0.17)	(0.24)	(0.23)	(0.28)
$\text{Volatility}_{i,t\text{-}2}$	0.93***	0.75***	1.33***	1.28***	1.11***	0.82***
	(0.09)	(0.14)	(0.11)	(0.19)	(0.20)	(0.23)
$\text{Stock Return}_{i,t\text{-}1}$	-0.54***	-0.33***	-0.44***	-0.37***	-0.41***	-0.44***
	(0.07)	(0.09)	(0.08)	(0.09)	(0.10)	(0.11)
$\text{Log Sales}_{i,t\text{-}1}$		-0.15***		-0.10**	-0.15***	-0.17***
		(0.04)		(0.04)	(0.04)	(0.04)
$\text{Tobin's Q}_{i,t\text{-}1}$		-0.23***		-0.17*	-0.12*	-0.15**
		(0.08)		(0.09)	(0.07)	(0.07)
$\text{Leverage}_{i,t\text{-}1}$		0.61**		0.34	0.16	0.26
		(0.30)		(0.68)	(0.42)	(0.40)
$\text{Intangible Assets}_{i,t\text{-}1}$		0.87***		0.44	0.31	0.44
		(0.30)		(0.62)	(0.56)	(0.58)
$\text{Return on Assets}_{i,t\text{-}1}$		0.71**		0.91**	0.54**	0.51**
		(0.32)		(0.39)	(0.26)	(0.24)
$\text{Tax}_{i,t\text{-}1}$		0.11		3.35	3.07	2.91
		(1.77)		(2.36)	(2.27)	(2.42)
1^{st} Moment 10 $\text{IV}_{i,t-1}$	No	No	No	Yes	Yes	Yes
Industry FE	No	No	No	No	Yes	Yes
Year FE	No	No	No	No	No	Yes
Firm-year Observations	48,060	36,452	33,711	26,034	26,034	26,034
No. of Firms	3,184	2,893	2,996	2,620	2,620	2,620
No. of Going Private Firms	525	378	356	252	252	252
Wald χ^2	171.0***	132.7***	133.4***	166.6***	364.6***	2207.8***

Table 2.3 Uncertainty Shocks and Going Private Transactions: Matching Analysis on IPO and Pre-delisting Characteristics

Panel A. At IPO Comparison

This table compares firm characteristics between the going private firms and the control firms two years after IPO. The going private sample is the firms that filed for a Schedule 13E-3 (the going private statement) and delisted within two years after the filing. The control sample is constructed with propensity score matching on firm characteristics (Fama-French 12 industry, log sales, Tobin's Q, and stock return) one year after IPO and three years before going private. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variables are defined in Appendix A.1.

	Going Private Firms		Matched Control Firms		
	Mean	SD	Mean	SD	Difference
Stock Return Variables					
ΔVolatility	0.023	0.299	0.006	0.268	0.017
Volatility	0.699	0.487	0.605	0.403	0.094
Stock Return	0.121	0.723	0.185	0.747	-0.064
Control Variables					
Log Sales	4.305	1.908	4.417	1.779	-0.112
Tobin's Q	2.557	2.981	2.715	3.420	-0.159
Leverage	0.182	0.201	0.176	0.189	0.006
Intangible Assets	0.095	0.138	0.096	0.161	-0.001
Return on Assets	-0.058	0.288	0.000	0.190	-0.058
Tax Ratio	0.015	0.028	0.022	0.033	-0.006
Other Firm Characteristics					
Dual Class	0.067	0.251	0.078	0.269	-0.011
Institutional Ownership	0.097	0.126	0.100	0.124	-0.003
Asset Redeployability	0.422	0.107	0.424	0.112	-0.002
Financial Distress	0.455	0.501	0.363	0.482	0.092
Loan to Bond Ratio	0.614	0.358	0.644	0.401	-0.030
Log Relative Tobin's Q	0.225	0.959	0.279	0.923	-0.054
Log ERC	-0.958	1.769	-0.277	1.765	-0.681**
Analyst Coverage	4.087	3.221	4.208	3.203	-0.121
No. of Firms	105		410		515

Pane B. Pre-delisting Comparison

This table compares firm characteristics between the going private firms and the control firms one year before delisting. The going private sample is the firms that filed for a Schedule 13E-3 (the going private statement) and delisted within two years after the filing. The control sample is constructed with propensity score matching on firm characteristics (Fama-French 12 industry, log sales, Tobin's Q, and stock return) one year after IPO and three years before going private. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variables are defined in Appendix A.1.

	Going Private Firms		Matched Control Firms		
	Mean	SD	Mean	SD	Difference
Stock Return Variables					
ΔVolatility	0.002	0.308	0.001	0.268	0.002
Volatility	0.588	0.428	0.554	0.393	0.033
Stock Return	-0.062	0.447	0.196	0.680	-0.258***
Control Variables					
Log Sales	5.315	1.735	5.526	1.757	-0.210
Tobin's Q	1.380	1.603	1.778	2.024	-0.398*
Leverage	0.197	0.218	0.195	0.193	0.002
Intangible Assets	0.142	0.178	0.134	0.184	0.008
Return on Assets	-0.041	0.273	0.010	0.172	-0.050
Tax Ratio	0.020	0.042	0.022	0.033	-0.002
Other Firm Characteristics					
Dual Class	0.069	0.255	0.082	0.275	-0.013
Institutional Ownership	0.139	0.142	0.174	0.141	-0.035*
Asset Redeployability	0.415	0.105	0.415	0.112	-0.000
Financial Distress	0.347	0.478	0.246	0.431	0.100
Loan to Bond Ratio	0.598	0.396	0.596	0.409	0.003
Log Relative Tobin's Q	-0.227	0.795	-0.073	0.865	-0.154
Log ERC	-0.098	1.701	-0.232	1.686	0.134
Analyst Coverage	4.875	5.395	6.174	5.601	-1.298
No. of Firms	105		410		515

Panel C. Cox Proportional Hazards Models for Time to Go Private

This table reports results of the Cox proportional hazards models for time to go private, estimated using Equation (2.1). The sample includes going-private firms over the period of 1994-2017 and control firms that matched on firm characteristics both one year after IPO and three years before delisting. The dependent variable is the hazard rate of going private. In the Cox proportional hazards models, the firm-year observations are treated as recurring censored events until the firm goes private or the end of the sample period. The control samples in columns (1)-(3) are matched on SIC 2-digit industry, log sales, and Tobin's Q respectively. The control sample in column (4) is constructed with propensity score matching on Fama-French 12 industry, log sales, Tobin's Q, and stock return. Standard errors (in parentheses) are clustered at SIC 3-digit level and bootstrapped with 300 replications. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variables are defined in Appendix A.1.

	Cox Proportional Hazards Model with Control Function			
	SIC2	Log Sales	Tobin's Q	P-score
	(1)	(2)	(3)	(4)
ΔVolatility$_{i,t\text{-}1}$	2.28***	1.90***	2.92***	2.35***
	(0.43)	(0.54)	(0.93)	(0.39)
Volatility$_{i,t\text{-}2}$	1.39***	1.07**	1.42*	1.06***
	(0.38)	(0.46)	(0.73)	(0.41)
Stock Return$_{i,t\text{-}1}$	-0.42***	-0.62***	-0.24	-0.66***
	(0.16)	(0.21)	(0.40)	(0.21)
Log Sales$_{i,t\text{-}1}$	-0.12**	-0.11	-0.02	-0.12
	(0.06)	(0.09)	(0.15)	(0.08)
Tobin's Q$_{i,t\text{-}1}$	-0.16	-0.27	-0.06	-0.14
	(0.11)	(0.17)	(0.23)	(0.15)
Tax$_{i,t\text{-}1}$	2.96	1.19	6.50	3.39
	(3.50)	(3.45)	(6.68)	(3.73)
Leverage$_{i,t\text{-}1}$	0.33	0.66	0.90	0.07
	(0.52)	(0.73)	(1.22)	(0.59)
Return on Assets$_{i,t\text{-}1}$	0.51	0.30	-0.37	0.15
	(0.40)	(0.62)	(0.98)	(0.57)
Intangible Assets$_{i,t\text{-}1}$	-0.21	-0.13	-0.72	0.43
	(0.72)	(0.76)	(1.60)	(0.67)
Control Variables	Yes	Yes	Yes	Yes
1st Moment 10 IV$_{i,t-1}$	Yes	Yes	Yes	Yes
Indystry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm-year Observations	13,774	8,353	2,163	6,055
No. of Firms	1,132	716	202	515
No. of Going Private Firms	140	105	50	105
Wald χ^2	2542.7***	1488.6***	96743.8***	99444.8***

Table 2.4 Shareholder Conflicts and Going Private Transactions

The table presents evidence of the economic mechanism, focusing on shareholder conflicts of the firms. Results are estimated using Cox proportional hazards models with control functions. The sample includes going-private firms over the period of 1994-2017 and a group of control firms that remain public. The dependent variable is the hazard rate of going private. Dual class is an indicator variable which equals to one if a firm has dual class shares in the year before going private. Inst. Ownership is the percentage ownership by institutional blockholders. In the Cox proportional hazards models, the firm-year observations are treated as recurring censored events until the firm goes private or the end of the sample period. Standard errors (in parentheses) are clustered at SIC 3-digit level and bootstrapped with 300 replications. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variables are defined in Appendix A.1.

Panel A. Dual Class Shares Status and Going Private Transactions

	Cox Proportional Hazards Model with Control Function			
	(1)	(2)	(3)	(4)
ΔVolatility$_{i,t\text{-}1}$	1.74***	1.60***	1.31***	1.04***
	(0.18)	(0.25)	(0.24)	(0.29)
ΔVolatility$_{i,t\text{-}1}$ × Dual Class$_{i,t\text{-}1}$	2.46***	5.50***	6.26***	6.90***
	(0.56)	(0.96)	(0.97)	(0.96)
Dual Class$_{i,t\text{-}1}$	0.58**	0.34	0.14	0.09
	(0.28)	(0.41)	(0.40)	(0.40)
Volatility$_{i,t\text{-}2}$	1.35***	1.26***	1.08***	0.77***
	(0.09)	(0.19)	(0.20)	(0.23)
Stock Return$_{i,t\text{-}1}$	-0.43***	-0.36***	-0.41***	-0.45***
	(0.07)	(0.09)	(0.10)	(0.16)
Control Variables	No	Yes	Yes	Yes
1st Moment 10 IV$_{i,t-1}$	No	Yes	Yes	Yes
Industry FE	No	No	Yes	Yes
Year FE	No	No	No	Yes
Firm-year Observations	33,711	26,034	26,034	26,034
No. of Firms	2,996	2,620	2,620	2,620
No. of Going Private Firms	356	252	252	252
Wald χ^2	143.9***	176.7***	377.9***	2325.5***

Panel B. Institutional Blockholders and Going Private Transactions

	Cox Proportional Hazards Model with Control Function			
	(1)	(2)	(3)	(4)
ΔVolatility$_{i,t\text{-}1}$	2.57***	1.97***	1.82***	1.40***
	(0.26)	(0.35)	(0.33)	(0.36)
ΔVolatility$_{i,t\text{-}1}$ × Inst. Ownership$_{i,t\text{-}1}$	-2.75**	-4.64**	-4.79***	-5.03***
	(1.27)	(1.86)	(1.83)	(1.78)
Inst. Ownership$_{i,t\text{-}1}$	-1.88***	-2.61***	-2.37***	-1.97***
	(0.44)	(0.65)	(0.66)	(0.64)
Volatility$_{i,t\text{-}2}$	1.57***	1.09***	1.00***	0.60***
	(0.12)	(0.21)	(0.20)	(0.22)
Stock Return$_{i,t\text{-}1}$	-0.52***	-0.54***	-0.56***	-0.57***
	(0.09)	(0.12)	(0.12)	(0.13)
Control Variables	No	Yes	Yes	Yes
1st Moment 10 IV$_{i,t-1}$	No	Yes	Yes	Yes
Industry FE	No	No	Yes	Yes
Year FE	No	No	No	Yes
Firm-year Observations	22,982	16,581	16,581	16,581
No. of Firms	2,382	2,000	2,000	2,000
No. of Going Private Firms	301	197	197	197
Wald χ^2	169.6***	215.2***	385.7***	4905.5***

Table 2.5. Shareholder-creditor Conflicts and Going Private Transactions
The table presents evidence of the economic mechanism, focusing on shareholder-creditor conflicts of the firms. Results are estimated using Cox proportional hazards models with the control function approach. The sample includes going-private firms over the period of 1994-2017 and a group of control firms that remain public. The dependent variable is the hazard rate of going private. Asset redeployability is minus one times the asset redeployability index from Kim and Kung (2017). Financial distress is an indicator variable if the Altman Z-score is lower than 1.8. Loan to bond ratio is the ratio of outstanding bank loans to corporate bonds. In the Cox proportional hazards models, the firm-year observations are treated as recurring censored events until the firm goes private or the end of the sample period. Standard errors (in parentheses) are clustered at SIC 3-digit level and bootstrapped with 300 replications. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variables are defined in Appendix A.1.

Panel A. Asset Redeployability and Going Private Transactions

	Cox Proportional Hazards Model with Control Function			
	(1)	(2)	(3)	(4)
ΔVolatility$_{i,t\text{-}1}$	1.43***	1.37***	1.12**	0.77
	(0.43)	(0.49)	(0.50)	(0.83)
ΔVolatility$_{i,t\text{-}1}$ × Asset Redeployability$_{i,t\text{-}1}$	0.97	1.69**	1.50**	1.45**
	(0.66)	(0.76)	(0.66)	(0.74)
Asset Redeployability$_{i,t\text{-}1}$	-0.16*	-0.17	-0.06	-0.05
	(0.09)	(0.10)	(0.10)	(0.10)
Volatility$_{i,t\text{-}2}$	1.20***	1.23***	1.07***	0.76*
	(0.23)	(0.29)	(0.29)	(0.42)
Stock Return$_{i,t\text{-}1}$	-0.49***	-0.45***	-0.48***	-0.51***
	(0.09)	(0.13)	(0.13)	(0.14)
Control Variables	No	Yes	Yes	Yes
1st Moment 10 IV$_{i,t-1}$	No	Yes	Yes	Yes
Industry FE	No	No	Yes	Yes
Year FE	No	No	No	Yes
Firm-year Observations	30,892	21,705	21,705	21,705
No. of Firms	2,640	2,264	2,264	2,264
No. of Going Private Firms	333	214	214	214
Wald χ^2	127.9***	146.8***	315.6***	3507.7***

Panel B. Financial Distress and Going Private Transactions

	Cox Proportional Hazards Model with Control Function			
	(1)	(2)	(3)	(4)
ΔVolatility$_{i,t\text{-}1}$	1.41***	1.34***	1.06***	0.78**
	(0.27)	(0.33)	(0.33)	(0.36)
ΔVolatility$_{i,t\text{-}1}$ × Financial Distress$_{i,t\text{-}1}$	0.58*	0.89**	0.89**	0.79
	(0.34)	(0.44)	(0.44)	(0.49)
Financial Distress$_{i,t\text{-}1}$	0.07	0.10	0.12	0.31
	(0.15)	(0.20)	(0.20)	(0.20)
Volatility$_{i,t\text{-}2}$	1.28***	1.25***	1.07***	0.72***
	(0.10)	(0.19)	(0.21)	(0.23)
Stock Return$_{i,t\text{-}1}$	-0.42***	-0.35***	-0.40***	-0.43***
	(0.07)	(0.09)	(0.10)	(0.11)
Control Variables	No	Yes	Yes	Yes
1st Moment 10 IV$_{i,t-1}$	No	Yes	Yes	Yes
Industry FE	No	No	Yes	Yes
Year FE	No	No	No	Yes
Firm-year Observations	32,867	25,522	25,522	25,522
No. of Firms	2,990	2,615	2,615	2,615
No. of Going Private Firms	355	252	252	252
Wald χ^2	133.2***	174.5***	411.8***	2870.3***

Panel C. Bank Loans, Corporate Bonds and Going Private Transactions

	Cox Proportional Hazards Model with Control Function			
	(1)	(2)	(3)	(4)
ΔVolatility$_{i,t\text{-}1}$	3.49**	3.02**	3.05**	4.19**
	(1.47)	(1.49)	(1.51)	(1.83)
ΔVolatility$_{i,t\text{-}1}$ × Loan to Bond Ratio$_{i,t\text{-}1}$	-4.19*	-4.28*	-4.28*	-5.12**
	(2.48)	(2.45)	(2.44)	(2.57)
Loan to Bond Ratio$_{i,t\text{-}1}$	0.23	0.20	0.10	0.27
	(0.21)	(0.28)	(0.26)	(0.25)
Volatility$_{i,t\text{-}2}$	1.00***	0.36	0.35	0.59
	(0.33)	(0.49)	(0.52)	(0.71)
Stock Return$_{i,t\text{-}1}$	-0.37***	-0.36*	-0.41*	-0.44*
	(0.14)	(0.22)	(0.23)	(0.23)
Control Variables	No	Yes	Yes	Yes
1st Moment 10 IV$_{i,t-1}$	No	Yes	Yes	Yes
Industry FE	No	No	Yes	Yes
Year FE	No	No	No	Yes
Firm-year Observations	14,404	11,750	11,750	11,750
No. of Firms	1,984	1,746	1,746	1,746
No. of Going Private Firms	134	96	96	96
Wald χ^2	48.6***	103.4***	664.1***	2687.6***

Table 2.6 Bank Loan Rates of the Going-Private Firms

The table compares loan rates of the going-private firms in the pre- and post-delisting periods. Panel A reports summary statistics of the going private firms and a matched sample of firms that remain public. Panel B compares the loan rates between the going private firms and control firms in the pre-delisting and post-delisting periods. Panel C reports results of the difference-in-differences analyses studying the impacts of going private on loan rate. The dependent variable is the loan rate. GP is a dummy variable which equals 1 if the firm goes private. Post is a dummy variable that equals one if the loan starts after the firm delists (or a matched loan for the control firm). All columns include year fixed effects. Columns (2)-(4) include matched pair fixed effects. The standard errors are in parentheses. The standard errors in Panel C are clustered at firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. Variables are defined in Appendix A.1.

Panel A. Summary Statistics

	Going Private Firms (GP)	Control Firms	Difference
Stock Return Volatility	0.64	0.58	0.06
	(0.13)	(0.08)	(0.14)
Stock Return	-0.26	-0.14	-0.12
	(0.13)	(0.10)	(0.17)
Total Assets ($B)	3.30	2.36	0.94
	(1.96)	(0.55)	(1.60)

Panel B. Loan Rate Comparisons

	Pre-delisting			Post-delisting		
	GP	Control	Difference	GP	Control	Difference
Loan Rate	7.34	5.89	1.46*	6.66	6.50	0.16
	(0.98)	(0.35)	(0.85)	(0.66)	(0.54)	(0.89)
Loan Rate Residual	1.44	-0.31	1.75**	-0.01	-0.16	0.15
with Year FE	(0.79)	(0.38)	(0.76)	(0.37)	(0.31)	(0.51)
Loan Rate Residual	1.40	-0.12	1.52**	-0.23	-0.23	0.00
with Year & Matched Pair FE	(0.64)	(0.32)	(0.64)	(0.19)	(0.31)	(0.46)

Panel C. Impact of Going Private on the Loan Rate

	(1)	(2)	(3)	(4)
GP = 1 × Post = 1	-2.13*	-2.46**	-2.72**	-2.30*
	(1.10)	(1.01)	(1.13)	(1.19)
GP = 1	2.19***	1.72**	1.52**	1.28*
	(0.71)	(0.66)	(0.65)	(0.68)
Post = 1	0.39	-0.98	-1.10	-0.65
	(0.71)	(0.95)	(1.05)	(1.13)
Term Loan			0.88	0.93
			(0.68)	(0.68)
Secured Loan			1.09*	1.00
			(0.59)	(0.59)
Loan Maturity			0.04	0.03
			(0.19)	(0.19)
Log Loan Amount				-0.33
				(0.30)
Year FE	Yes	Yes	Yes	Yes
Matched Pair FE	No	Yes	Yes	Yes
Adjusted R^2	0.39	0.53	0.56	0.56
Observations	70	70	68	68

Table 2.7 Uncertainty Shocks and Going Private Transactions: Subsample Analysis
The table reports results of the subsample analysis, estimated using Cox proportional hazards models with control functions. The going private sample in Panel A and B include management and non-management buyouts. The going private sample in Panel C and D involve private equity and non-private equity buyouts. The control sample constitutes companies that remain public at the end of 2017. The dependent variable is the hazard rate of going private. In the Cox proportional hazards models, the firm-year observations are treated as recurring censored events until the firm goes private or the end of the sample period. Standard errors (in parentheses) are clustered at SIC 3-digit level and bootstrapped with 300 replications. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variables are defined in Appendix A.1.

Panel A. Management Buyouts

	Cox Proportional Hazards Model with Control Function			
	(1)	(2)	(3)	(4)
ΔVolatility$_{i,t\text{-}1}$	2.60***	2.85***	2.85***	3.41***
	(0.47)	(0.79)	(0.82)	(1.02)
Volatility$_{i,t\text{-}2}$	1.90***	1.75***	1.79***	1.53**
	(0.21)	(0.50)	(0.53)	(0.73)
Stock Return$_{i,t\text{-}1}$	-0.30**	-0.38	-0.45**	-0.44
	(0.14)	(0.24)	(0.23)	(0.33)
Control Variables	No	Yes	Yes	Yes
1st Moment 10 IV$_{i,t-1}$	No	Yes	Yes	Yes
Industry FE	No	No	Yes	Yes
Year FE	No	No	No	Yes
Firm-year Observations	30,863	24,048	24,048	24,048
No. of Firms	2,561	2,265	2,265	2,265
No. of Going Private Firms	70	40	40	40
Wald χ^2	39.6***	124.4***	214.9***	13776.6***

Panel B. Non-management Buyouts

	Cox Proportional Hazards Model with Control Function			
	(1)	(2)	(3)	(4)
ΔVolatility$_{i,t\text{-}1}$	2.05***	2.07***	1.78***	3.49***
	(0.36)	(0.48)	(0.49)	(0.45)
Volatility$_{i,t\text{-}2}$	1.48***	1.30***	1.08***	1.59***
	(0.19)	(0.33)	(0.35)	(0.37)
Stock Return$_{i,t\text{-}1}$	-0.32**	-0.16	-0.20	-0.29
	(0.15)	(0.19)	(0.19)	(0.21)
Control Variables	No	Yes	Yes	Yes
1st Moment 10 IV$_{i,t-1}$	No	Yes	Yes	Yes
Industry FE	No	No	Yes	Yes
Year FE	No	No	No	Yes
Firm-year Observations	31,509	24,575	24,575	24,575
No. of Firms	2,639	2,345	2,345	2,345
No. of Going Private Firms	128	101	101	101
Wald χ^2	46.3***	134.2***	173.2***	11036.7***

Panel C. Private Equity Buyouts

	Cox Proportional Hazards Model with Control Function			
	(1)	(2)	(3)	(4)
ΔVolatility$_{i,t\text{-}1}$	2.03***	2.67***	2.48***	4.56***
	(0.45)	(0.68)	(0.69)	(0.81)
Volatility$_{i,t\text{-}2}$	1.85***	1.82***	1.74***	2.27***
	(0.20)	(0.44)	(0.44)	(0.53)
Stock Return$_{i,t\text{-}1}$	-0.24	-0.34	-0.43	-0.58*
	(0.17)	(0.27)	(0.29)	(0.31)
Control Variables	No	Yes	Yes	Yes
1st Moment 10 IV$_{i,t-1}$	No	Yes	Yes	Yes
Industry FE	No	No	Yes	Yes
Year FE	No	No	No	Yes
Firm-year Observations	30,866	24,074	24,074	24,074
No. of Firms	2,560	2,267	2,267	2,267
No. of Going Private Firms	74	46	46	46
Wald χ^2	30.2***	184.3***	4294.1***	97049.6***

Panel D. Non-private Equity Buyouts

	Cox Proportional Hazards Model with Control Function			
	(1)	(2)	(3)	(4)
ΔVolatility$_{i,t\text{-}1}$	2.34***	2.08***	1.80***	2.69***
	(0.33)	(0.45)	(0.45)	(0.46)
Volatility$_{i,t\text{-}2}$	1.51***	1.27***	1.05**	1.24**
	(0.16)	(0.34)	(0.37)	(0.42)
Stock Return$_{i,t\text{-}1}$	-0.37***	-0.18	-0.23	-0.28
	(0.13)	(0.18)	(0.19)	(0.21)
Control Variables	No	Yes	Yes	Yes
1st Moment 10 IV$_{i,t-1}$	No	Yes	Yes	Yes
Industry FE	No	No	Yes	Yes
Year FE	No	No	No	Yes
Firm-year Observations	31,506	24,549	24,549	24,549
No. of Firms	2,640	2,343	2,343	2,343
No. of Going Private Firms	124	95	95	95
Wald χ^2	58.6***	117.7***	167.0***	7737.4***

Table 2.8 Alternative Explanations

The table reports results investigating the alternative hypotheses. Columns (1) and (2) examine the undervaluation hypothesis. Columns (3) and (4) examine the market distraction hypothesis. Columns (5) and (6) examine the information production hypothesis. Results are estimated using Cox proportional hazards models with control functions. The sample includes going private firms over the period of 1994-2017 and a group of control firms that remain public. The dependent variable is the hazard rate of going private. Relative Tobin's Q is the log of firm Tobin's Q relative to the industry average. Log ERC is the log of earnings response coefficient. Analyst coverage is the number of analysts following the company. In the Cox proportional hazards models, the firm-year observations are treated as recurring censored events until the firm goes private or the end of the sample period. Standard errors (in parentheses) are clustered at SIC 3-digit level and bootstrapped with 300 replications. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variables are defined in Appendix A.1.

	Cox Proportional Hazards Model with Control Function					
	Undervaluation		Market Distraction		Cost of Info. Production	
	(1)	(2)	(3)	(4)	(5)	(6)
ΔVolatility$_{i,t\text{-}1}$	1.22***	1.29***	1.41***	1.35***	1.27***	1.15**
	(0.28)	(0.30)	(0.28)	(0.28)	(0.36)	(0.52)
Relative Tobin's Q$_{i,t\text{-}1}$	-0.36**	-0.36**				
	(0.15)	(0.15)				
ΔVolatility$_{i,t\text{-}1}$ × Relative Tobin's Q$_{i,t\text{-}1}$		0.15				
		(0.25)				
Log ERC$_{i,t\text{-}1}$			0.05	0.06		
			(0.07)	(0.07)		
ΔVolatility$_{i,t\text{-}1}$ × Log ERC$_{i,t\text{-}1}$				-0.12		
				(0.16)		
Analyst Coverage$_{i,t\text{-}1}$					-0.09***	-0.09***
					(0.03)	(0.03)
ΔVolatility$_{i,t\text{-}1}$ × Analyst Coverage$_{i,t\text{-}1}$						0.03
						(0.11)
Volatility$_{i,t\text{-}2}$	0.74***	0.74***	0.86***	0.86***	0.65**	0.65**
	(0.24)	(0.24)	(0.25)	(0.28)	(0.32)	(0.33)
Stock Return$_{i,t\text{-}1}$	-0.43***	-0.43***	-0.44***	-0.44***	-0.63***	-0.63***
	(0.10)	(0.10)	(0.12)	(0.12)	(0.14)	(0.15)

Table 2.8 Continued

	(1)	(2)	(3)	(4)	(5)	(6)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
1^{st} Moment 10 $IV_{i,t-1}$	Yes	Yes	Yes	Yes	Yes	Yes
Year, Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-year Observations	26,034	26,034	22,200	22,200	16,635	16,635
No. of Firms	2,620	2,620	2,580	2,580	1,950	1,950
No. of Going Private Firms	252	252	223	223	144	144
Wald χ^2	2128.9***	2200.8***	2203.2***	2209.4***	2439.2***	2504.8***

Chapter 3

Relative Pricing of Private and Public Debt: The Role of Money Creation Channel

3.1 Introduction

Bank loans and public bonds are the two most important sources of debt for non-financial firms. While there is a large literature studying the optimal debt structure of firms and heterogeneity in firms' reliance on bank loans and bonds (Diamond, 1991; Rajan, 1992; Bolton and Freixas, 2000; Rauh and Sufi, 2010; Becker and Ivashina, 2014), less is known about determinants of the relative cost of raising funds in the private versus public debt market. The chapter fills this gap by offering evidence on the role of the bank money creation channel in explaining the relative pricing of bank loans and public bonds in the primary market.

Our work is motivated by the theoretical literature that explains how banks create demand deposits – money-like securities that are redeemable at par and liquid. For a security to be money-like, its value needs to be insensitive to information. Dang et al. (2015) show that when debt, a relatively information insensitive financial claim, is used as a collateral for another debt contract, the latter debt contract is the least sensitive to information. By lending to firms, banks use this 'debt-on-debt' structure to create demand deposits that are money-like. Dang et al. (2017) show that banks' money-creation function can be further enhanced if they issue loans to borrowers that are unlikely to fail and opaque, and when banks keep the information they produce about the borrowers secret. If banks' assets are safe but hard to evaluate by outside investors, the return to outsiders from exerting effort to learn about such opaque assets is low.

Little information is produced outside of banks, which ensures that banks' demand deposits are insensitive to information and thus money-like – by lending to safe and opaque projects, banks lower their costs of private money production.

Guided by this theory, we argue that the production of private money creates an incentive to lend to firms that are safe and opaque, which is unique to banks. Since banks benefit from the opacity of their borrowers, it should be less expensive for banks, relative to non-bank lenders, to finance such borrowers. From a firm's perspective, this reasoning implies that the cost of bank credit relative to the cost of raising funds in the public debt market should depend on the firm's opacity – firms whose assets are harder to evaluate by outside investors will have a relatively lower cost of capital when they borrow from banks.

To quantify the effect of this money creation channel on a firm's cost of borrowing, we examine how the relative pricing of loans and bonds changes in response to shocks to the firm's opacity, or in other words, shocks to investors' information acquisition cost about the firm's assets. We construct a granular dataset on loan-bond pairs issued by the same firm in the primary market, with investment-grade credit rating, with the same maturity and seniority, and at the same time. We define our main variable of interest – the loan-bond spread – as the within firm difference in the price of bank credit relative to public debt for each loan-bond pair in the sample. We consider several alternative proxies to construct the main independent variable – the change in the cost of acquiring information about a firm's assets.[1] This shock should capture how hard it is for outside investors to learn about the fundamental value of the firm's assets.

In our baseline analysis, following the growing literature on the impact of economic uncertainty on the corporate sector, we measure information acquisition cost using changes in volatility of the firm's stock returns, as well as changes in volatility of the firm's stock returns that are induced by aggregate uncertainty shocks. An increase in equity volatility and an increase in equity volatility due to aggregate uncertainty shocks plausibly makes it harder for outside investors to learn about the firm and thus can be considered an increase in a firm's opacity in

[1] We refer to firm opacity and the cost of acquiring information by outside investors synonymously throughout the chapter.

accordance with the notion of opacity in Dang et al. (2017). Our main hypothesis is that a positive information cost shock leads to a larger increase in the firm's cost of public debt relative to that of bank credit, that is, the loan-bond spread decreases. This is because a positive information cost makes it harder for outside investors to learn about the firm's assets, which reduces the return on producing information about those assets, thereby making such assets relatively easier to be funded by the banking sector.

Using a sample of matched loan-bond pairs, we find that a positive firm-level information cost shock reduces the loan-bond spread, suggesting that higher cost of acquiring information makes bank credit relatively cheaper compared to public debt. In terms of economic magnitudes, one standard deviation increase in the level of a firm's opacity is associated with a reduction in the loan-bond spread of 22 bps, which is economically significant given an average spread of 123 bps. We refer to this reduction in the loan-bond spread in response to the firm-level information cost shock as the 'opacity discount'.

Since we focus on the within-firm response of the loan-bond spread to the information cost shock, our main finding is not influenced by any issuer-level time-varying characteristics, both observable and unobservable, such as firm credit risk, growth opportunities, or governance, that could affect the pricing of either of the two debt contracts. Furthermore, our result survives when we include different sets of fixed effects, for example, when we control for unobservable bank/underwriter time-invariant characteristics, or when we include different sets of control variables, mainly to capture detailed characteristics of loan and bond contracts used in any specific deal.

One concern with using changes in the volatility of stock returns as a proxy for information cost is that unobserved firm-level factors can simultaneously affect the volatility of stock returns and the loan-bond spread. For example, a departure of a firm's CEO can lead to a change in the firm's stock return volatility and, at the same time, to a change in the loan rate due to the loss of a bank relationship. In this case, the negative relationship between an increase in volatility and the loan-bond spread cannot be attributed to the information acquisition cost channel. To

establish the causal effect of a firm-level information cost shock on the relative cost of bank credit, we employ an instrumental variable estimation approach following Alfaro et al. (2021).

Specifically, we instrument changes in firm-level volatility using firms' differential exposures to changes in aggregate volatility of the macro variables such as energy, currency, policy, and U.S. Treasury notes. The instruments, by construction, capture only those changes in firm-level volatility that are induced by changes in aggregate volatility of the macro variables. Hence, this approach allows us to rule out alternative factors, such as changes in firm fundamentals, which can simultaneously lead to an increase in firm-level volatility and the loan-bond spread. The results from the instrumental variable estimation are consistent with the baseline analysis. We find that firms experiencing positive information cost shock induced by aggregate volatility shocks receive opacity discounts on bank debt.

To provide further evidence that our information cost measure captures changes in equity volatility induced by exogenous factors, we look at the impact of the 9/11 uncertainty shock event on firms' cost of borrowing from banks relative to that from the public bond market. The 9/11 shock was exogenous to firm fundamentals but it had a significant impact on firm-level volatility. We show that firms that experienced a larger increase in volatility after the 9/11 shock had lower loan-bond spreads in the post-shock period. This finding again lends support to the hypothesis that an increase in the information acquisition cost made it harder for outside investors to learn about the firms' fundamentals, which in turn made it relatively easier for banks to fund projects of these firms.

We consider two alternative measures of firm information acquisition cost. First, we follow Anderson et al. (2009) to construct a firm-level opacity index, which ranks the relative opacity of firms in our sample based on four proxies for opacity: bid-ask spread, trading volume, analyst coverage, and analyst forecast errors. The firm-level opacity index is the sum of the rankings based on these four variables, normalized by 20. A higher opacity index indicates larger information asymmetry which should make it more difficult for outside investors to evaluate the firm's assets. Second, we follow Morgan (2002) and measure information acquisition cost using

disagreement in ratings assigned to a firm by Standard & Poor's and Moody's. If a firm's assets are harder to evaluate, there will be more disagreement among rating agencies about the true value of the firm's assets. Following this argument, we define a proxy for information acquisition cost as the absolute difference in ratings assigned to a firm by Standard & Poor's and Moody's. Using both these alternative measures of firm-level information acquisition cost we obtain results that are consistent with our hypothesis: as the information cost increases, the loan-bond spread shrinks.

Next, we provide direct evidence on the economic mechanism driving our results. According to the financial intermediation theory, the need for banks to maintain opacity should be larger when private money creation is not backed by the government. Specifically, deposit insurance provided by the government on demandable debt produced by banks makes such insured deposits insensitive to information, reducing banks' need to maintain opacity through their lending decisions. Supporting this hypothesis, Chen et al. (2020) show that uninsured deposits are more responsive to negative information about banks' assets. We hypothesize that a higher opacity discount should be offered by banks that create relatively more liquidity in the form of uninsured deposits and that experience outflows due to the uncertainty about the value of banks' assets. To preserve the value of uninsured deposits and to prevent further deposit outflows, these banks should invest in firms whose assets are hard to evaluate by outside investors.

To test this hypothesis, we exploit variation in the ratio of uninsured deposits and uninsured deposit outflows across banks and test whether banks with a higher ratio of uninsured deposits offer a larger opacity discount when they see a larger outflow of uninsured deposits. We find that banks relying more on uninsured deposits offer significantly larger opacity discounts to firms after they experience large uninsured deposits outflows. This result supports the presence of the money creation mechanism.

To provide further evidence that these deposit outflows are induced by investors' confidence in the asset quality of the bank, we use the money market dollar funding shock of April 2011.

European banks in the U.S. raise most of their dollar funding from uninsured sources, such as the commercial paper market while the dollar funding of U.S. banks is mostly sourced from insured retail deposits (Ivashina et al., 2015). In April 2011, money market funds started becoming concerned about European banks' exposure to Greek sovereign debt and they reduced their exposure to the Eurozone banks active in the U.S., which led to uninsured deposit outflows from these banks. We hypothesize that following the money market funding shock, the European banks should offer larger opacity discounts to firms whose assets are harder to evaluate since those banks have a greater need to keep information about their assets secret to prevent further withdrawals. Our results lend support to this hypothesis. Using difference-in-differences analysis, we find that a relatively larger opacity discount was offered by European banks to firms whose assets became harder to evaluate in the post-shock period.

We also exploit the role of implicit government guarantees after crisis to further isolate the role of the money creation mechanism. Following the 2008-09 financial crisis, the Financial Stability Board started to publish a list of global systemically important banks (G-SIBs). Such banks receive implicit 'too-big-to-fail' guarantees. These guarantees reduce banks' need to manage the opacity of their assets, and G-SIBs should thus offer lower opacity discounts to their borrowers. To test this hypothesis, we conduct a difference-in-differences analysis to investigate whether banks offer lower opacity discounts after they are classified as G-SIBs. We show that non-G-SIBs offer a significantly larger opacity discount to firms following a positive information cost shock after 2009 compared to G-SIBs. This result suggests that while banks no longer need to manage opacity after they are classified as G-SIBs, the need for using lending decisions to manage opacity remains present for non-G-SIBs. Both these results lend further support to the presence of the money creation mechanism.

Can relationship lending explain our results? Existing studies have shown that firms with longer bank relationships pay lower interest rates (Berger and Udell, 1995) and, during periods of crises, firms are able to receive cheaper bank credit from relationship banks compared to banks with which firms have only transaction lending relationships (Bolton et al., 2016). It is

thus possible, that the lower loan-bond spread in response to firm information cost shocks is driven by relationship lending and not by the money creation channel. We test this hypothesis by evaluating how the loan-bond spread responds to the interaction between firm information cost and length of the firm's relationship with the bank. We find that the opacity discount offered by banks does not depend on the length of the firm's relationship with the bank. This finding suggests that relationship lending is not driving our results.

Is it possible that firms' demand for bank credit relative to public bonds explains our results? If firms that experience larger volatility in their stock returns lower their demand for bank credit and increase their demand for public debt, this relative fall in demand for bank credit may translate into a lower cost of bank credit and a higher cost of public debt and may thereby generate a negative relationship between firm opacity and the loan-bond spread. If firms actively switch to public debt when they are hit by an opacity shock, we should see a fall in the share of bank loans to the total credit by firms that experience positive opacity shocks. Our results show that this is not the case. We do not find any significant effect of the firm information cost shock on the share of loans in total amount borrowed by the firm.

Another alternative explanation of our results may be that banks could participate less in loan syndicates when borrowers are opaque, which may lower their exposure and thereby lower their cost of lending to such borrowers. To investigate this alternative hypothesis, we examine the effects of firm information cost shock on bank participation in loan syndicates and find no significant relationship between the two.

In summary, our evidence suggests that the reduction in the loan-bond spread for firms whose assets become harder to evaluate by outside investors reflects the money creation channel. A key takeaway from our findings is that the need for banks to maintain opacity to perform their core function of money creation does have meaningful benefits for non-financial firms that are relatively more opaque but safe. This result has important policy-relevant implications. Mainly, regulations that promote greater public disclosure of banks' assets may adversely affect cost of capital for safe but opaque firms, especially for those that are not able to access

the public bond market.

The chapter contributes to the literature on the relative pricing of private and public debt. Schwert (2020) finds that loans are relatively overpriced compared to a bond-implied credit spread. Relative to Schwert (2020), our contribution to the literature is twofold. First, we compare the at issuance price of bonds with the cost of banks loans while Schwert (2020) compares the pricing of loans with a model implied spread based on secondary market quotes of traded bonds. Hence, our analysis provides a direct empirical estimate of the difference in firms' cost of raising funds in the form of bank loans vs bonds. Second, we identify an economic channel suggested by theory – the money creation channel – that we show partially explains the difference in the pricing of bank loans and bonds. To the best of our knowledge, ours is the first chapter to provide empirical evidence on the link between the money creation channel and the relative pricing of private and public debt.

The chapter builds on the recent literature (Dang et al., 2017) that endogenizes bank opacity and studies how banks optimally manage their opacity to support their core function of money creation. This recent literature belongs to the larger literature on the costs and benefits of bank opacity. Cost of bank opacity is studied in asset-based theories of financial intermediation that highlight the disciplining role of bank transparency (Diamond, 1984; Calomiris and Kahn, 1991; Diamond and Rajan, 2001). Empirical studies documenting the negative effects of bank opacity focus on the impact on financial stability (Jones et al., 2012; Flannery et al., 2013; Acharya and Ryan, 2016) and bank lending (Zheng, 2020). On the other hand, benefits of bank opacity are highlighted in liability based theories of financial intermediation (Gorton and Pennacchi, 1990; Dang et al., 2017). More broadly, the chapter contributes to the literature on costs and benefits of public disclosure of information. Starting from Hirshleifer (1971), a large theoretical literature has argued that more information is not always better and, in some instances, opacity can be socially optimal.[2] In the context of banking, Dang et al. (2017) argue that financing of opaque projects helps the money creation function of banks. The chapter adds to this literature

[2]See, for example, Kaplan (2006); Monnet and Quintin (2017); Andolfatto (2010); Pagano and Volpin (2012).

by being the first to provide empirical support to the endogenous bank opacity for money creation hypothesis of Dang et al. (2017), and by showing the potential benefits of this endogenous bank opacity on the cost of credit for non-financial firms.

The costs of public disclosure of information have also been extensively studied in the context of supervisory stress-tests for banks. Most studies arguing against public disclosure of supervisory test results focus on the proprietary costs for banks whose information is being disclosed (Dye, 1986; Darrough and Stoughton, 1990; Gigler, 1994) or the negative effects on risk sharing (Hirshleifer, 1971; Goldstein and Sapra, 2014), or inefficient ex post reaction to disclosure (Morris and Shin, 2002). We highlight a new channel – cost of borrowing for opaque and safe firms – through which public disclosure of stress test results can negatively affect the real economy.

Our work also adds to the literature studying the effects of disclosure by non-financial firms. Diamond and Verrecchia (1991) show that while more information revelation can reduce the cost of capital for firms, it can negatively affect liquidity in the secondary market. Some studies have shown that greater disclosure can have a negative effect on non-financial firms by revealing trade secrets to competitors (Bernard, 2016; Li et al., 2018). Jayaraman and Wu (2019) show that mandated disclosure can have a negative effect on managerial learning. Agarwal et al. (2018) show that greater transparency of a firm's assets through mutual funds' portfolio disclosures leads to myopic corporate investment behaviour and leads to a negative effect on corporate innovation. The chapter shows that another important channel through which information revelation can affect firms is the bank credit channel.

Finally, we contribute to the literature examining the effects of bank frictions on corporate lending. Adverse capital and liquidity shocks to banks are transmitted to borrowers through reductions in credit supply and stricter loan contracts (Peek and Rosengren, 1997, 2000; Khwaja and Mian, 2008; Paravisini, 2008; Chava and Purnanandam, 2011; Murfin, 2012; Schandlbauer, 2017). Other studies emphasize the role of bank capital for bank lending behavior (Thakor, 1996; Gambacorta and Mistrulli, 2004; Behn et al., 2016; Fraisse et al., 2020). Gornall and Stre-

bulaev (2018) model the joint capital structure decisions of banks and their borrowers and argue that bank leverage and firm leverage are both strategic substitutes and complements. Our research points out that banks' role as liquidity providers may affect loan pricing even in the absence of frictions.

The chapter is organized as follows. Section 3.2 discusses the conceptual framework and the main hypotheses. Section 3.3 describes the sample, data, and our empirical strategies. Section 3.4 summarizes the main results. Section 3.5 shows results for a variety of robustness tests, and Section 3.6 concludes.

3.2 Conceptual Framework and Hypotheses

The conceptual framework underlying our main hypothesis is derived from the financial intermediation theory which argues that banks need to be opaque with respect to third parties in order to perform one of their core functions – creation of demand deposits, that is, private money in the form of securities redeemable at par. This money creation is facilitated by opacity of banks' assets. The argument for why money is created by banks and why banks' endogenous opacity facilitates money creation proceeds in two steps.

First, Gorton and Pennacchi (1990); Holmström (2009); Dang et al. (2015); Holmström (2015) note that, for a security to be money-like it should have the desirable features of liquidity and safety, that is, agents should be able to use money for economic transactions without worrying about the fact that its value will change over time due to trading by privately informed agents.[3] These studies argue that one way to achieve such value-invariance is to make money insensitive to information, either public or privately produced. This implies that optimal design of these securities should be such that agents have the least incentives to produce private information about the payoffs of these securities.

Dang et al. (2015) show that when debt is used as a collateral for another debt contract, the

[3] As an example, tradable shares of a non-financial firm are not money-like because the value of tradable shares changes over time as a result of trading by privately informed agents.

'debt-on-debt' structure is least sensitive to information. This is because it preserves symmetric ignorance optimally from the security design perspective – the debt-on-debt contract structure minimizes the incentive of third parties to produce private information about the payoffs. The idea is that if the collateral value protecting the debt contract is sufficiently high relative to the face value of the debt contract, producing costly information about the exact value of the collateral is not worthwhile. If a particular debt contract is almost always information-insensitive, then using that debt contract as collateral for another debt contract makes the second debt contract even more information-insensitive. For this reason, bank's demand deposits (which are essentially debt claims) issued against loans on the bank's asset side (which are also debt claims) are the least information-sensitive, which makes them liquid and safe.

The second conceptual point, made in Dang et al. (2017), is that, in order for the above mechanism to work, a bank needs to be able to keep the information about its assets secret. This implies that a bank needs to select its assets so that expert outsiders do not have an incentive to produce private information about the value of the bank's assets. This can be accomplished if the bank makes loans that are costly for outsiders to learn about, such as loans to small businesses or firms that are opaque. Opacity makes it costly for an expert investor to find out information about the details of the bank's balance sheet, eliminating the expert's informational advantage and thereby facilitating the value-invariance of money. Outside investors will also have a low incentive to produce private information if the projects that the bank funds are unlikely to fail. As a result, to support their function of private money creation, banks have, relative to other financial intermediaries, a unique incentive to issue loans to projects that are unlikely to fail and opaque because such assets lower the cost of producing private money the most.

From the firms' perspective, banks' intrinsic need to maintain opacity implies that the cost of bank credit relative to that of public debt, as an alternative form of debt financing, should depend on firms' opacity. Specifically, all else equal, firms whose assets are harder to evaluate by outside investors will have a lower cost of capital when they borrow from banks. This effect

does not rely on any comparative advantage that banks may have in evaluating and overseeing projects. Based on these theories, we develop our main hypothesis that an increase in the cost of acquiring information about a firm's assets leads to a larger increase in the firm's cost of public debt relative to bank credit. In other words, banks offer 'opacity discounts' to firms experiencing positive information cost shocks, and larger opacity discounts should be offered by banks with a greater need to finance opaque projects.

3.3 Sample, Data, and Empirical Methodology

3.3.1 Data and Sample Construction

Our main analyses rely on a unique sample design which facilitates within firm comparison of the pricing of new loans and bond issuances. We construct loan-bond pairs issued by non-financial public firms in the U.S. using data on new loan facilities from the Dealscan database and data on bond issuances in the primary market from the FISD database over 1995-2019.[4] Within firm pairing of loan contracts with bond issuances is based on date of issuance and maturity of the contracts. For each firm, we pair new loan facilities and bond issuances with the same maturity and those that are issued within a window of 60 days. If one loan facility is matched to multiple bond issuances, we retain the one with the closest issuance date to the loan facility start date. We restrict the sample to senior loans and bonds denominated in USD.

For each loan-bond contract pair, we create our main dependent variable as the difference between the loan spread and the bond spread – the loan-bond spread. Our dependent variable measures a firm's cost of bank credit relative to that of public debt. By constructing loan-bond pairs issued by the same firm at the same time, we control for any issuer-level time-varying characteristics, both observed and unobservable, like firm credit risk, growth opportunities, or governance, that affect the pricing of either of the two debt contracts. We also control for

[4]Our sample starts in starts in 1995 to exclude the period of high volatility in the bond market before 1994 (Lemmon and Roberts, 2010).

maturity, the key contract level characteristic affecting pricing, by selecting the loan-bond pair with the same maturity category, i.e., short-term, mid-term or long-term loans and bonds.

Another important factor that can affect the loan-bond spread is the seniority of bank debt in bankruptcy. A higher recovery rate for bank loans compared to bonds in the state of default implies a relatively larger cost of public debt. This difference in recovery rate is especially relevant for firms that are likely to default but should matter less for safer firms. This is supported by Schwert (2020) who shows that the loan and bond spreads are statistically indistinguishable from each other when firms are far from default. To alleviate concerns that seniority of bank loans in bankruptcy could drive our results, we restrict our sample to investment grade rated firms since these firms are the least likely to default, which should make the seniority of different debt contracts relatively less important as a pricing factor. Restricting the sample to investment grade firms is also consistent with the financial intermediation theory of endogenous bank opacity and money creation as the theory suggests that the banks' function of money creation is supported by investment in projects that are unlikely to fail and opaque.

After imposing these restrictions, our final sample consists of a quarterly panel of 1,597 loan-bond pairs issued by 414 firms in 1995-2019. On average, each firm has 3.86 loan-bond pairs throughout the sample period. We describe our sample construction process in detail in Table B.3.1.

We use several measures to construct the main independent variable – firm information cost shock. First, following the literature that examines consequences of economic uncertainty, we construct a quarterly measure of firm information cost shock as the year-on-year change in the annualized stock return volatility of the firm for each quarter. Second, to address concerns that changes in firm fundamentals can simultaneously affect firm-level volatility and the loan-bond spread, we employ an instrumental variable approach following Alfaro et al. (2021). Specifically, we instrument firm opacity shocks using aggregate volatility shocks of macro variables such as currency, energy, policy, and U.S. Treasury. We use data from Bloomberg, the St. Louis Fed, and the Economic Policy Uncertainty Index from Baker et al. (2016) to construct the

instruments. Third, we use the 9/11 shock and define the information cost shock as the change in firm-level volatility in a small window around the 9/11 event. Finally, we use two alternative measures to measure firm-level information cost and construct an opacity index measure following Anderson et al. (2009) and Morgan (2002). Section 3.3.3 discusses these measures in detail.

Data on firm characteristics and stock returns are from Compustat and CRSP. Data on loan- and bond-level characteristics are from Dealscan and FISD. Information on bank lenders is from the FR Y-9C reports filed by bank holding companies. See Appendix B.1 for variable definitions.

3.3.2 Summary Statistics

Table 3.1 reports sample summary statistics. All the variables are winsorized at 1% and 99% level. Our sample consists of a quarterly panel of 1,597 loan-bond pairs issued by 414 firms in 1995-2019. On average, each firm has 3.86 loan-bond pairs throughout the sample period. Since we focus on firms that access both the loan and bond market, and issue investment-grade public debt, they are large and have strong fundamentals. The average size of firms in our sample is 1.4 billion USD (in terms of asets). On average, firms in our sample exhibit positive return on assets in the quarter before the loan-bond pair origination, and the average firm exhibits a stock return of 16% in the year before the loan-bond pair origination.

Since we restrict the sample to firms with investment-grade bonds, the firms are far from default with the implied probability of default (Bharath and Shumway, 2008) close to zero. The average bond in our sample is rated BBB+, with the vast majority of bonds falling between A to BBB- rating. On average, the cost of bank loans is 124 bps lower than the costs of borrowing in the bond market. The average loan facility amount is 1.34 billion and the bond face value is 639 million. On average, the loan facility accounts for 61% of the total borrowing amount within the loan-bond pair.

Most loans in our sample are syndicated loans; 16.5% of them are term loans and 15.4% are

secured loans. The fraction of secured loans is lower compared to that in Schwert (2020), consistent with the fact that loans to investment-grade firms are generally unsecured. Only 3% of the bonds in our sample are secured bonds. In our empirical analyses, we control for whether loans and bonds are secured to make sure our results are not driven by differences in collaterizability of the debt contract. The fraction of redeemable bonds is 89%. 27% of the bonds have embedded investor options. 64% have bondholder protective covenants, and 66% have negative-pledge covenants. We include an indicator variable for each of these bond characteristics in our regressions to control for any difference in bond pricing due to variation in bond features.

In Figure 3.1, we illustrate the time series patterns of the loan-bond spread. The spread is close to zero in normal times and it becomes significantly negative in recessions. During economic recoveries, the loan-bond spread gradually approaches zero as the loan rate approximates bond rate. This pattern suggests that changes in loan-bond spread over time are mainly driven by fluctuations in the loan rate, rather than the bond rate. Overall, the time-series pattern of the loan-bond spread is consistent with the money creation channel according to which the spread should be more negative in periods of stress when opacity is needed the most for banks to maintain the value-invariance of demand deposits.

Figure 3.2 demonstrates the cross-sectional properties of the loan-bond spread. It shows how the loan-bond spread varies across the firm cost shock distribution. We divide the loan-bond pairs in our sample into quartiles based on the firm information cost shock. The firm information cost shock is measured using firm-level changes in return volatility. To isolate the effects of firm information cost shocks from other factors, we plot loan rate residuals and bond yield residuals from a regression of loan rates and bond yields on loan/bond maturity, stock volatility, and year fixed effects. We discuss two key observations from Figure 3.2.

First, Figure 3.2 shows that firms in the bottom quartile of information cost shock pay more for bank credit than for public debt. This finding is consistent with the bank money creation hypothesis. The cost of private money production is higher when banks' assets are less opaque.

Therefore, banks can finance such projects only when they receive higher compensation from funding these projects than that received in the bond market.

Second, Figure 3.2 shows that as the firm-level information cost increases, it becomes more expensive for banks as well as the public bond market to finance such firms – both the bond rate and loan rate increases with the magnitude of the information cost shock. However, banks also benefit from the opacity of their borrowers as it helps their money creation function, therefore, even though the loan rate increases with the level of firm-level uncertainty, the rate of increase is much lower compared to the rate of increase in the bond rate. As a result, the loan-bond spread decreases with higher firm-level information acquisition cost. On average, firms in the highest information cost shock quartile exhibit a 29 bps lower loan-bond spread compared to those in the bottom quartile.

3.3.3 Information Cost Shock and the Loan-bond Spread

In this section, we consider several different alternatives to measure shocks to information acquisition cost of firms' assets and study the subsequent effect on the loan-bond spread.

Firm-level Uncertainty Shock: OLS Estimation

Following the growing literature on the impact of economic uncertainty on the corporate sector, we use uncertainty shocks to capture changes in the cost of information acquisition for outside investors. We argue that it becomes more costly for investors to learn about the fundamental value of firms whose stock experiences a larger increase in volatility. In particular, to study the impact of an information cost shock on the loan-bond spread, we estimate:

$$(loan-bond)_{i,t} = \beta_1 + \beta_2 \cdot \Delta\sigma_{i,t-1} + \beta_3 \cdot \sigma_{i,t-5} + \beta_4 \cdot r_{i,t-1} + \beta_5 \cdot Bond_{i,t} + \beta_6 \cdot Loan_{i,t} + \phi_j + \psi_t + \epsilon_{ij,t}. \tag{3.1}$$

The dependent variable is the within-firm difference between loan and bond spread for firm i at quarter t when the loan facility starts. $\Delta\sigma_{i,t-1}$ is our measure of firm information cost shock,

which is a year-on-year change in the annualized equity volatility lagged by one quarter from the facility start date. Based on the bank opacity hypothesis, an increase in equity volatility should make it harder for outside investors to acquire precise information about the firm and, therefore, should lower the relative cost of bank credit to public debt. This implies that the estimate of β_2 should be negative and statistically significant.

We include lagged stock return $r_{i,t-1}$ and the annual stock return volatility measured before the information cost shock, $\sigma_{i,t-5}$, to control for firm credit risk. $Bond_{i,t}$ is a vector of bond-level attributes such as bond rating, indicators for whether a bond is secured, redeemable, with embedded investor options, as well as whether the bond has bondholder-protective or negative-pledge covenants. $Loan_{i,t}$ is a vector of attributes for loans, including indicators for term and secured loans, and the loan amount. The loan-bond pairs are matched on maturity category, that is, short-term, mid-term, and long-term. In addition, we control for the exact difference in maturity between the loan facility and the bond issuance. We include year-by-quarter fixed effects, ψ_t, to control for any macroeconomic factors affecting the differential pricing of loans versus bonds, such as the state of a business cycle or monetary policy shocks. Last, we include fixed effects for lead banks or bank holding companies, ϕ_j, to control for unobserved lender/underwriter time-invariant characteristics that might affect the loan-bond spread.

Firm-level Uncertainty Shock: IV Estimation

The estimated results from Equation (3.1) could be biased if unobserved factors simultaneously affect the change in the firm's equity volatility and the loan-bond spread. For example, the departure of a firm's CEO may result in an increase in stock return volatility and an increase in the loan rate due to the loss of bank relationship at the same time. To isolate the causal effect of information cost shocks driven by factors exogenous to firm fundamentals, we follow Alfaro et al. (2021) and employ an instrumental variable estimation that allows us to capture changes in firm information cost caused by factors orthogonal to unobservable firm characteristics.

We construct instruments for firm uncertainty shocks by exploiting firms' differential exposures to aggregate volatility shocks of multiple variables such as crude oil, currencies, the 10-year U.S. Treasury note, or aggregate economic policy uncertainty. By construction, the instrumented firm-level uncertainty shocks capture the changes in firm stock return volatility that are induced by aggregate uncertainty shocks. For instance, when an aggregate variable, such as the 10-year Treasury note, experiences a volatility shock, firms with different levels of exposure to the 10-year Treasury note will experience different degrees of uncertainty shocks. We first estimate a firm's exposure to each aggregate variable c as the sensitivity of the firm's stock returns to the price changes of the aggregate variable. Then, we construct the instrument variable for each aggregate variable c as the product of the estimated sensitivity and the year-on-year change in the standard deviation of daily price changes for c.[5]

Aggregate volatility shocks are unlikely to be driven by firm characteristics. For this reason, the instruments, by construction, do not correlate with any unobservable firm characteristics. The instruments together are strong predictors of changes in firm-level stock return volatilities. We report the 1st stage results of the 2SLS estimator in Appendix B.3.2. The 2nd stage of the 2SLS estimation studying the impact of information cost shock on the loan-bond spread is:

$$\begin{aligned}(loan-bond)_{it} = \beta_1 + \beta_2 \cdot \widehat{\Delta\sigma}_{i,t-1} + \beta_3 \cdot \sigma_{i,t-5} + \beta_4 \cdot r_{i,t-1} + \beta_5 \cdot Bond_{i,t} + \beta_6 \cdot Loan_{i,t} \\ + \beta_7 Agg^c_{k,t} + \phi_j + \psi_t + \epsilon_{i,j,t},\end{aligned} \tag{3.2}$$

where $\Delta\sigma_{i,t-1}$ is the instrumented firm-level uncertainty measure using the set of instruments. We control for the direct impact of aggregate price changes by including the aggregate first moment effects, $Agg^c_{k,t}$. For each aggregate variable c and industry k, $Agg^c_{k,t}$ is calculated as the product of the estimated sensitivity of industry k to the aggregate variable c and the annual price changes of c. Controlling for $Agg^c_{k,t}$ allows us to isolate the effects of aggregate volatility shocks from the changes in levels of aggregate quantities on firm-level changes in volatility. In this way, the instruments capture only those changes in firm-level volatility that are driven by

[5] See Appendix B.2 for a full description of the construction of instruments.

changes in aggregate volatility shocks, rather than by firm specific characteristics or macroeconomic conditions. Hence, this approach allows us to rule out alternative explanations driven by omitted variables that could generate patterns in the data consistent with our money creation hypothesis. The remaining control variables in Equation (3.2) are the same as in Equation (3.1).

Measuring Firm-level Information Cost Shock using the 9/11 Event

Next, we conduct an event study analysis using the 9/11 shock to see how it affects firms' relative cost of loan vs bond financing. Since the 9/11 uncertainty shock was orthogonal to firm fundamentals, the firm-level equity volatility induced by this shock can be considered an exogenous increase in investors' cost of acquiring information about the firms' assets. Formally, we define a firm's information cost shock as the difference in annualized stock return volatility between the post- and the pre-9/11 period and estimate the impact of this shock on the loan-bond spread using the following equation:

$$(loan-bond)_{i,post} - (loan-bond)_{i,pre} = \beta_1 + \beta_2(\sigma_{i,post} - \sigma_{i,pre}) + X_{i,t} + \phi_j + \psi_t + \epsilon_{i,t}, \quad (3.3)$$

where $(loan-bond)_{i,post} - (loan-bond)_{i,pre}$ is the difference in the loan-bond spreads between the post- and the pre-event. $\sigma_{i,post} - \sigma_{i,pre}$ is the difference in annualized stock return volatility between the post- and the pre-9/11 period. $X_{i,t}$ is the set of controls and includes bond ratings and differences in maturity of the loan-bond pairs. We restrict the sample to loan-bond pairs within [-365, -90] and [90, 365] days around the 9/11 event and define these periods as the pre- and post-shock periods respectively.

Alternative Measures of Information Cost: Opacity Index and Rating Disagreement

We consider two alternative measures of firm information cost. First, we follow Anderson et al. (2009) to construct a firm-level opacity index, which ranks the relative opacity of firms in our sample based on four proxies for opacity: bid-ask spread, trading volume, analyst coverage, and

analyst forecast errors. We rank each firm based on quintiles of each of these four variables. The opacity index is the sum of the rankings based on these four variables, normalized by 20. A higher opacity index indicates larger information asymmetry which should make it more difficult for outside investors to evaluate the firm's assets. Second, we follow Morgan (2002) and define opacity as the difference in ratings assigned to a firm by Standard & Poor's and Moody's. The idea is that if a firm's assets are harder to evaluate, there will be more disagreement among rating agencies about the true value of the firm's assets. Following this argument, we construct two additional proxies for firm opacity shocks. Rating gap measures the absolute difference in ratings assigned to a firm by Standard & Poor's and Moody's. Rating disagreement, an indicator variable which equals one if the rating gap is equal or greater than two and is zero otherwise. This indicator variable captures large bond rating disagreements at issuance. We re-estimate Equation (3.1) using these three variables that measure firm information cost.

3.4 Main Results

3.4.1 Information Cost and the Loan-bond Spread

Firm-level Uncertainty Shock: OLS Estimation Results

Table 3.2 presents estimates for the effect of information cost shocks on the loan-bond spread. Panel A shows results for the OLS estimation based on Equation (3.1). The dependent variable is a firm's relative cost of bank credit, measured as the difference between the loan spread and bond spread on new loans and bonds issued by the firm with the same maturity and at the same time. A negative loan-bond spread indicates that the bank loan is cheaper than public debt. In Panel A, the main independent variable – the information cost shock – is proxied by the firm-level uncertainty shock, measured as year-on-year change in the annualized equity volatility lagged by one quarter from the start of the loan facility.

Columns (1)-(3) report the OLS results controlling for lagged stock returns and the level of

firm opacity, measured as the annualized stock return volatility of the firm prior to the information cost shock. Columns (4)-(6) control for additional loan- and bond-level characteristics that can affect the loan-bond spread as described in Section 3.3.3. We include year-by-quarter fixed effects in all specifications. We also include bank holding company fixed effects and lender fixed effects in columns (2) and (5), and columns (3) and (6), respectively, to control for any variation in the loan-bond spread driven by lender/underwriter time-invariant characteristics.

The coefficient of the information cost shock is negative and statistically significant across all specifications we consider, suggesting that firms whose assets become harder to evaluate receive a discount when borrowing from banks. In terms of magnitudes, results in column (4) imply that a one-standard deviation increase in the information cost shock leads to a discount of 22 bps, which is about 17.8% of the sample average loan-bond spread.[6]

Firm-level Uncertainty Shock: IV Estimation Results

To address the concern that part of the decline in the loan-bond spread in our baseline estimation could be explained by unobservable firm-level factors that simultaneously affect firm-level information cost and the relative pricing of bank and public debt, we present results from the IV estimation.

Panel B of Table 3.2 shows results from the second stage of the IV estimation described in Section 3.3.3. Columns (1)-(3) report the results based on instruments constructed using realized volatility shocks, and columns (4)-(6) report the results based on instruments constructed using aggregate implied volatility shocks. Year and quarter fixed effects are included in all specifications. We include bank holding company fixed effects in columns (2) and (5), and lender fixed effects in columns (3) and (6), respectively, to control for any variation in the loan-bond spread driven by lender/underwriter time-invariant characteristics.

[6]Table 3.2 Panel A also suggests that firms with higher level of opacity pay relatively less for bank credit compared to debt in the public market. Firms with high stock returns secure cheaper funding in the public debt market relative to bank credit. Loans with higher residual maturity than the matched bonds have a higher loan-bond spread. Term loans and secured loans have significantly higher spreads. The positive coefficient of secured loans indicator could reflect the endogenous choice of more risky firms asking for secured credit.

Across all specifications we consider, the IV results are consistent with our main hypothesis. Firms experiencing positive information cost shocks, which are induced by aggregate volatility shocks, receive larger discounts from banks. P-values of the LM underidentification tests and the Sargan-Hansen overidentification tests support the validity of our identification strategy. Results in column (1) and (4) imply that a one-standard deviation increase in the firm information cost shock leads to a discount of 46 bps and 30 bps, respectively, which is larger than the estimate of opacity discount from the baseline analysis.[7] Larger magnitude of the opacity discount in the IV estimation reflects the ability of this estimation strategy to address endogeneity issues that were biasing the estimates downward in our baseline results.[8]

Firm-level Uncertainty Shock: The 9/11 Event Study Results

Panel C of Table 3.2 reports results for the 9/11 event study. We consider the period [-365, -90] days before the 9/11 event as the pre-shock period and the period [90, 365] days after the shock as the post-shock period. The dependent variable is the difference between the loan-bond spread for each firm in the post- and pre-shock period. The main independent variable is the difference between the realized stock return volatility in the post- and the pre-shock period. Realized volatility is calculated using stock returns in the year preceding the loan origination date.

Column (1) does not include any control variables. Columns (2), (3), and (4) include residual difference in maturity of the loan-bond pairs and bond ratings as additional control variables. All columns include year fixed effects. Column (3) includes bank holding company fixed effects and column (4) includes lender fixed effects. We find that, across all specifications we consider,

[7] Magnitudes of the coefficients are smaller in columns (4) to (6) when instruments are constructed using implied volatilities of aggregate variables. Data for daily implied volatility for treasuries (TYVIX) starts in 2003. The instruments are lagged by three years and require one additional year of data to calculate annual average implied volatility. Thus, instruments in columns (4) to (6) are only available after 2007. The magnitudes drop because global systemically important banks offer significantly smaller opacity discounts after the global financial crisis. We discuss this fact in detail in Section 3.4.2.

[8] Coefficients of the control variables are similar to those in the baseline analysis. Loan-bond spreads are lower for firms with low stock returns and high level of opacity. Loan-bond spreads are higher for term loans and secured loans, and bonds with higher ratings.

the coefficient of the post-shock change in firm-level volatility is negative and statistically significant. These results suggest that firms that experienced a larger increase in volatility due to the 9/11 shock had lower loan-bond spreads in the post-shock period relative to the pre-shock period. This finding again lends support to the hypothesis that an increase in the information acquisition cost after the 9/11 event made it harder for outside investors to learn about the firms' fundamentals, which in turn made it relatively easier for banks to fund projects of these firms.

Results using Alternative Measures of Information Cost

Table 3.3 reports results for the OLS regressions of the loan-bond spread on firm information cost proxied using alternative measures. The dependent variable is a firm's relative cost of bank credit, measured as the difference between the loan spread and bond spread on new loans and bonds issued by the firm with the same maturity and at the same time. In columns (1) and (2), we measure information cost using opacity index constructed following Anderson et al. (2009). In columns (3) and (4), information cost is measured as the rating gap between bond ratings by Standard & Poor's and Moody's. In columns (5) and (6), we measure information cost using an indicator variable that equals one if the rating gap is greater or equal to two. All columns include year-by-quarter fixed effects. Columns (1), (3), and (5) include bank holding company fixed effects. Columns (2), (4), and (6) include lender fixed effects. All columns include bond and loan-level control variables as described in Section 3.3.3. Irrespective of how we define the cost of information acquisition, we find that higher information cost are associated with lower loan-bond spread.

3.4.2 Evidence on the Money Creation Channel

So far, our results suggest that firms experiencing information cost shocks are able to obtain cheaper credit from banks relative to raising funds in the public debt market. We argue that this reduction in the cost of bank credit relative to that of public debt is driven by the banks' need

to create money in the form of safe and liquid deposits. In this section, we implement three tests to provide support on this channel by exploiting heterogeneity in banks' need to maintain opacity of their assets that arises due to this channel.

Uninsured Deposits Outflows

According to the financial intermediation theory, the need for banks to maintain opacity should be larger when private money creation is not backed by the government. Specifically, deposit insurance provided by the government on demandable debt produced by banks makes such insured deposits insensitive to information, reducing banks' need to maintain opacity of their assets though lending decisions. Therefore, a higher opacity discount should be offered by banks that create relatively more liquidity in the form of uninsured deposits and when the value of those deposits is under threat. To test this hypothesis, we exploit variation in the ratio of uninsured deposits to total assets across banks and test whether banks with a higher ratio of uninsured deposits offer a larger opacity discount to firms with information cost shocks when they experience deposits outflows. Specifically, we estimate equation:

$$\begin{aligned}(loan-bond)_{i,t} = \beta_1 + \beta_2 \Delta\sigma_{i,t-1} \times Udep_{j,t-5} \times Outflow_{j,t-1} + \beta_3 \cdot \Delta\sigma_{i,t-1} + \beta_4 \cdot \Delta\sigma_{i,t-1} \\ \times Udep_{j,t-5} + \beta_5 \Delta\sigma_{i,t-1} \times Outflow_{j,t-1} + \beta_6 Udep_{j,t-5} + \beta_7 Outflow_{j,t-1} \\ + \beta_8 Udep_{j,t-5} \times Outflow_{j,t-1} + \beta_9 \sigma_{i,t-5} + \beta_{10} r_{i,t-1} + \beta_{11} Bond_{i,t} + \beta_{12} Loan_{i,t} \\ + \phi_j + \psi_t + \epsilon_{i,j,t},\end{aligned} \tag{3.4}$$

where $Outflow_{j,t-1}$ is an indicator variable which equals one if the bank holding company experiences large uninsured deposits outflow in the past year, measured at the quarter before loan origination. We define banks with large uninsured deposits outflow as those in the bottom 5 percentile of the sample, representing an annual decrease in uninsured deposits of more than 25%. $Udep_{j,t-5}$ is the ratio of uninsured deposits to total assets of the bank holding company before the uninsured deposits outflow.

Panel A of Table 3.4 reports the results. In columns (1) and (2), we measure information cost shock using firm-level changes in equity volatility, in columns (3) and (4) information cost is proxied using opacity index following Anderson et al. (2009), and in columns (5) and (6) information cost is measured using the rating gap between bond ratings by Standard & Poor's and Moody's. All columns include year-by-quarter fixed effects. Columns (1), (3), and (5) include bank holding company fixed effects while columns (2), (4), and (6) include lender fixed effects.

Consistent with the baseline results, we find that the coefficient of the information cost is negative and statistically significant across all specifications we consider. Firms receive larger opacity discounts from banks when they experience positive information cost shocks. Furthermore, the coefficient on the interaction term between reliance on uninsured deposits, deposit outflows, and firm information cost shock is negative and statistically significant. This result implies that banks that rely more on uninsured deposits offer larger opacity discount to firms that experience positive information cost shock when the value of those deposits is under threat as proxied by deposit outflows. These results support the view that the economic mechanism driving the baseline results is the money creation channel. Since uninsured deposits are more responsive to negative information about banks' assets, banks that rely more heavily on uninsured deposits have a greater need to maintain opacity, and, hence, they offer larger opacity discounts when they see depositors worrying about the value of their deposits.

Uninsured Deposit Outflows: Evidence using the Money Market Funding Shock

In this section, we refine our evidence on the money creation channel by focusing on deposits outflows that are induced by a shock to investors' confidence in the asset quality of banks. To this end, we use the money market dollar funding shock of April 2011. European banks active in the U.S. raise most of their dollar funding from uninsured sources, such as the commercial paper market while the dollar funding of U.S. banks is mostly sourced from insured retail deposits (Ivashina et al., 2015). In April 2011, money market funds started becoming concerned about European banks' exposure to Greek sovereign debt and they reduced their exposure to

the Eurozone banks in the U.S., which led to uninsured deposit outflows from these banks. We hypothesize that after the money market funding shock, the European banks should offer larger opacity discounts to firms affected by larger information cost shocks since those banks have a greater need to keep information about their assets secret to prevent further withdrawals. We estimate the following equation to test our hypothesis:

$$\begin{aligned}(loan-bond)_{i,t} = \beta_1 + \beta_2 \Delta\sigma_{i,t-1} \times EuropeanBank_j \times Post_t + \beta_3 \cdot \Delta\sigma_{i,t-1} + \beta_4 \cdot \Delta\sigma_{i,t-1} \\ \times EuropeanBank_j + \beta_5 \Delta\sigma_{i,t-1} \times Post_t + \beta_6 EuropeanBank_j + \beta_7 Post_t \\ + \beta_8 EuropeanBank_j \times Post_t + \beta_9 \sigma_{i,t-5} + \beta_{10} r_{i,t-1} + \beta_{11} Bond_{i,t} + \beta_{12} Loan_{i,t} \\ + \phi_j + \psi_t + \epsilon_{i,j,t},\end{aligned} \tag{3.5}$$

where $EuropeanBank_j$ is the fraction of lead European banks in the loan syndicate j and $Post_t$ is an indicator variable that takes a value of one after April 2011. Firm information cost is measured as the year-on-year change in annualized stock return volatility lagged by one quarter before loan origination. All other control variables are the same as in Equation (3.1). We estimate Equation (3.5) on a sample of matched loan facilities and investment-grade bond pairs issued by U.S. non-financial public firms within 60 days between July 2004 to June 2007, and between May 2011 to April 2014. The main coefficient of interest is β_2 which measures the differential impact of firm information cost shock on European banks loan pricing in the post-shock period. Since European banks had a greater need to keep information about their assets secret after the uninsured deposit outflows following the 2011 money market funding shock, we expect European banks to offer larger opacity discounts, which implies a negative β_2.

Panel B of Table 3.4 presents the results. All columns include year-by-quarter fixed effects. Column (1) controls for stock return and volatility while columns (2) and (3) include additional control variables as in Equation (3.1). Column (2) adds bank holding company fixed effects while column (3) includes lender fixed effects. We find that the estimate of β_2 is negative and statistically significant in all specifications we consider. This result suggests that larger opacity discount was offered by European banks to firms whose assets became harder to evaluate in

the post-funding-shock period. This result further suggest that the money creation channel is driving our results.

Difference-in-Differences Analysis of G-SIBs

Similar to the deposit insurance argument above, banks that are deemed to be systemically important should offer lower opacity discounts as the value of their deposit contracts is implicitly backed by the government which makes these contracts information insensitive. To test this hypothesis, we conduct a difference-in-differences analysis employing the classification of global systemically important banks (G-SIBs) following the 2008-09 global financial crisis. To maintain global financial stability, the Financial Stability Board started to publish a list of G-SIBs after the financial crisis. The global systemically important banks receive implicit "too-big-to-fail" guarantees, which should diminish their need to maintain opacity on the asset side of their balance sheet. Hence, these banks should offer lower opacity discounts to firms after they are classified as G-SIBs, compared to non-G-SIBs. We estimate the differential opacity discount offered by G-SIBs vs non-G-SIBs after the global financial crisis using the following regression:

$$\begin{aligned}(loan-bond)_{i,t} = \beta_1 + \beta_2 \Delta\sigma_{i,t-1} \times Non-GSIBs_j \times Post_t + \beta_3 \cdot \Delta\sigma_{i,t-1} + \beta_4 \cdot \Delta\sigma_{i,t-1} \\ \times Non-GSIBs_j + \beta_5 \Delta\sigma_{i,t-1} \times Post_t + \beta_6 Non-GSIBs_j + \beta_7 Post_t \\ + \beta_8 Non-GSIBs_j \times Post_t + \beta_9 \sigma_{i,t-5} + \beta_{10} r_{i,t-1} + \beta_{11} Bond_{i,t} + \beta_{12} Loan_{i,t} \\ + \phi_j + \psi_t + \epsilon_{i,j,t},\end{aligned} \tag{3.6}$$

where $Non-GSIBs_j$ is the fraction of non-global systemically important banks among lead banks in the loan syndicate. $Post_t$ is an indicator variable that equals one if the loan facility starts after November 2009.[9] We exclude the period 2007-08 from the analysis.

Panel C of Table 3.4 reports estimates from Equation (3.6). All columns include year-by-quarter fixed effects. Column (1) controls for stock return and volatility while columns (2)

[9]Although the list of G-SIBs was officially published in 2011, an "unofficial" list of G-SIBs was leaked in November 2009.

and (3) include additional control variables as in Equation (3.1). Column (2) has bank holding company fixed effects while column (3) includes lender fixed effects. Consistent with the baseline results, we find that the coefficient of the information cost is negative and statistically significant across all specifications we consider. The estimates of difference-in-differences coefficients β_2 are negative in all specifications we consider and are statistically significant in columns (1) and (3). This result suggests that Non-G-SIBs offer larger opacity discounts compared to G-SIBS after 2009. In terms of economic magnitude, after the Financial Stability Board published the list of globally systemically important banks, non-G-SIBs offer 75 bps larger opacity discounts than G-SIBs when there is one standard deviation increase in firm information cost shock. The results are consistent with the bank opacity channel of money creation: the implicit government guarantee on deposits offered to G-SIBs after the 2008-09 crisis implied that these banks have less incentives to maintain opacity on their asset side after the global financial crisis. In other words, G-SIBs offer lower discounts when lending to opaque firms.

3.5 Alternative Explanations and Robustness Tests

3.5.1 Alternative Explanations

In this section, we discuss and rule out multiple other channels that could explain our main results.

Relationship Lending

A large literature has documented that relationship lending can affect the quantity and cost of bank financing for firms (Petersen and Rajan, 1994). Firms with longer bank relationships pay lower interest rates (Berger and Udell, 1995) and, in crisis times, firms are able to receive cheaper bank credit from relationship banks compared to banks with which firms have only transaction lending relationships (Bolton et al., 2016). Following these arguments, one can argue that the lower loan-bond spread in response to firm information cost shock is driven by relationship

lending and not by the money creation channel.

To test this hypothesis, we construct two measures of relationship lending at the firm level and examine whether the opacity discount offered by banks differs by the strength of lending relationship. Our first measure of lending relationship is an indicator variable that takes a value of one if a firm has received a loan from the lead bank in the past two years and is zero otherwise. The second measure is a continuous measure of the strength of lending relationship and is constructed as the natural logarithm of the number of years since the start of the relationship between the firm and the lead bank.

We re-estimate Equation (3.1) interacting the information cost with our measures of lending relationship. Results are presented in Table 3.5. In columns (1) and (2), we measure information cost shocks using firm-level changes in equity volatility, in columns (3) and (4) information cost is proxied using opacity index following Anderson et al. (2009), and in columns (5) and (6) information cost is measured as the rating gap between bond ratings by Standard & Poor's and Moody's. All columns include year-by-quarter fixed effects. Columns (1), (3), and (5) include bank holding company fixed effects while columns (2), (4), and (6) include lender fixed effects.

Panel A of Table 3.5 shows results for the discrete measure of lending relationship and Panel B shows the results for the continuous measure. We find that across all specifications we consider, the coefficient of the information cost is negative and statistically significant, consistent with the baseline results. The coefficients of the interaction term between relationship lending and the information cost are not statistically different from zero in most specifications. For the opacity index measure in Panel A, the coefficients of the interaction term are positive and statistically significant, which is inconsistent with relationship lending leading to opacity discount. Overall, the evidence suggests that there is no difference in the opacity discount received by firms with and without prior bank relationships. This finding, therefore, alleviates the concern that our results are driven by relationship lending.

Changes in Demand for Bank Credit

Can active switching between bank credit and bonds by firms over business cycles explain our results? Becker and Ivashina (2014) finds that firms substitute bonds for loans at times with depressed aggregate lending and tight lending criteria. We argue that this substitution between bank loans and bonds over the business cycle does not affect our results since we control for year-by-quarter fixed effects. Our main finding is that in the cross-section of firms, a higher information cost shock is associated with relatively lower cost of bank credit.

Can the negative relationship between the loan-bond spread and firm information cost in the cross-section of firms be driven by changes in firm demand for credit when firms are hit by information cost shocks? For example, it is possible that firms that experience larger volatility in their stock returns lower their demand for bank credit and increase their demand for public debt. This relative fall in demand for bank credit may translate into a lower cost of bank credit and a higher cost of public debt and may thereby generate a negative relationship between firm opacity and the loan-bond spread. We argue and show evidence suggesting that this channel cannot explain our results.

The argument that the impact of lower demand for bank credit translates into a lower cost of bank credit is more likely to be valid for the aggregate cost of bank credit in the economy and not for individual firms, which take the price of loans as given. A change in the demand for bank credit by one firm should not significantly affect the cost of credit for that firm. However, one can still argue that a lower volume of bank credit demanded by a firm might be associated with a lower loan spread. If this is true, and if firms actively switch to public debt when they are hit by an information cost shock, we should see a fall in the share of bank loans to the total credit by firms that experience positive information cost shocks. We test this hypothesis formally using the regression in Equation (3.1) with $LoanShare_{i,t}$ as the dependent variable. $LoanShare_{i,t}$ is defined as the share of bank borrowing in the total amount borrowed by a firm from the banking sector and the public debt market combined.

Table 3.6 presents the results from the regression of bank loan share on information cost. In columns (1) and (2), we measure information cost shock using firm-level changes in equity volatility, in columns (3) and (4) information cost is proxied using opacity index following Anderson et al. (2009), and in columns (5) and (6) information cost is measured as the rating gap between bond ratings by Standard & Poor's and Moody's. All columns include year-by-quarter fixed effects. Columns (1), (3), and (5) include bank holding company fixed effects while columns (2), (4), and (6) include lender fixed effects. Table 3.6 shows that the impact of information cost on the loan share is close to zero and statistically insignificant for firm-level changes in equity volatility and rating gap and is positive and statistically significant for the opacity index measure. This evidence suggests that there is no loan-bond switching when firms experience information cost shocks or that the share of bank loans to the total credit increases with information cost in our sample, which is inconsistent with changes in firm demand for credit explaining our results. Overall, we conclude that the fall in the loan-bond spread is unlikely to be driven by compositional changes in demand or supply of bank credit.

Bank Allocation in Loan Syndicates

Another alternative explanation of our results is that banks may participate less in loan syndicates when borrowers are opaque, which may lower their exposure and thereby lower their cost of lending to such borrowers. To investigate this alternative hypothesis, we examine the effects of firm information cost on bank participation in loan syndicates using the regression in Equation (3.1) with $BankFraction_{i,t}$ or $BankAllocation_{i,t}$ as the dependent variables. $BankFraction_{i,t}$ is the number of bank lenders in a loan syndicate divided by total number of lenders in the syndicate. $BankAllocation_{i,t}$ is the percentage of total loan amount bank lenders have committed to a loan facility.

The results are reported in Table 3.7. The dependent variable in columns (1), (3), and (5) is $BankAllocation_{i,t}$, and the dependent variable in column (2), (4), and (6) is $BankFraction_{i,t}$. In columns (1) and (2), we measure information cost shock using firm-level changes in equity

volatility, in columns (3) and (4) information cost is proxied using opacity index following Anderson et al. (2009), and in columns (5) and (6) information cost is measured as the rating gap between bond ratings by Standard & Poor's and Moody's. All columns include year-by-quarter fixed effects. We find no or positive relationship between information cost and the measures of bank participation in loan syndicates, which is inconsistent with the possibility that our results can be due to changes in bank allocation in loan syndicates.

3.5.2 Robustness Tests

In this section, we discuss the results of a series of robustness tests. The results are presented in Appendix B.3. First, we re-estimate Equation (3.1) using alternative samples. In Panel A of Table B.3.3, we exclude the global financial crisis (years 2007-09) from the sample. In Panels B and C, we restrict our sample to the loan-bond pairs issued by the same firm within 30 days and 10 days, respectively. In Panel D, we relax the restriction on maturity when matching loan-bond pairs. In Panel E, we match the loan-bond pairs based on effective maturity instead of maturity. In Panel F, we re-stimate the results from Panels A through E using the opacity index, rating gap, and the rating disagreement measures. Overall, the evidence presented in Table B.3.3 shows that our results are robust to all these alternative ways we construct the sample and suggests that our findings are thus unlikely to be driven by any specific sample selection procedure.

Second, we re-estimate Equation (3.1) with alternative sets of control variables. Panel A of Table B.3.4 reports the results controlling for a full set of firm, loan and bond characteristics, such as firm profitability, distance to default, and various bond terms. These results suggests that our baseline findings are robust to including a wide variety of characteristics that could affect the loan-bond spread. Panel B excludes stock return as a control variable from the regressions. Panel C excludes stock return volatility from the regressions with alternative information cost measures. The results in Panel B and C suggests that our results are not driven by the correlation between information costs, stock return, and stock return volatility.

Lastly, we re-estimate Equation (3.4) using alternative regression specifications. Uninsured

deposits may be correlated with bank size. To ensure our results are not driven by the comparative advantage of big banks lending to large firms, we control for size of the bank holding company or the borrower in Table B.3.5 Panel A and B, respectively. In Table B.3.5 Panel C, we exclude stock return volatility as a control variable to address the concern that the opacity index or rating disagreement measures may be correlated with stock return volatility. Results in Table B.3.5 suggest that our results are robust to all these the alternative regression specifications.

3.6 Conclusion

This chapter shows that the need for banks to be opaque to support their primary function of private money creation translates into a lower cost of bank credit compared to public debt for firms that experience information cost shocks. By using a unique sample design that facilitates within firm comparison of the cost of bank credit and public bonds at issuance, we are able to rule out firm-specific factors, such as credit risk, that could affect the relative cost of bank credit and public bonds.

The chapter contributes to the literature by not only providing empirical evidence on one of the core theories of financial intermediation but also documenting the potential benefits of endogenous bank opacity, which could guide the ongoing debate on disclosure of stress test results. Our results show that the cost advantage for banks to finance opaque borrowers is passed on to opaque firms through a lower cost of bank credit relative to that of public debt. The results from our analyses can also guide government intervention policies during periods of heightened economic uncertainty, such as the ongoing pandemic. Higher uncertainty increases firms' overall borrowing cost, but leads to a smaller increase in the cost of bank credit. Support for corporate sector in times of economic uncertainty may be more effective if an additional dollar of government support is intermediated through the banking sector rather than through the public capital market.

Figure 3.1 The Loan-Bond Spread: 1995-2020

The figure plots the average cost of bank credit, public debt, and the relative cost of bank credit for firms in our sample over the period 1995-2020. The relative cost of bank credit – the loan-bond spread – is measured as the difference between the loan rate and the bond yield on new loans and bonds with the same maturity issued by the same firm at the same time. The shaded vertical bars represent NBER recessions.

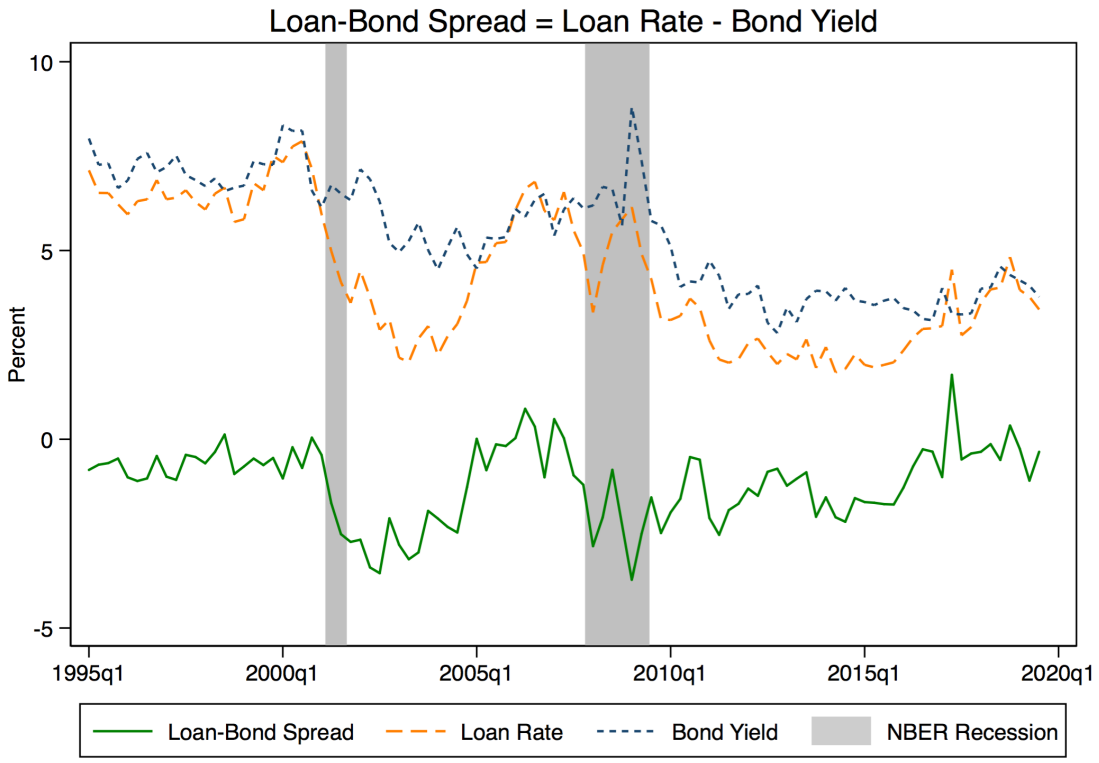


Figure 3.2 The Loan-Bond Spread across Firm Information Cost Shock Quartiles

The figure illustrates the average cost of bank credit, public debt, and the relative cost of bank credit for firms in different quartiles of the information cost shock, where the information cost shock is measured using changes in firm-level stock return volatility. The loan rate and the bond yield are residuals from a regression of loan rate and bond yield on maturity, firm equity return volatility, and year fixed effects. The relative cost of bank credit – the loan-bond spread – is measured as the difference between the loan rate residual and the bond yield residual on new loans and bonds with the same maturity issued by the same firm at the same time.

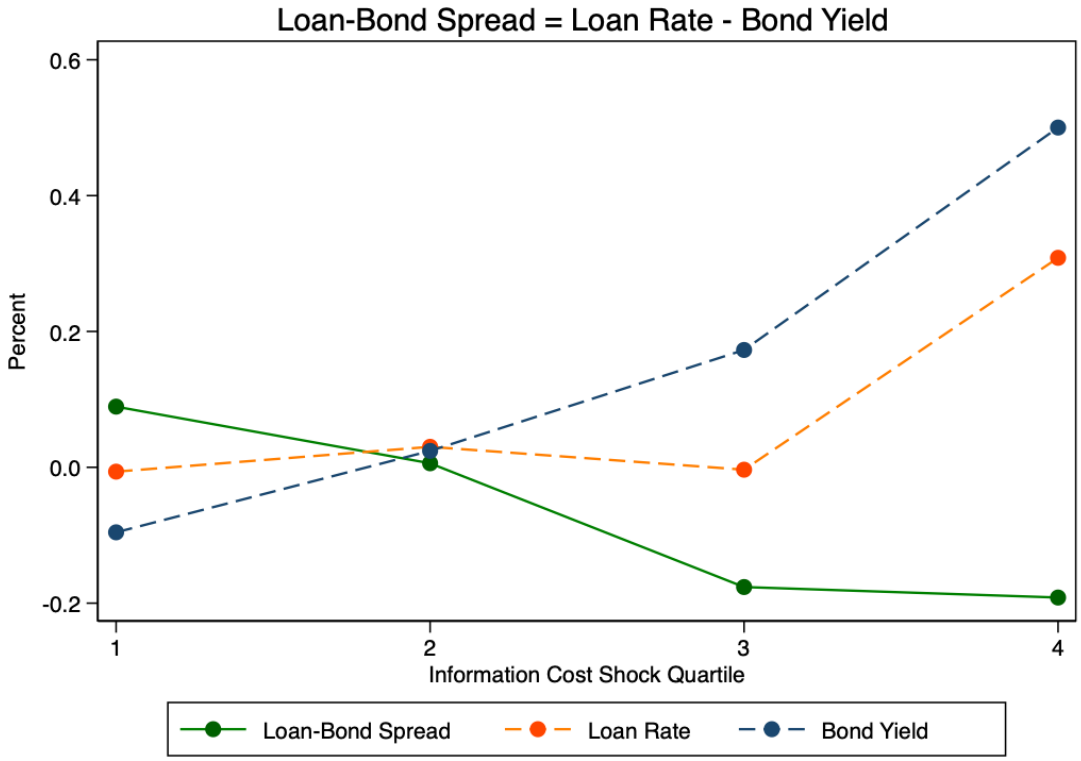


Table 3.1 Summary Statistics

The table reports summary statistics for the main variables used in the empirical analysis. The sample includes new loan facilities and investment-grade bonds issued by U.S. non-financial public firms from 1995 to 2019. The sample is restricted to senior loans and bonds denominated in USD. Each loan is paired with the closest bond issued by the same firm within 60 days. We further restrict the loan-bond pairs to those with the same maturity category, i.e. short-term, mid-term or long-term in maturity. See Appendix B.1 for variable definitions.

	Mean	SD	p10	p50	p90	Observations
Loan-Bond Pair Characteristics						
Loan-bond Spread (bps)	-123	152	-314	-112	35	1,597
Total Borrowing ($MM)	1,980	1,785	500	1,425	4,000	1,597
Δ Maturity (years)	-9.18	10.42	-25.07	-5.03	-0.01	1,567
Loan Share	0.61	0.21	0.29	0.65	0.85	1,597
Information Cost						
Uncertainty Shock	-0.03	0.29	-0.42	-0.02	0.32	1,597
Opacity Index	0.61	0.16	0.4	0.6	0.8	1565
Rating Gap	0.61	0.71	0	0	2	1,217
Rating Disagreement	0.10	0.31	0	0	1	1,217
Firm Characteristics						
Volatility	0.28	0.12	0.16	0.25	0.43	1,597
Stock Return	0.16	0.29	-0.16	0.14	0.48	1,597
Total Assets ($B)	1,413	889	242	1,458	2,466	1,072
Profitability	0.04	0.02	0.02	0.03	0.06	1,558
Implied Prob. Default	0.00	0.03	0.00	0.00	0.00	1,525
No. of Loan-Bond Pairs per Firm	3.86	3.52	1	3	9	1,597
Loan Characteristics						
Facility Amount ($MM)	1,340	1,391	150	1,000	3,000	1,597
All-in-drawn Spread (bps)	117	90	27	110	200	1,597
Syndicated Loan	0.99	0.08	1	1	1	1,597
Term Loan	0.17	0.37	0	0	1	1,597
Secured Loan	0.15	0.36	0	0	1	972
Bond Characteristics						
Face Value ($MM)	639	628	200	500	1,250	1,597
Bond Spread (bps)	497	233	259	475	740	1,597
Bond Rating	BBB+	1.87	BBB-	BBB	A	1,597
Secured Bond	0.03	0.17	0	0	0	1,597
Redeemable Bond	0.89	0.32	0	1	1	1,597
Embedded Investor Option	0.27	0.44	0	0	1	1,597
Bondholder Protective Covenant	0.64	0.48	0	1	1	1,597
Negative Pledge Covenant	0.66	0.48	0	1	1	1,597

Table 3.2 Firm Information Cost Shock and the Loan-Bond Spread

Panel A. OLS Estimation

The table reports results from the OLS regression of the loan-bond spread on firm uncertainty shock, estimated using Equation (3.1). The sample includes matched loan facilities and investment-grade bond pairs issued by U.S. non-financial public firms within 60 days from 1995 to 2019. The dependent variable is the difference between loan rate and bond yield for each matched loan-bond pair in the sample. Uncertainty shock is the year-on-year change in the annualized stock return volatility lagged by one quarter before the loan origination. All columns include year by quarter fixed effects. Column (2) and (5) include bank holding company fixed effects. Column (3) and (6) include lender fixed effects. Columns (4)-(6) include contract-level control variables. See Appendix B.1 for variable definitions. The standard errors (in parentheses) are clustered at firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Uncertainty Shock	-0.62**	-0.63***	-0.52**	-0.83***	-0.70***	-0.76***
	(0.27)	(0.23)	(0.20)	(0.30)	(0.25)	(0.23)
Volatility	-2.29***	-1.57***	-1.60***	-2.65***	-2.16***	-2.31***
	(0.66)	(0.53)	(0.52)	(0.59)	(0.58)	(0.56)
Stock Return	0.53***	0.42**	0.47***	0.71***	0.58***	0.45***
	(0.20)	(0.17)	(0.16)	(0.24)	(0.18)	(0.16)
Log Total Borrowing				-0.03	-0.21	-0.24
				(0.17)	(0.20)	(0.20)
Δ Maturity (years)				0.06***	0.06***	0.06***
				(0.00)	(0.00)	(0.00)
Term Loan				0.34***	0.22**	0.23***
				(0.12)	(0.10)	(0.08)
Secured Loan				1.07***	0.67***	0.55***
				(0.27)	(0.19)	(0.17)
Log Facility Amount				-0.16	0.06	0.13
				(0.11)	(0.14)	(0.15)
Bond Rating				0.19***	0.19***	0.17***
				(0.04)	(0.04)	(0.04)
Secured Bond				-0.60**	-0.25	-0.11
				(0.26)	(0.26)	(0.22)
Redeemable Bond				0.12	0.15	0.29
				(0.23)	(0.23)	(0.20)
Embedded Investor Option				-0.14	-0.00	-0.07
				(0.11)	(0.10)	(0.11)
Bondholder Protective Covenant				-0.03	-0.08	-0.06
				(0.12)	(0.12)	(0.11)
Negative Pledge Covenant				-0.17	-0.18*	-0.23**
				(0.11)	(0.10)	(0.10)
Year×Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Holding Company FE	No	Yes	No	No	Yes	No
Lender FE	No	No	Yes	No	No	Yes
Adjusted R^2	0.36	0.43	0.52	0.63	0.68	0.73
Observations	1,597	1,338	1,588	963	838	960

Panel B. Second Stage of the IV Estimation

The table reports the results from the IV regression of the loan-bond spread on firm uncertainty shocks. The sample includes matched loan facilities and investment-grade bond pairs issued by U.S. non-financial public firms within 60 days from 1995 to 2019. The dependent variable is the difference between loan rate and bond yield for each matched loan-bond pair in the sample. Uncertainty shock is the year-on-year change in the annualized stock return volatility lagged by one quarter before loan origination, instrumented using volatility shocks for macro variables. In columns (1)-(3), the instruments are calculated using realized volatility shocks. In columns (4)-(6), the instruments are calculated using implied volatility shocks. All columns include year and quarter fixed effects. Column (2) and (5) include bank holding company fixed effects. Column (3) and (6) include lender fixed effects. See Appendix B.1 for variable definitions. The standard errors (in parentheses) are clustered at 3-digit SIC level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Realized Volatility Instruments			Implied Volatility Instruments		
	(1)	(2)	(3)	(4)	(5)	(6)
Uncertainty Shock	-2.72**	-3.79***	-2.83**	-1.30**	-1.58**	-1.57**
	(1.17)	(1.10)	(1.28)	(0.66)	(0.69)	(0.76)
Volatility	-3.91***	-4.51***	-3.51***	-3.03***	-2.14***	-2.29***
	(1.30)	(1.18)	(1.34)	(0.74)	(0.70)	(0.75)
Stock Return	0.79***	0.87***	0.66***	0.50*	0.31	0.27
	(0.25)	(0.27)	(0.23)	(0.28)	(0.26)	(0.20)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Year, Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Holding Company FE	No	Yes	No	No	Yes	No
Lender FE	No	No	Yes	No	No	Yes
Adjusted R^2	0.55	0.51	0.65	0.70	0.76	0.81
Observations	797	750	794	515	482	513
P-value LM underidentification	0.04	0.01	0.04	0.01	0.01	0.02
F-statistic CD	3.21	4.56	2.50	4.18	4.09	4.38
P-value-SarganHJ	0.199					

Panel C. 9/11 Event Study

The table reports the results of the 9/11 event study. The sample includes loan facility and investment-grade bond pairs issued by U.S. non-financial public firms in the pre- [-365d, -90d] and the post-9/11 period [90d, 365d]. The dependent variable is the difference between the loan-bond spread in the post 9/11 period and that in the pre 9/11 period. The independent variable is the difference between realized firm stock return volatility in the post-9/11 period and that in the pre-9/11 period. Realized volatility is calculated using stock returns in the year preceding the loan staring date. All columns include year fixed effects. Column (3) includes bank holding company fixed effects, and column (4) includes lender fixed effects. See Appendix B.1 for variable definitions. The standard errors (in parentheses) are clustered at firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
$\text{Volatility}_{\text{Post-9/11 - Pre-9/11}}$	-3.67*	-4.11**	-5.61***	-5.15***
	(1.75)	(1.78)	(1.35)	(0.21)
Δ Maturity (Pre-9/11 Loan-bond Pair)		0.00	-0.02	-0.03***
		(0.04)	(0.02)	(0.00)
Δ Maturity (Post-9/11 Loan-bond Pair)		-0.02	-0.07	-0.09
		(0.05)	(0.04)	(0.08)
Pre-9/11 Bond Rating		-0.80	1.19	1.74
		(1.31)	(0.83)	(1.24)
Post-9/11 Bond Rating		0.86	-1.62	-2.27
		(1.54)	(1.02)	(1.59)
Year FE	Yes	Yes	Yes	Yes
Bank Holding Company FE	No	No	Yes	No
Lender FE	No	No	No	Yes
Adjusted R^2	0.61	0.59	0.83	0.95
Observations	47	47	47	47

Table 3.3 Firm Information Cost and the Loan-Bond Spread: Alternative Measures

The table reports results from the OLS regressions of the loan-bond spread on firm information cost, where firm information cost is estimated using alternative proxies. The sample includes matched loan facilities and investment-grade bond pairs issued by U.S. non-financial public firms within 60 days from 1995 to 2019. The dependent variable is the difference between loan rate and bond yield for each matched loan-bond pair in the sample. In columns (1) and (2), firm information cost is measured using the opacity index following Anderson et al. (2009) In columns (3) and (4), information cost is measured as the rating gap, defined as the absolute rating gap between a firm's bond ratings by Standard & Poor's and Moody's. In columns (5) and (6), information cost is measured using a rating disagreement dummy variable that equals one if the rating gap is greater or equal to two. All columns include year by quarter fixed effects. Column (1), (3) and (5) include bank holding company fixed effects. Column (2), (4) and (6) include lender fixed effects. Contract level control variables are included in all columns. See Appendix B.1 for variable definitions. The standard errors (in parentheses) are clustered at firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Opacity Index		Rating Gap		Rating Disagreement	
	(1)	(2)	(3)	(4)	(5)	(6)
Information Cost	-1.17***	-1.14***	-0.17***	-0.18***	-0.52***	-0.49***
	(0.36)	(0.36)	(0.06)	(0.06)	(0.17)	(0.16)
Volatility	-1.05*	-1.25**	-1.85***	-1.95***	-2.10***	-2.18***
	(0.60)	(0.58)	(0.62)	(0.63)	(0.64)	(0.64)
Stock Return	0.56***	0.52***	0.47**	0.41**	0.49**	0.43**
	(0.18)	(0.17)	(0.20)	(0.19)	(0.20)	(0.19)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Year×Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Holding Company FE	Yes	No	Yes	No	Yes	No
Lender FE	No	Yes	No	Yes	No	Yes
Adjusted R^2	0.69	0.73	0.68	0.73	0.69	0.74
Observations	823	945	675	736	675	736

Table 3.4 Money Creation Mechanism

The table presents evidence of the money creation mechanism. The dependent variable is the difference between loan rate and bond yield for each matched loan-bond pair in the sample. All columns include year by quarter fixed effects. Control variables are included in all columns. See Appendix B.1 for variable definitions. The standard errors (in parentheses) are clustered at firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Uninsured Deposits Outflow and the Loan-Bond Spread

The table presents evidence of the economic mechanism using heterogeneity in banks' reliance on uninsured deposits. The sample includes matched loan facilities and investment-grade bond pairs issued by U.S. non-financial public firms within 60 days from 1995 to 2019. Uncertainty shock is the year-on-year change in the annualized stock return volatility lagged by one quarter before the loan origination. Opacity index is constructed following Anderson et al.(2009). Rating gap is the absolute rating gap between bond ratings by Standard & Poor's and Moody's. Outflow is a dummy variable which equals to one if the bank experiences large uninsured deposits outflow in the past year (banks in the bottom 5 percentile of the sample in terms of changes in uninsured deposits, representing a decrease in uninsured deposits of more than 25%), lagged by one quarter before loan origination. Udep is the ratio of uninsured deposits to total assets of the bank holding company before the uninsured deposits outflow. All columns include year by quarter fixed effects. Column (1), (3) and (5) include bank holding company fixed effects. Column (2), (4) and (6) include lender fixed effects.

	Uncertainty Shock		Opacity Index		Rating Gap	
	(1)	(2)	(3)	(4)	(5)	(6)
Info. Cost × Udep × Outflow	-2.82**	-2.54***	-3.29***	-3.37***	-1.13***	-1.06***
	(1.21)	(0.95)	(1.20)	(0.97)	(0.26)	(0.21)
Info. Cost	-0.89***	-1.03***	-1.38***	-1.51***	-0.20***	-0.17***
	(0.25)	(0.25)	(0.38)	(0.42)	(0.06)	(0.06)
Info. Cost × Udep	-0.35*	-0.63***	-0.71**	-0.60*	0.11*	0.23***
	(0.20)	(0.20)	(0.35)	(0.31)	(0.06)	(0.08)
Info. Cost × Outflow	-0.09	0.69	0.48	1.44	-0.33	-0.18
	(0.96)	(0.85)	(1.18)	(1.17)	(0.29)	(0.32)
Udep	0.30*	0.45***	0.72**	0.82***	0.27**	0.25*
	(0.16)	(0.16)	(0.28)	(0.26)	(0.13)	(0.15)
Outflow	1.29**	2.14***	-0.22	-0.49	1.71*	2.37**
	(0.55)	(0.45)	(0.85)	(0.84)	(0.98)	(0.95)
Udep × Outflow	-0.51	-0.41	1.92***	2.09***	1.36***	1.33***
	(0.34)	(0.26)	(0.72)	(0.56)	(0.23)	(0.22)
Volatility	-2.08***	-2.38***	-0.61	-0.91	-1.73***	-2.07***
	(0.56)	(0.55)	(0.58)	(0.57)	(0.58)	(0.59)
Stock Return	0.66***	0.54***	0.65***	0.56***	0.59***	0.55***
	(0.19)	(0.19)	(0.18)	(0.18)	(0.19)	(0.19)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Year×Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Holding Company FE	Yes	No	Yes	No	Yes	No
Lender FE	No	Yes	No	Yes	No	Yes
Adjusted R^2	0.65	0.68	0.65	0.67	0.65	0.67
Observations	760	761	749	750	607	607

Panel B. Uninsured Deposits Outflow and the Loan-Bond Spread: European Banks after the Money Market Funding Shock

The table reports the opacity discount offered by European banks after the dollar funding shock in April 2011. The sample includes matched loan facilities and investment-grade bond pairs issued by U.S. non-financial public firms within 60 days between July 2004 to June 2007, and between May 2011 to April 2014. Uncertainty shock is the year-on-year change in the annualized stock return volatility lagged by one quarter before loan origination. Post is a dummy variable that equals to one if the loan facility starts between May 2011 to April 2014, and zero otherwise. European Bank is the fraction of European banks among lead banks in a loan syndicate. Column (2) includes bank holding company fixed effects, and column (3) includes lender fixed effects.

	(1)	(2)	(3)
Uncertainty Shock × European Bank × Post	-5.77**	-9.78***	-7.69*
	(2.22)	(3.17)	(3.90)
Uncertainty Shock	-0.79	-0.51	-0.84
	(0.66)	(0.74)	(0.93)
Uncertainty Shock × European Bank	4.09**	5.86***	4.30
	(1.80)	(2.11)	(2.66)
Uncertainty Shock × Post	-0.59	0.53	0.67
	(0.99)	(0.87)	(1.11)
European Bank	0.90	0.75	1.10
	(0.58)	(0.70)	(0.78)
Post	0.56	0.16	0.26
	(0.64)	(0.48)	(0.74)
European Bank × Post	-1.13	-1.26	-2.10**
	(0.78)	(0.85)	(1.00)
Volatility	-1.51	0.15	-0.92
	(1.39)	(1.17)	(1.32)
Stock Return	0.68	0.42	0.66*
	(0.43)	(0.32)	(0.36)
Control Variables	Yes	Yes	Yes
Year×Quarter FE	Yes	Yes	Yes
Bank Holding Company FE	No	Yes	No
Lender FE	No	No	Yes
Adjusted R^2	0.59	0.62	0.68
Observations	296	285	295

Panel C. Loan-Bond Spread by Non-Global Systemically Important Banks (non-GSIBs)

The table reports the opacity discount offered by non-global systemically important banks (non-GSIBs) after November 2009. The sample includes matched loan facilities and investment-grade bond pairs issued by U.S. non-financial public firms within 60 days from 1995 to 2019, excluding 2007-08. Uncertainty shock is the year-on-year change in the annualized stock return volatility lagged by one quarter before loan origination. Post is a dummy variable that equals to one if a loan facility starts after November 2009, and zero otherwise. Non-GSIBs is the fraction of non-global systemically important banks among lead banks in the loan syndicate. Column (2) includes bank holding company fixed effects, and column (3) includes lender fixed effects.

	(1)	(2)	(3)
Uncertainty Shock × Non-GSIBs × Post	-4.38***	-1.79	-4.48**
	(1.10)	(1.90)	(2.14)
Uncertainty Shock	-1.37***	-1.46***	-1.86***
	(0.43)	(0.51)	(0.49)
Uncertainty Shock × Non-GSIBs	0.97	-0.87	0.99
	(0.76)	(1.39)	(1.33)
Uncertainty Shock × Post	1.43**	1.66**	1.91***
	(0.56)	(0.70)	(0.65)
Non-GSIBs	1.06***	0.67	0.52
	(0.28)	(0.45)	(0.45)
Post	1.91***	0.09	1.84***
	(0.48)	(0.75)	(0.55)
Non-GSIBs × Post	-2.12***	-0.96*	-0.81*
	(0.33)	(0.50)	(0.47)
Volatility	-2.55***	-2.52***	-3.02***
	(0.74)	(0.84)	(0.83)
Stock Return	0.32	0.52*	0.41
	(0.22)	(0.28)	(0.26)
Control Variables	Yes	Yes	Yes
Year×Quarter FE	Yes	Yes	Yes
Bank Holding Company FE	No	Yes	No
Lender FE	No	No	Yes
Adjusted R^2	0.68	0.64	0.72
Observations	551	480	551

Table 3.5 Relationship Lending and the Loan-Bond Spread

The table reports the results examining the alternative hypothesis of relationship lending and the opacity discount. The sample includes matched loan facilities and investment-grade bond pairs issued by U.S. non-financial public firms within 60 days from 1995 to 2019. Uncertainty shock is the year-on-year change in the annualized stock return volatility lagged by one quarter before the loan origination. Opacity index is constructed following Anderson et al.(2009). Rating gap is the absolute rating gap between bond ratings by Standard & Poor's and Moody's. All columns include year by quarter fixed effects. Column (1), (3) and (5) include bank holding company fixed effects. Column (2), (4) and (6) include lender fixed effects. Control variables are included in all columns. See Appendix B.1 for variable definitions. The standard errors (in parentheses) are clustered at firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Relationship Lending Measured by Previous Lending Relationship

Relationship in Panel A is a dummy variable which equals one if a firm had received a loan from the lead bank in the past two years, and zero otherwise.

	Uncertainty Shock		Opacity Index		Rating Gap	
	(1)	(2)	(3)	(4)	(5)	(6)
Info. Cost	-0.82***	-0.79***	-1.71***	-1.45***	-0.16*	-0.17*
	(0.29)	(0.27)	(0.46)	(0.45)	(0.09)	(0.09)
Info. Cost × Relationship	0.17	-0.01	1.36**	1.02*	-0.03	0.01
	(0.31)	(0.29)	(0.60)	(0.61)	(0.13)	(0.12)
Relationship	-0.21**	-0.23**	-1.03***	-0.82**	-0.09	-0.16
	(0.09)	(0.09)	(0.40)	(0.40)	(0.13)	(0.12)
Volatility	-2.20***	-2.35***	-1.21**	-1.38**	-1.84***	-1.92***
	(0.57)	(0.55)	(0.59)	(0.57)	(0.62)	(0.63)
Stock Return	0.60***	0.49***	0.61***	0.55***	0.49**	0.43**
	(0.18)	(0.16)	(0.17)	(0.17)	(0.20)	(0.19)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Year×Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Holding Company FE	Yes	No	Yes	No	Yes	No
Lender FE	No	Yes	No	Yes	No	Yes
Adjusted R^2	0.68	0.74	0.69	0.74	0.68	0.74
Observations	838	960	823	945	675	736

Panel B. Relationship Lending Measured by Log Years since the First Loan

Relationship in Panel B is the natural log of one plus the number of years since the first loan with the lead bank.

	Uncertainty Shock		Opacity Index		Rating Gap	
	(1)	(2)	(3)	(4)	(5)	(6)
Info. Cost	-0.96***	-0.85***	-1.06**	-1.04*	-0.21*	-0.19*
	(0.32)	(0.33)	(0.51)	(0.54)	(0.11)	(0.11)
Info. Cost × Relationship	0.23	0.07	-0.10	-0.09	0.03	0.01
	(0.16)	(0.15)	(0.30)	(0.30)	(0.06)	(0.06)
Relationship	0.00	-0.05	0.04	0.01	-0.03	-0.07
	(0.06)	(0.05)	(0.20)	(0.20)	(0.07)	(0.07)
Volatility	-2.22***	-2.38***	-1.07*	-1.27**	-1.83***	-1.98***
	(0.59)	(0.57)	(0.60)	(0.58)	(0.64)	(0.64)
Stock Return	0.59***	0.45***	0.55***	0.50***	0.48**	0.40**
	(0.18)	(0.17)	(0.18)	(0.17)	(0.20)	(0.19)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Year×Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Holding Company FE	Yes	No	Yes	No	Yes	No
Lender FE	No	Yes	No	Yes	No	Yes
Adjusted R^2	0.68	0.73	0.68	0.73	0.68	0.73
Observations	838	960	823	945	675	736

Table 3.6 Information Cost and Loan Share

The table reports the results of the OLS regression of the proportion of bank loans to the total amount of borrowing on firm information cost. The dependent variable is loan facility amount as a proportion of total borrowing, measured as the sum of the loan volume and the face value of the bond. Uncertainty shock is the year-on-year change in the annualized stock return volatility lagged by one quarter before the loan origination. Opacity index is constructed following Anderson et al.(2009). Rating gap is the absolute rating gap between bond ratings by Standard & Poor's and Moody's. All columns include firm fixed effects, and year by quarter fixed effects. Column (1), (3) and (5) include bank holding company fixed effects. Column (2), (4) and (6) include lender fixed effects. Control variables are included in all columns. See Appendix B.1 for variable definitions. The standard errors (in parentheses) are clustered at firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Uncertainty Shock		Opacity Index		Rating Gap	
	(1)	(2)	(3)	(4)	(5)	(6)
Information Cost	0.02	0.01	0.20**	0.14*	0.01	-0.00
	(0.04)	(0.03)	(0.08)	(0.08)	(0.02)	(0.02)
Volatility	0.34**	0.16*	0.27*	0.02	0.11	0.12
	(0.14)	(0.09)	(0.15)	(0.11)	(0.26)	(0.24)
Stock Return	-0.06*	-0.05	-0.07**	-0.05*	-0.05	-0.01
	(0.03)	(0.03)	(0.03)	(0.03)	(0.05)	(0.06)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Year×Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Holding Company FE	Yes	No	Yes	No	Yes	No
Lender FE	No	Yes	No	Yes	No	Yes
Adjusted R^2	0.92	0.92	0.92	0.92	0.93	0.93
Observations	956	1,118	936	1,098	757	836

Table 3.7 Information Cost and Bank Participation in the Loan Syndicate

The table reports the results for the OLS regression of bank participation in the loan syndicate on the firm information cost. The dependent variable in column (1), (3) and (5) is the fraction of loan amount syndication allocated to a bank in a syndicate. The dependent variable in column (2), (4) and (6) is the fraction of bank counts in a syndicate. Uncertainty shock is the year-on-year change in the annualized stock return volatility lagged by one quarter before the loan origination. Opacity index is constructed following Anderson et al.(2009). Rating gap is the absolute rating gap between bond ratings by Standard & Poor's and Moody's. All columns include firm fixed effects, and year by quarter fixed effects. Control variables are included in all columns. See Appendix B.1 for variable definitions. The standard errors (in parentheses) are clustered at firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Uncertainty Shock		Opacity Index		Rating Gap	
	Bank Allocation	Bank Count	Bank Allocation	Bank Count	Bank Allocation	Bank Count
	(1)	(2)	(3)	(4)	(5)	(6)
Information Cost	0.91*	0.26	0.30***	0.07	-0.05	0.01
	(0.50)	(0.33)	(0.02)	(0.10)	(0.12)	(0.03)
Volatility	3.90	-0.58	0.61	0.24	0.16	0.27
	(2.90)	(0.89)	(0.57)	(0.20)	(0.18)	(0.39)
Stock Return	-0.21**	-0.25**	0.93***	0.10*	0.10	0.07
	(0.10)	(0.10)	(0.10)	(0.06)	(0.07)	(0.11)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Year×Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.88	0.88	0.95	0.83	0.82	0.84
Observations	570	567	441	1,166	1,147	884

Chapter 4

Earnout: Managing Valuation Risks in Mergers and Acquisitions under Uncertainty

4.1 Introduction

Uncertainty plays a vital role in economic outcomes, especially during economic downturns. Many studies have documented the negative impact of uncertainty on investment.[1] In mergers and acquisitions, the impact of uncertainty has also received growing attention. Studies show that higher uncertainty leads to less M&A activities. Uncertainty can hinder M&A activities for many reasons, one of which is the elevated target valuation risks following uncertainty shocks. Steve Baronoff, Chairman of Global Mergers & Acquisitions at Bank of America Merrill Lynch, describes the impact of uncertainty on M&A transactions as follows: "Several transactions hit the 'pause' button. With the current market volatility, it can be difficult to price and execute deals."[2]

Uncertainty can make it difficult to predict future cash flows of the target company and the expected synergies. It can also aggravate information asymmetry (Nagar et al., 2019), which leads to significant disagreements on the target valuation between the two parties. Even after the buyer and seller form a consent on the initial valuation, it can change substantially in the period between deal announcement and completion. Bhagwat et al. (2016) show that target

[1] Bloom (2009); Mian and Sufi (2010); Pastor and Veronesi (2012); Alfaro et al. (2021)

[2] Deals Fall by the Wayside, the Wall Street Journal, Oct 3, 2011.

stand-alone valuation changes more than 20% within the deal completion window more than 50% of the time. Because of the valuation risks, many acquirers postpone M&A activities during periods of high uncertainty. Bhagwat et al. (2016) find that a one standard deviation increase in the VIX reduces public deal activity by 6% in the subsequent month.

In this chapter, I focus on the earnout agreement, a contingent payment contract primarily used to manage valuation risks in mergers and acquisitions. Payment in an earnout contract consists of two parts, an upfront payment and the earnout payment. The earnout payment is contingent on the post-transaction performance of the acquired business. Conditions to receive the earnout payment are usually specified in the M&A contract. The criteria can be achieving some earnings or sales target for manufacturing companies, or obtaining FDA approvals for pharmaceutical companies. As described by the term "earnout", the sellers will earn the second part of the M&A payment out.

Earnout agreement is primarily used to bridge the valuation gap between the buyer and the seller during the negotiation process. In addition, it facilitates the post-transaction transition period by aligning the seller's incentives to the acquired company's performance. Because of these benefits, earnout agreement has been increasingly used in recent years. Earnout is mainly employed in deals with private targets with high information asymmetry. Figure 4.1 Panel A shows that the fraction of earnout transactions increased from almost 0 in 1991 to 21.5% in the full sample, and 32.8% in the private target sample in 2019. Earnout payment accounts for 33% of total transaction value on average in the M&A transactions with earnout. Figure 4.2 illustrates the fraction of earnout transactions within each industry, indicating that earnout is mostly used when the target company operates in the healthcare industry.

While earnout is helpful to reduce information asymmetry and resolve moral hazard problems of target manager/owner shirking, it can cause potential problems. It is almost impossible to design a complete earnout contract. Many issues need to be addressed in the negotiation process. For example, how long should the earnout period last? What size should the earnout amount be? Who controls the business during the earnout period? Other issues include the

metrics and accounting standards to calculate the earnout payment. Failure to incorporate these covenants in the M&A agreement can lead to legal disputes in the post-transaction period. Resolution of earnout disputes involves third parties as arbitrators and is fact specific. As a consequence, the outcome of an earnout dispute is usually beyond the control of the buyer and the seller. Even though earnout is used to resolve valuation uncertainty, it can introduce more uncertainty to both parties in the post-transaction period. As one court commented: "An earnout often converts today's disagreement over price into tomorrow's litigation over outcome."[3]

More importantly, the contingent payment scheme may cause additional moral hazard problems after the transaction. Buyers (sellers) can engage in value-destroying activities to minimize (maximize) earnout payments. Such activities can be earning manipulation by the seller, or unwillingness to provide resources by the buyer. If the seller continues to manage the company after the transaction, he(she) can reduce R&D expenses to achieve the earnout objective in the short run. However, such activities can be detrimental to the acquired business in the long run. On the other hand, if the buyer controls the business, the earnout agreement can generate an opposite incentive. The moral hazard problems can be severe when the earnout targets are not objectively verifiable. Even for the verifiable targets such as obtaining FDA approval, the timing may still be manipulated. While the earnout contracts imply obligations of the buyers to exert reasonable efforts to facilitate achievement of the earnout targets, many sellers argue in the legal disputes that they fail to achieve the objectives due to a lack of buyer cooperation.[4]

To understand the trade-off of earnout agreements, I collect a sample of 23,304 M&A transactions announced by U.S. public acquirers from 1991 to 2019. Among these transactions, 1,971 transactions involve earnouts. I find that employing earnout in a M&A transaction facilitates deal completion. Including an earnout agreement in the transaction increases the deal completion rate by 3.2%, which is 14.2% of the standard deviation. The number is economically significant considering an average deal failure rate of 9.4%. The positive effect of earnout on deal completion rate suggests the vital role earnout plays in bridging the valuation gap. However,

[3]Aveta, Inc. v. Bengoa, 984 A 2d 126, 132 (Del. Ch. 2009).
[4]Wolf and Fox (2012)

the probability of deal completion decreases as the earnout fraction increases. A large fraction of earnout payment may suggest a valuation gap which is too large to fill, or other moral hazard problems discussed above that can lead to deal failure.

I apply a standard event study methodology to investigate the effect of earnout agreements on acquirer wealth gains. The results suggest that acquirer announcement returns for earnout transactions are insignificantly different from those of the transactions without earnout when a small fraction of earnout payment is used. When earnout payments constitute only a small fraction of the total deal value, the incentive distortion problems are modest because the amount of contingent payment is low. The benefits of bridging a small valuation gap can be offset by the costs of setting up an earnout agreement. As a result, public investors react indifferently between such transactions and the transactions without earnout. When an earnout represents 8% of the total transaction value (the 10th percentile), the acquirer's announcement return is insignificantly (0.05%) lower than that of a transaction without earnout. However, acquirers receive significantly lower CARs when large fractions of earnout are included in the transaction. An average earnout fraction of 33.38% decreases acquirer wealth gains at announcement by 0.44%. When the earnout fraction increases to 66.67% (the 90th percentile), the acquirer experiences a 1.17% lower announcement return. In such deals, the incentive distortion problems are expected to be higher because of the large amount of contingent payment. Disputes may also arise in the future, destroying the value of the combined business. As a result, acquires experience lower announcement returns.

To investigate the reasons for earnout usage, I study the impact of target uncertainty on the probability of earnout in mergers and acquisitions. It is challenging to measure target uncertainty directly because most earnout targets are private companies. I use the value-weighted average of uncertainty shocks faced by public companies in the target industry as a proxy. Precisely, I measure uncertainty shocks as the annual change in equity volatility of the public companies. To address the endogeneity concerns, I focus on the component in equity volatility changes which are induced by macro uncertainty shocks. Results suggest that earnouts are

more likely to be used when target industry uncertainty is high. A one standard deviation increase in target industry uncertainty increases the probability of earnout usage by 1%, representing a 12% increase given an average earnout rate of 8.5% in the sample. The fraction of earnout payment also increases with target industry uncertainty. The results suggest that bridging the valuation gap between the acquirer and the target company induced by target uncertainty shocks is one of the reasons for acquirers to use earnouts.

If target uncertainty is low, using an earnout agreement may not be optimal because the potential costs can outweigh the benefits. To further understand market perceptions on earnouts, I investigate the effect of earnout misuse on acquirer announcement returns. I employ a logistic model to predict the probability of earnout usage based on target uncertainty and other characteristics that are correlated with information asymmetry between the two parties. The earnout transactions with predicted probabilities lower than the median are categorized as improperly used earnouts. The results suggest that acquirers experience lower CARs when earnouts are improperly used. The market perceives an earnout agreement as detrimental to acquirer value if earnouts are not used to manage the valuation risks of the target company.

Comparison between the earnout and non-earnout transactions suggests significant differences in deal, target, and acquirer characteristics between the two groups. I conduct a matching analysis to ensure the results are not driven by fundamental differences between the two groups. The matched control sample includes transactions that happen in the same year with similar deal values as the earnout transactions. Additional matching conditions are included to ensure the target company has the same status as the earnout target firm, and the acquirers share similar characteristics. The results are robust to the matching analysis. Earnout increases deal completion rate significantly, while a large fraction of earnout decreases the probability of deal completion. Acquirers in deals with a larger fraction of earnout payment receive lower CARs. Earnouts are more likely to be used when target industry uncertainty is high. A larger fraction of earnout payment is employed as target industry uncertainty increases.

The chapter is related to the literature on earnouts in mergers and acquisitions. Kohers and

Ang (2000) is the seminal paper that studies the earnout agreements. They show that earnouts are more likely to be used in deals with high information asymmetry, e.g. in deals with private targets and targets operating in hi-tech or service industries. They also find that earnouts are more likely to be used when the acquirer and the target operate in different industries. In addition, they highlight the benefits of employing earnout to retain key talents of the target company after the transaction. Reuer et al. (2004) show that earnouts are more likely to be used in international M&A where information asymmetry is high. Viarengo et al. (2018) find that earnouts are more likely to be used in countries with strong legal enforcement. Cain et al. (2011) conduct a detailed analysis of the earnout contracts. Barbopoulos and Sudarsanam (2012) and Barbopoulos and Adra (2016) argue that earnout structure matters for takeover premia and acquirer gains. Bates et al. (2018) find earnouts provide a source of financing for financially constrained acquirers. Different from previous studies, this chapter documents a negative impact of earnout on acquirer wealth gains when earnout accounts for a large fraction of the total deal value. The findings highlight the potential issues with earnouts and suggest that such contracts should be employed with caution.

The chapter also relates to the literature on uncertainty and M&A activities. Mitchell and Mulherin (1996), Harford (2005), Ahern and Harford (2014) find that M&A activities are affected by economic, technological, and regulatory shocks, and are clustered by industry. On the other hand, Shleifer and Vishny (2003) and Rhodes-Kropf et al. (2005) argue that mispricing in the stock market drives M&A activities. Empirically, studies document a negative correlation between economic uncertainty and M&A activities. Bhagwat et al. (2016) find that firms delay M&A transactions because of the interim uncertainty of target valuation. Bonaime et al. (2018) and Hao et al. (2022) show that policy uncertainty reduces M&A activities through the real options framework. Nguyen and Phan (2017) document that uncertainty lengthens the deal completion time. They also find that stock payments are more likely to be used in M&A when policy uncertainty is high. This chapter contributes to the literature by highlighting the advantages of contingent payment contracts in managing the valuation risks under uncertainty. In addition,

the chapter discusses the potential problems of including such agreements in the transactions.

The chapter is organized as follows. Section 4.2 describes the sample and variables used in the empirical analysis. Section 4.3 discusses the empirical strategies. Section 4.4 summarizes the results, and section 4.5 concludes.

4.2 Data

This section describes the sample construction process and discusses the variables used in the empirical analysis. The section also provides summary statistics of the sample.

4.2.1 Sample

The sample consists of acquisitions in the Thomson Reuters SDC M&A database announced by U.S. public companies between January 1, 1991 and December 31, 2019. The sample period starts from 1991 because earnout agreements are seldomly used in the 1980s. The sample includes both completed and withdrawn deals. The following criteria are applied to construct the final sample: (1) Acquirers are U.S. public companies listed on NYSE, AMEX, or Nasdaq with a market valuation no less than $1 million four weeks prior to announcement. (2) Acquirers conduct more than one deal throughout the sample period from 1991 to 2019. (2) Status of the target company is public, private, or subsidiary. (3) Deal value is no less than $1 million. (4) Bidders own less than 50% before the acquisition and are seeking a transfer of control (own more than 50% after the acquisition). Deals with missing acquirer ownership information are excluded from the sample. (5) Deals announced on the same day by the same acquirer are excluded from the sample. (6) Deals with targets from the financial and utility industries are excluded from the sample. (7) Repurchases and recapitalizations are excluded from the sample. The selection criteria yield a full sample of 23,304 deals by 6,502 acquirers. Information on stock returns are from CRSP.

Figure 4.1 and Table C.3.1 Panel A illustrate the annual distribution of the earnout agree-

ments. Figure 4.1 Panel A shows the relative number of earnout transactions to the total number of M&A deals by year. The dotted lines represent the fraction of earnout transactions with different subsamples when the target is a public, private, or subsidiary company. Figure 4.1 Panel A illustrates a counter-cyclical pattern of the earnout agreements. They are more likely to be used during periods of economic contraction. During economic expansion periods, earnouts are less likely to be used because the M&A market is competitive. Panel B illustrates the fraction of earnout transactions in terms of deal volume. Despite the increase in the number of earnout transactions, total deal volume with earnouts stables after the financial crisis. The low earnout deal volume after 2009 may be attributed to the regulatory reforms in the post-recession period, which led to a more careful selection of the earnout deals. Panel C illustrates the fraction of earnout value to total deal value. It shows that the fraction of earnout payments increases dramatically during recessions. Figure 4.1 also suggests that earnouts are most likely to be used when the target is a private company, and least likely when the target is public. Panel B and C suggest that the increase in earnout amount is primarily driven by the rise in earnout agreements with private targets.

Figure 4.2 shows the fraction of earnout transactions within each industry.[5] Panel A demonstrates the fraction in the number of deals, and Panel B shows it in terms of deal volume. Figure 4.2 Panel C illustrates the ratio of earnout value to the total M&A transaction value within each industry. Figure 4.2 Panel A suggests that the number of earnout transactions surges throughout the sample period within each industry. Among the five sectors, the healthcare sector experiences the most significant increase. The popularity of earnout agreements in the healthcare sector may be attributed to the objectively verifiable earnout targets, e.g., the FDA approval of a drug. Figure 4.3 illustrates the distribution of earnout transactions by industry. Panel A and B demonstrate the fraction in deal number and deal value respectively. 39.1% of the target companies of earnout transactions operate in the hi-tech industry. 21.4% target companies are from the healthcare sector. 12% and 9.3% operate in consumer and manufacturing industries

[5]Industries are classified based Fama-French five industry classifications.

respectively. Table C.3.1 Panel B offers the industry distribution of earnout transactions based on the Fama-French twelve industry classifications.

A standard event study methodology is applied to calculate acquirer announcement returns of the M&A transactions in the sample. Acquirer cumulative abnormal returns (CARs) are estimated in the 5-day event window centered around the M&A deal announcement date. The benchmark returns are estimated using the CAPM model from 300 to 46 days prior to announcement. This allows a 45-day gap between the estimation window and the event window. Acquirers must have at least 70 valid returns during the estimation window to be included in the analysis. Stock returns and other financial variables are winsorized at the 1st and 99th percentiles. Appendix C.1 provides definitions of the variables used in the analysis.

4.2.2 Measuring Uncertainty

It is very challenging to measure target uncertainty directly since most targets in earnout transactions are private. To capture uncertainty shocks to the target company, I calculate the value-weighted average of the uncertainty shocks to the public companies operating in the target industry. One way to measure uncertainty shocks is to use the changes in stock return volatility. However, changes in equity volatility can be endogenous. For example, stock return volatility is correlated with company performance. In the meanwhile, performance can affect the valuation of a company, which further affects the decision of whether an earnout should be employed.

To address the endogeneity concerns, I follow Alfaro et al. (2021) and calculate the exogenous changes in stock return volatility due to macroeconomic uncertainty shocks for each listed company operating in the target SIC 3-digit industry:

$$\Delta\sigma_{p,t} = \beta_0 + \sum_c \beta^c \cdot IV^c_{j,t} + \epsilon_{p,t}. \tag{4.1}$$

$\Delta\sigma_{p,t}$ is the year-on-year change in annualized equity volatility for the public company p operating in the target's SIC 3-digit industry j. $IV^c_{j,t}$ is the uncertainty shock for each macro

factor c faced by industry j, taking industry j's exposure into account. Macro factor c includes oil, interest rate, 7 major currency exchange rate[6] and economic policy uncertainty. To generate the industry variations, the macro uncertainty variables $IV^c_{j,t}$ are constructed by exploiting companies' differential exposures to the aggregate volatility shocks. The idea is that companies operating in different industries can experience various levels of uncertainty shocks because of the difference in exposure. For instance, a mining company will experience a higher level of uncertainty compared to companies operating in the public sector when oil uncertainty is high. On the other hand, companies in the public sector may face a higher uncertainty level when economic policy uncertainty is high. To construct the variables, I first estimate industry exposure to each aggregated variable c as the sensitivity of regressing stock returns to the price changes of c for each industry j. $IV^c_{j,t}$ is constructed as the product of the estimated sensitivity and the year-on-year change in the standard deviation of daily price changes for c. A detailed description of how $IV^c_{j,t}$ is constructed is described in Appendix C.2.

The predicted value $\widehat{\Delta\sigma_{p,t}}$ from equation (4.1) is treated as the exogenous part in changes in equity volatility that is induced by macroeconomic uncertainty. The aggregate uncertainty shocks, by construction, do not correlate with any observable firm characteristics that may affect the usage of earnout. The value-weighted average of $\widehat{\Delta\sigma_{p,t}}$ of the public companies within each SIC 3-digit industry, $\Delta\sigma_{j,t}$, is used as the proxy for target industry uncertainty.

4.2.3 Descriptive Statistics

Table 4.1 Panel A reports summary statistics for the main variables used in the empirical analysis. The sample consists of 23,304 M&A transactions from 1991 to 2019. 1,971 transactions, representing 8.5% of the full sample, employ earnout agreements. The average earnout value is $44 million, accounting for 33% of the total earnout transaction value on average. Both the amount and fraction of earnout payment vary significantly across transactions. The median earnout value is $8 million, which is significantly lower than the average. The distribution of

[6]These include: Australian Dollar, British pound, Canadian Dollar, the Euro, Japanese Yen, and Swedish Krona.

earnout value suggests that including only an indicator variable for earnout is not enough for the earnout analyses. Acquirer CARs are 1.35% on average, consistent with Betton et al. (2008) that acquirers receive positive but modest CARs at announcement. The majority of M&A transactions are completed with an average deal completion rate of 90.6%.

50.3% of the targets are private companies. 32.5% are subsidiaries of other companies, and 17.1% are public companies. 22.8% of the target companies operate in hi-tech industries. The mean (median) deal value is $356.7 ($42) million. The acquirer and target company operate in the same SIC 2-digit industry 62.6% of the cases. 17.1% of the transactions are cross-border acquisitions. In terms of acquirer characteristics, the acquirer's mean (median) total assets is $5,043.8 ($560) million. The average log market to book ratio is 4.96. Acquirers have a leverage ratio of 46.9% on average.

Table 4.1 Panel B compares deal, target, and acquirer characteristics between M&A transactions with and without earnouts. Transactions without earnout demonstrate slightly higher acquirer announcement returns, but the difference is statistically insignificant. Earnout transactions demonstrate a significantly higher deal completion rate compared to the control group. Target industry uncertainty is slightly higher for earnout transactions compared to the deals without earnout. There are significantly more transactions with private targets, and less transactions with subsidiary or public targets in the earnout sample. 25.5% of the target companies operate in the hi-tech industries in the earnout sample, which is 3% higher than the control sample. Transactions with earnout are smaller in size on average. Differences in the fraction of diversification deals, i.e., when the acquirer and target company operate in different industries, or cross-border deals are insignificant between the two samples. In terms of acquirer characteristics, acquirers that employ earnout transactions are smaller in size, have lower market to book ratio, and perform worse than those that do not use earnout on average. They also have higher leverage ratios. Acquirers in earnout transactions can be more financially constrained and use earnout due to financial considerations.

4.3 Empirical Methodology

In this section, I discuss the methodology used in the empirical analysis. First, I describe the analyses of the effect of earnout on deal completion and acquirer wealth gains. Then, I discuss the study to investigate the impact of target uncertainty on the earnout employment. After that, a matching analysis is conducted to address the sample selection bias. The study of how earnout misuse can affect acquirer wealth gains is discussed at the end of this section.

4.3.1 Earnout and M&A Deal Completion

If earnout helps bridge the valuation gap between the acquirer and the target company, employing an earnout agreement in the M&A transaction should facilite deal completion. A binomial logistic model is applied to estimate the impact of earnout on the probability of deal completion:

$$ln\frac{P_i}{1-P_i} = \beta_0 + \beta_1 \text{Earnout}_i + \beta_2 \text{Earnout Pct}_i + \chi_i + \upsilon_a + \theta_t + \phi_k + \psi_j + \epsilon_{i,t}. \tag{4.2}$$

The probability that deal i is completed, $P_i = p(\text{Deal Completion}_i = 1)$, is given by

$$P_i = \frac{1}{1 + exp^{-(\beta_0 + \beta_1 \text{Earnout}_i + \beta_2 \text{Earnout Pct}_i + \chi_i + \upsilon_a + \theta_t + \phi_k + \psi_j)}}. \tag{4.3}$$

The log likelihood function is estimated using maximum likelihood techniques. Deal Completion_i is an indicator variable which equals to one if deal i is completed, and zero if the deal is withdrawn. The variables Earnout_i and Earnout Pct_i are the main independent variables. Earnout_i is an indicator variable which equals one if an earnout agreement is involved in the transaction, and zero otherwise. Earnout Pct_i is the fraction of earnout value of the total transaction value. For transactions that do not employ earnout agreement, both Earnout_i and Earnout Pct_i are equal to zero.

The hypothesis that earnout bridges the valuation gap implies a positive and statistically significant estimate of β_1. The fraction of earnout payment exerts two confronting effects on

deal completion. On one hand, it helps bridge the valuation gap. On the other hand, a large fraction of earnout payment can introduce greater post-transaction moral hazard problems, which may bread down the deal. Depending on the relative size of benefits and costs of the earnout agreement, the sign of β_2 becomes an empirical question.

Deal and target characteristics χ_i are included to control for any deal- and target-specific effects on deal completion. υ_a is a vector of acquirer-level attributes including log assets, log market to book ratio, return on assets, and leverage ratio. Year fixed effects, θ_t, are included to control for any macroeconomic factors that may affect the deal completion rate. Last, I include acquirer and target SIC 2-digit industry fixed effects to control for any industry characteristics affecting the estimated results.

4.3.2 Earnout and Acquirer Wealth Gains

Next, I investigate the impact of earnout on acquirer wealth gains using an OLS regression:

$$\text{CAR[-2,+2]}_{i,t} = \beta_0 + \beta_1 \text{Earnout}_i + \beta_2 \text{Earnout Pct}_i + \chi_i + \upsilon_a + \theta_t + \phi_k + \psi_j + \epsilon_{i,t}. \tag{4.4}$$

The dependent variable, $\text{CAR[-2,+2]}_{i,t}$, is acquirer cumulative abnormal returns (CARs) estimated using a five-day event window [-2,+2] centered around the announcement date (day 0). Earnout_i is an indicator variable which equals one if an earnout agreement is involved in the transaction, and zero otherwise. Earnout Pct_i is the ratio of earnout value to total deal value. Because of the trade-offs of earnout agreements, signs of the estimated β_1 and β_2 are empirical questions, depending on the relative magnitude of the benefits and expected costs.

Similar to Equation (4.2), deal, target, and acquirer characteristics χ_i and υ_a are included to control for any deal- and acquirer-specific effects on acquirer announcement returns. Year fixed effects, θ_t, are included to control for any macroeconomic factors affecting acquirer wealth gains from the M&A transaction. Acquirer and target SIC 2-digit industry fixed effects are in-

cluded to control for any industry characteristics that might affect acquirer CARs.

4.3.3 Earnout and Target Industry Uncertainty

If earnouts are primarily used to manage valuation risks of the target company, the likelihood of employing an earnout agreement should increase with target uncertainty. To investigate the hypothesis, I estimate the regressions:

$$ln\frac{P_i}{1-P_i} = \beta_0 + \beta_1 \Delta\sigma_{j,t} + \chi_i + \upsilon_a + \theta_t + \phi_k + \psi_j + \epsilon_{i,t}, \tag{4.5}$$

where $P_i = p(\text{Earnout}_i = 1)$ is the probability that deal i involves an earnout agreement.

$$\text{Earnout Pct}_i = \beta_0 + \beta_1 \Delta\sigma_{j,t} + \chi_i + \upsilon_a + \theta_t + \phi_k + \psi_j + \epsilon_{i,t}. \tag{4.6}$$

Earnout_i is an indicator variable that equals one if an earnout agreement is included. Earnout Pct_i is the ratio of earnout payment to deal value. The main independent variable $\Delta\sigma_{j,t}$ is the value-weighted uncertainty shock of the public companies operating in the target SIC 2-digit industry j described in Section 4.2.2. When the target industry experiences an uncertainty shock, target valuation risks are expected to increase. Acquirers may be more likely to employ earnout in the transaction to resolve the enlarged disagreement between the two parties. As target industry uncertainty increases, the fraction of earnout payment is also expected to increase to reflect the larger information asymmetry and valuation gap. This implies that the estimates of β_1 in Equations (4.5) and (4.6) should be positive and statistically significant.

Similar to Equation (4.2), deal, target, and acquirer characteristics χ_i and υ_a are included to control for any deal, target, and acquirer effects on the usage of earnout. Year, acquirer, and target industry fixed effects, θ_t, ϕ_k, and ψ_j are included to control for any macroeconomic and industry factors that might affect the employment of earnout agreements.

4.3.4 Matching Analysis

A comparison between the earnout transactions and the M&A transactions without earnout in Table 4.1 Panel B suggests that deal, target, and acquirer characteristics differ significantly between the two groups. To address the concern that the results of the above analyses may be driven by the fundamental differences between the earnout and non-earnout transactions, I conduct a matching analysis using various matching criteria. In this section, I discuss the details of the matching process.

The control group constitutes M&A transactions without earnout agreements announced by U.S. acquirers between 1991 to 2019. The following criteria are applied to construct the matched sample: (1) The deal is announced in the same year as the earnout transaction. (2) The target company shares the same status as the earnout target company. (3) Deal value is +/- 20% of the earnout transaction value. (4) Acquirer total assets are +/- 20% of the acquirer total assets of the earnout transaction. I also conduct a one-to-two propensity score matching with no replacement using criteria (1)-(3) and acquirer characteristics including total assets, market to book ratio, return on assets, and leverage ratio. The propensity score matching yields a sample of 1,836 earnout transactions and a control sample of 2,835 non-earnout transactions.

Table 4.5 Panel A compares the earnout and non-earnout transactions after the propensity score matching. The summary statistics indicate that most differences in target characteristics become insignificant after the matching. The two samples have similar compositions in terms of target status. Acquirer characteristics are still significantly different, but the differences become much smaller compared to Table 4.1 Panel B. One thing worth noticing in Table 4.5 Panel A is acquirer CARs. Table 4.1 Panel B shows an insignificant difference in acquirer CARs between the two groups. However, earnout transactions demonstrate significantly lower acquirer wealth gains compared to the non-earnout group in the matching sample.

4.3.5 Earnout Misuse

Lastly, I investigate market responses on acquirer wealth gains when earnouts are misused. The benefits of employing earnout agreements are limited when valuation risks are low, e.g., when target industry uncertainty is low. On the other hand, acquirers bear the expected costs such as the settlement costs for future legal disputes, or destruction in firm value due to incentive misalignment in the post-transaction period. Acquirers are expected to receive lower wealth gains if the expected costs outweigh the benefits of the earnout agreements.

To investigate this, I calculate the predicted probability of earnout usage based on Equation (4.5). Deals with earnouts are categorized into two samples where earnouts are properly used or misused, i.e., whether earnouts are employed to manage valuation risks. An earnout is identified as proper if the predicted probability is above the median. Otherwise, the earnout is deemed as misused. One possible reason when an earnout is not used to manage the valuation risks might be that acquirers are trying to exploit the target companies with earnouts, which possibly causes incentive misalignment and legal disputes in the future.

The impact of earnout misuse on acquirer wealth gains is estimated using:

$$\text{CAR[-2,+2]}_{i,t} = \beta_0 + \beta_1 \text{Earnout Misuse}_i + \chi_i + \upsilon_a + \theta_t + \phi_k + \psi_j + \epsilon_{i,t}. \tag{4.7}$$

The dependent variable, $\text{CAR[-2,+2]}_{i,t}$, is acquirer CARs within the 5-day event window around the announcement date. The main independent variable is an indicator variable which equals one if the predicted probability of earnout is lower than the median. Deal, target, and acquirer characteristics are included in the analysis to control for the impacts on CARs. Year, acquirer, and target SIC 2-digit industry fixed effects are included to control for the impact of any macroeconomics or industry factor. Based on the hypothesis, the estimate of β_1 is expected to be negative and statistically significant.

4.4 Results

This section summarizes results of the empirical analyses described in Section 4.3.

4.4.1 Earnout and M&A Deal Completion: Logistic Estimation Results

Table 4.2 presents estimates for the effect of earnout agreement on deal completion based on Equation (4.2). The dependent variable is an indicator variable which equals one if the deal is completed. The main independent variables are an indicator variable of whether an earnout agreement is employed, and the ratio of earnout value to deal value. Columns (1) and (2) include the earnout dummy variable as the independent variable. Columns (3) and (4) add the earnout fraction as an additional independent variable. Previous literature (Betton et al., 2008) documents that target status plays an important role in various M&A outcomes. Therefore, target status is included as a control variable in all specifications. Columns (5) and (6) control for deal and target characteristics that can affect deal completion. Columns (7) and (8) include additional acquirer characteristics that may affect M&A outcomes. Year fixed effects are included in all specifications. Columns (2), (4), (6) and (8) include acquirer and target industry fixed effects.

Results from column (2) show that the impact of earnout agreement on deal completion is insignificantly different from zero when the value of the earnout is neglected in the analysis. Results in columns (3) to (8) indicate that including an earnout agreement in the M&A transaction increases the deal completion rate significantly controlling for the earnout fraction. The probability of deal completion increases by 3.2% when earnout is employed in the transaction. The effect is economically significant given the average deal withdrawal rate is 9.4%. Earnout fraction, on the other hand, decreases the deal completion rate significantly. A one standard deviation increase in earnout fraction decreases the probability of deal completion by 1.23%. A comparison of the results between columns (1)-(2) and columns (3)-(8) suggests that both the earnout usage and the fraction of earnout payment are important factors in explaining M&A

outcomes. They play confronting roles in terms of facilitating deal completion.

Consistent with previous studies, a deal is more likely to complete when the target is a private or subsidiary company. The deal withdrawal rate is higher in cross-border acquisitions. A transaction is more likely to complete when acquirers have better performance and lower leverage ratio.

4.4.2 Earnout and Acquirer Wealth Gains: OLS Estimation Results

Table 4.3 reports estimates for the impact of earnout agreement on acquirer CARs based on Equation (4.4). The dependent variable is acquirer cumulative abnormal returns in the 5-day event window around the announcement date. The key independent variables are the earnout indicator variable and the fraction of the earnout payment. Specifications in columns (1) and (2) include only the earnout indicator variable as the independent variable. Columns (3) and (4) add the earnout fraction as an additional variable of interest. Dessaint et al. (2021) show that acquirer announcement returns are significantly higher when the target is a private or subsidiary company. To control for such effects, target status is included in all specifications. Columns (5) to (8) include deal and acquirer characteristics affecting acquirer wealth gains. Year fixed effects are included in all specifications to control for any macroeconomic factor that may drive M&A waves and affect acquirer CARs. Specifications in columns (2), (4), (6), and (8) include acquirer and target industry fixed effects to control for any industry characteristics affecting acquirer announcement returns.

The insignificant impact of earnout usage on acquirer CARs can suggest the trade-offs of an earnout agreement. Because of the benefits and expected costs, acquirer CARs are similar to the transactions without earnouts. However, incorporating a large fraction of earnout payment significantly reduces acquirer wealth gains. The results are consistent with the hypothesis that large contingent payments may introduce incentive misalignment problems which are detrimental to firm value. A one standard deviation increase in the earnout fraction decreases acquirer CARs by 0.44%. The effect is economically significant given an average acquirer an-

nouncement return of 1.35%. Target characteristics that affect acquirer CARs include target status and whether the target company operates in hi-tech industries. Transactions with private and subsidiary targets receive significantly higher acquirer announcement returns. The CARs are lower when target company operates in high-tech industries. Consistent with the literature, smaller acquirers with higher leverage ratios receive higher CARs.

4.4.3 Estimation Results on Earnout and Target Industry Uncertainty

Table 4.4 reports estimates for the impact of target industry uncertainty on earnout agreement. Table 4.4 Panel A reports the estimated results from the logistic regression of the earnout indicator on target industry uncertainty, estimated using Equation (4.5). Table 4.4 Panel B shows the estimated results from the OLS regression of the earnout fraction on target industry uncertainty, estimated using Equation (4.6). The dependent variable in Panel A is an indicator variable that equals one if an earnout agreement is used. The dependent variable in Panel B is the ratio of earnout value to deal value. The main independent variable is the target industry uncertainty, which is the value-weighted average of the uncertainty shocks to public companies operating in the target SIC 3-digit industry. To address the endogeneity concerns, uncertainty shocks to public companies are estimated as the changes in annualized stock return volatility induced by macroeconomic uncertainty shocks.

Previous studies find that earnout transactions are more likely to be used when there is high information asymmetry between the acquirer and target company. Deal characteristics such as whether the acquirer and the target operate in the same industry, whether the target company operates in hi-tech sectors, and whether the transaction is a cross-border deal are included in columns (3) to (6) to control for the impact of information asymmetry on earnout employment. Additional acquirer characteristics are included to control for any acquirer effect on the adoption of an earnout agreement. Year fixed effects are included in all specifications to account for the aggregate time trend of earnout adoption. Acquirer and target SIC 2-digit industry fixed effects are included in columns (2), (4), and (6) to control for any time-invariant industry char-

acteristics affecting the earnout usage.

Results in Table 4.4 suggest that earnout agreements are more likely to be used when the target industry uncertainty is high. Results in Panel A column (6) indicate that a one standard deviation increase in targe industry uncertainty increases the likelihood of earnout usage by approximately 1%, representing a 12% increase given an average earnout rate of 8.5% in the sample. The fraction of earnout payment also increases with target industry uncertainty. Consistent with previous studies, earnouts are more likely to be used when the target is a private or subsidiary company. Smaller acquirers with low leverage ratios are more likely to employ earnout agreements.

4.4.4 Results on Matching Analysis

To address the concern that the earnout and non-earnout groups are fundamentally different, I re-estimate Equations (4.2) to (4.6) using various matched control samples. Table 4.5 Panel A compares the earnout transactions and a matched sample using a one-to-two propensity score matching on deal announcement year, target status, deal value, acquirer total assets, market to book ratio, return on assets, and leverage ratio. Results in Panel A indicate that differences between the two groups in most deal and target characteristics become insignificant after the matching. The differences in acquirer characteristics become smaller compared to those in Table 4.1.

Table 4.5 Panel B to Panel E report results of re-estimating Equations (4.2) to (4.6) with different control samples. The control sample in columns (1) and (2) is matched on deal announcement year and the target status. The sample in columns (3) and (4) further restricts the deal value to be within 20% of the earnout transaction. An additional criterion of within 20% of acquirer total assets is imposed in the control sample in columns (5) and (6). Columns (7) and (8) use the control sample based on the propensity score matching mentioned above. Year, acquirer, and target industry fixed effects are included in all specifications.

Table 4.5 suggests that the results in Table 4.2 to Table 4.4 are robust to various matched control samples. Earnout agreement facilitates deal completion, while a larger fraction of earnout payment decreases the probability of deal completion. Acquirers receive insignificant CARs when an earnout agreement is included. However, acquire announcement returns are significantly lower when a large fraction of earnout amount is involved. The magnitude of the impact of target industry uncertainty on earnout usage becomes larger with the propensity score matched sample.

4.4.5 Earnout Misuse and Acquirer Wealth Gains: OLS Estimation Results

Table 4.6 reports estimates of the impact of earnout misuse on acquirer wealth gains. The dependent variable is the acquirer cumulative abnormal returns estimated within the 5-day event window around the announcement date. The main independent variable is an indicator variable that equals one if the earnout is identified as misused. An earnout is identified as misused if the predicted probability of using an earnout agreement based on Equation (4.5) is lower than the median. Additional control variables, and year and industry fixed effects are included to control for any characteristic that may affect acquirer wealth gains from the M&A transaction.

The results show that acquirers receive significantly lower CARs when earnouts are misused. Estimates in column (6) suggest that acquirer receives 1.08% lower announcement returns when the earnout is improperly used. A comparison between estimations in Table 4.3 and Table 4.6 reveals market perceptions of earnout agreements. In general, acquirer CARs are insignificantly different between the earnout and non-earnout transactions. However, when earnouts are used improperly for reasons other than to resolve high valuation risks, acquirers receive significantly lower announcement returns.

4.4.6 Robustness Tests

In this section, I discuss the results of the robustness tests. The results are presented in Appendix C.3. First, I re-estimate Equations (4.2) and (4.5)using linear probability models:

$$\text{Deal Completion}_i = \beta_0 + \beta_1 \text{Earnout}_i + \beta_2 \text{Earnout Pct}_i + \chi_i + \upsilon_a + \theta_t + \phi_k + \psi_j + \epsilon_{i,t}, \quad (4.8)$$

$$\text{Earnout}_i = \beta_0 + \beta_1 \Delta\sigma_{j,t} + \chi_i + \upsilon_a + \theta_t + \phi_k + \psi_j + \epsilon_{i,t}. \quad (4.9)$$

The dependent variable in Equation (4.8), Deal Completion$_i$, is an indicator variable which equals one if the M&A transaction is completed, and zero if the deal is withdrawn. Same as Equation (4.2), the main independent variables are Earnout$_i$ and Earnout Pct$_i$. The dependent variable in Equation (4.9), Earnout$_i$, is an indicator variable of earnout usage. $\Delta\sigma_{j,t}$ is the value weighted uncertainty shock of all the public companies operating in the target industry as described in Section 4.2.2. Same as Equations (4.2) and (4.5), deal, target, and acquirer control variables are included in the regressions. Year, acquirer, and target industry fixed effects are also included to control for any macroeconomic conditions or industry characteristics affecting the estimates.

Table C.3.2 and Table C.3.3 suggest that the results are robust using linear probability models. Earnout significantly increases the probability of deal completion. The economic magnitudes are similar to Table 4.2. Including an earnout agreement in the M&A transaction increases the deal completion rate by approximately 3.1%. The estimated impacts of target uncertainty on earnout usage are also similar to the main analysis. Target industry uncertainty increases the probability of using an earnout significantly. Earnouts are 1.2% more likely to be used with a one standard deviation increase in target industry uncertainty.

Second, I include additional variables to control for the impact of the target company's growth prospective on earnout usage. An earnout agreement may be more likely to be employed when the target company demonstrates high growth potential. I construct two variables to measure the target company's future growth: the median of the target industry's sales growth

and the medium age of the public companies operating in the target industry. Target companies operate in less mature industries with higher sales growth are expected to have better growth perspectives.

Third, I include additional variables to control for the impacts of M&A advisors on earnout usage. The likelihood of earnout usage may depend on whether the acquirer and the target company hire boutique banks as M&A advisors. On one hand, an earnout agreement may not be necessary if the financial advisor has specific knowledge about an industry. On the other hand, the boutique financial advisor may be more likely to suggest an earnout agreement when it is necessary. I include two indicator variables of whether the acquirer and the target hire boutique financial advisors to control for the impacts. I also include the acquirer and the target company's financial advisor fixed effects to control for any additional impact of the financial advisors.

Table C.3.4 Panel A reports the results controlling for the impacts of the target company's growth prospective. Panel B reports the results controlling for the impact of M&A advisors. Columns (1) and (2) in Panel A and columns (1) to (3) in Panel B report the estimated results using Equation (4.5), where the dependent variable is an indicator variable of whether earnout is employed in the transaction. In columns (3) and (4) in Panel A and columns (4) to (6) in Panel B, the dependent variable is the fraction of the earnout payment, and the results are estimated based on Equation (4.6). Table C.3.4 shows that the results are robust controlling for various alternative control variables. The impacts of target industry uncertainty on earnout usage and earnout percentage remain positive and significant. Earnouts are more likely to be used when the target company operates in less mature industries, which may suggest more information asymmetry or growth potential. Earnouts are less likely to be used when the target company hires a boutique advisor.

4.5 Conclusion

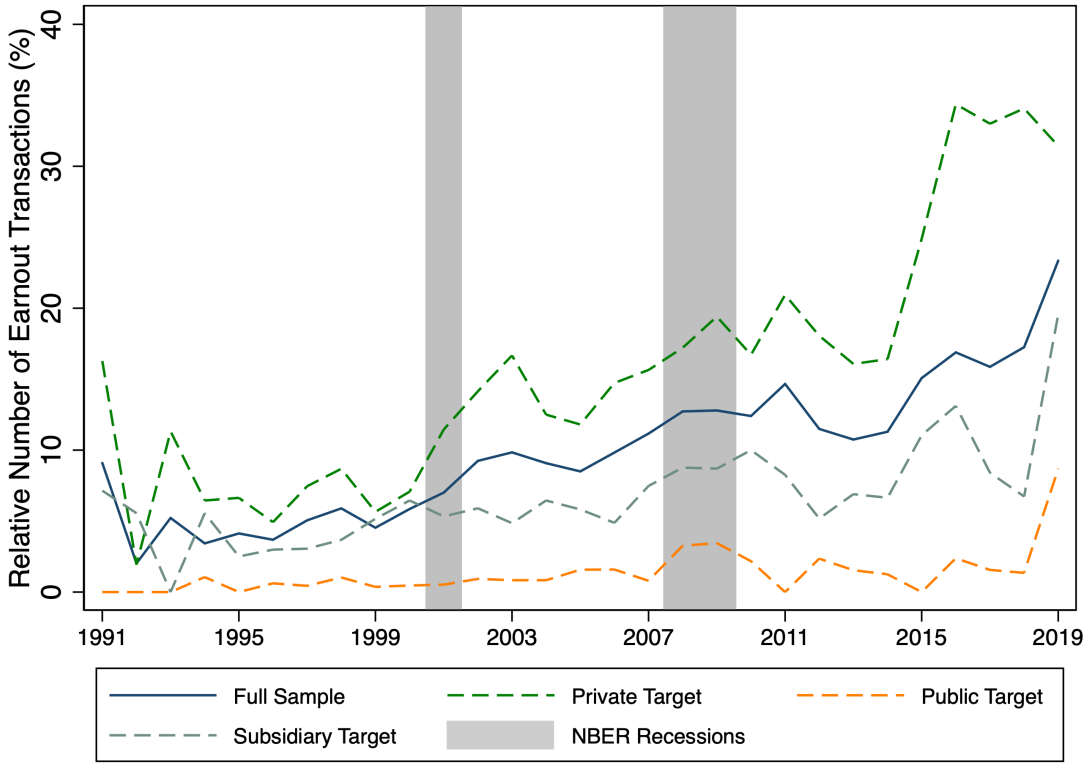
Earnout agreements have been increasingly used in M&A transactions in the past 30 years, especially in the deals with private or subsidiary targets. The chapter finds that earnouts are primarily used as a mechanism to bridge the valuation gap between the buyer and the seller. The likelihood of earnout usage and the fraction of earnout payment increase significantly with the target industry uncertainty. Including an earnout agreement in the M&A transaction increases the deal completion rate significantly.

Despite the benefits of bridging the valuation gap, industry practitioners have controversial opinions on the application of earnout agreement. The process of negotiating an earnout contract can be very complicated. Failure to design a complete earnout contract can lead to legal disputes at the end of the earnout period. In addition, the contingent payment scheme introduces an incentive misalignment problem in the merged business. The acquirer's objective is to maximize firm value and minimize earnout payment in some cases, while the target's objective is to maximize the earnout payment. When the earnout fraction is low, such conflict of interest is trivial. Acquirer wealth gains from the earnout deal are insignificantly different from those deals without earnout. However, when a large contingent payment amount is included, acquirer experiences significantly lower announcement returns. The chapter provides a deep understanding of the earnout agreement, and sheds light on the trade-offs to consider when employing an earnout agreement. Managers who would like to employ earnouts in M&A transactions should be aware of the potential problems and use them with caution.

Figure 4.1 Fraction of M&A Transactions with Earnout: 1991-2019

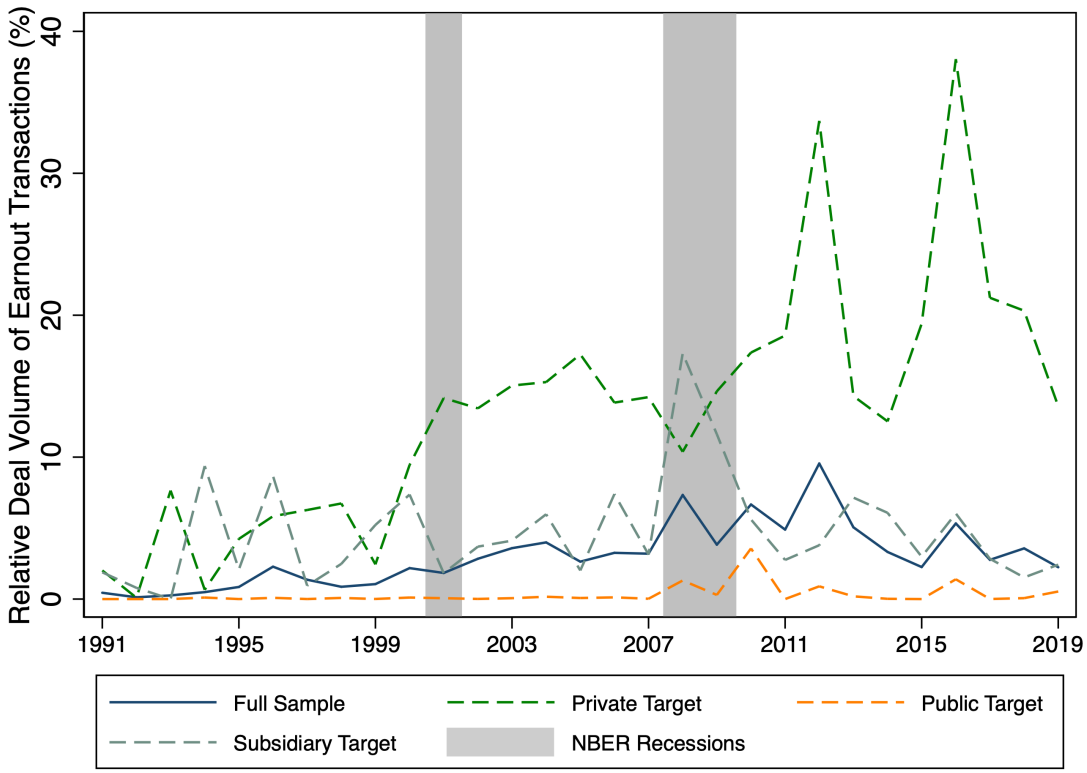
Panel A. Relative Number of M&A Transactions with Earnout

The figure depicts the annual distribution of the number of earnout transactions relative to total number of M&A transactions in the sample. The sample constitutes of completed M&A transactions by U.S. public acquirers over the period 1991-2019. The shaded vertical bars represent NBER recessions.



Panel B. Relative Deal Volume of M&A Transactions with Earnout

The figure depicts the annual distribution of deal volume of earnout transactions relative to total deal volume of M&A transactions in the sample. The sample constitutes of completed M&A transactions by U.S. public acquirers over the period 1991-2019. The shaded vertical bars represent NBER recessions.



Panel C. Ratio of Earnout value to Deal Volume of M&A Transactions: 1991-2019

The figure plots the annual distribution of the earnout value relative to total deal volume of M&A transactions in the sample. Earnout value is calculated as the sum of earnout payment of the earnout transactions each year. The sample constitutes of completed M&A transactions by U.S. public acquirers over the period 1991-2019. The shaded vertical bars represent NBER recessions.

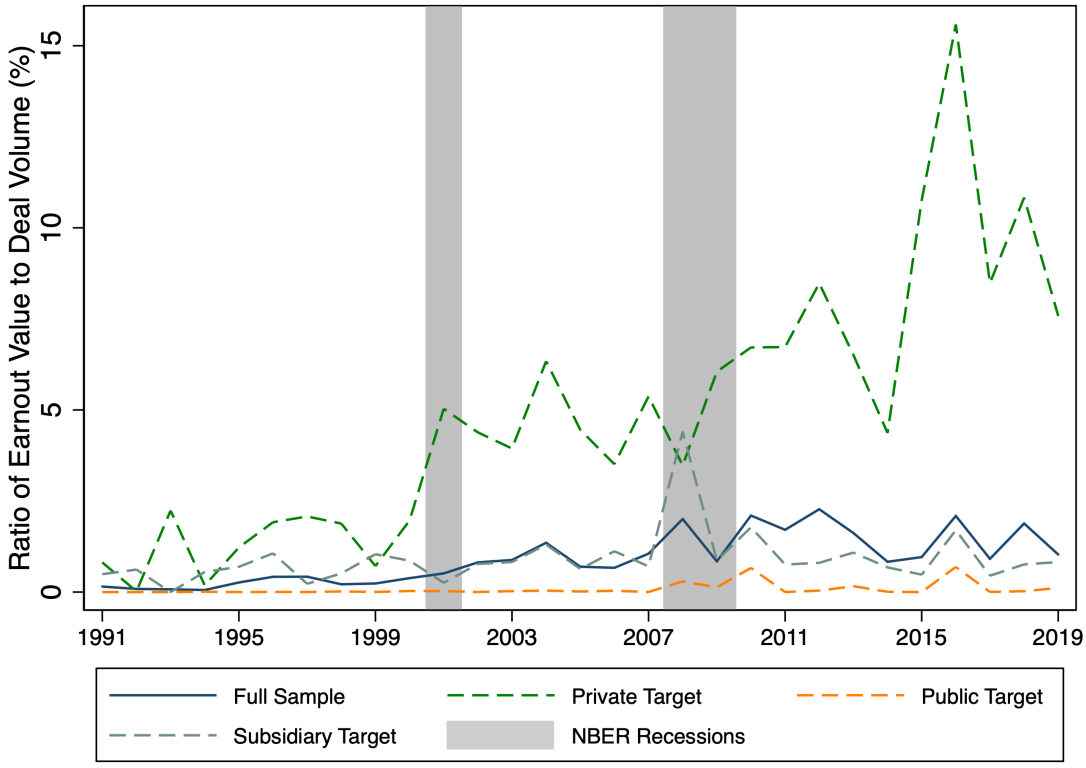
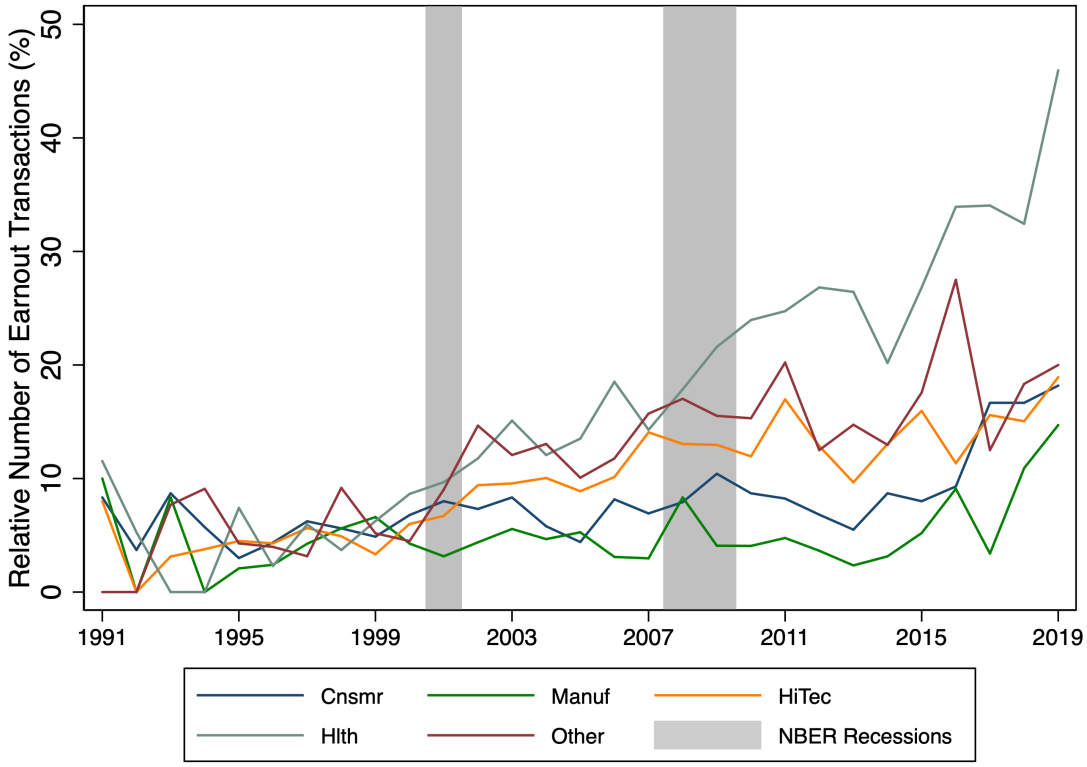


Figure 4.2 Fraction of M&A Transactions with Earnout: Within Industry

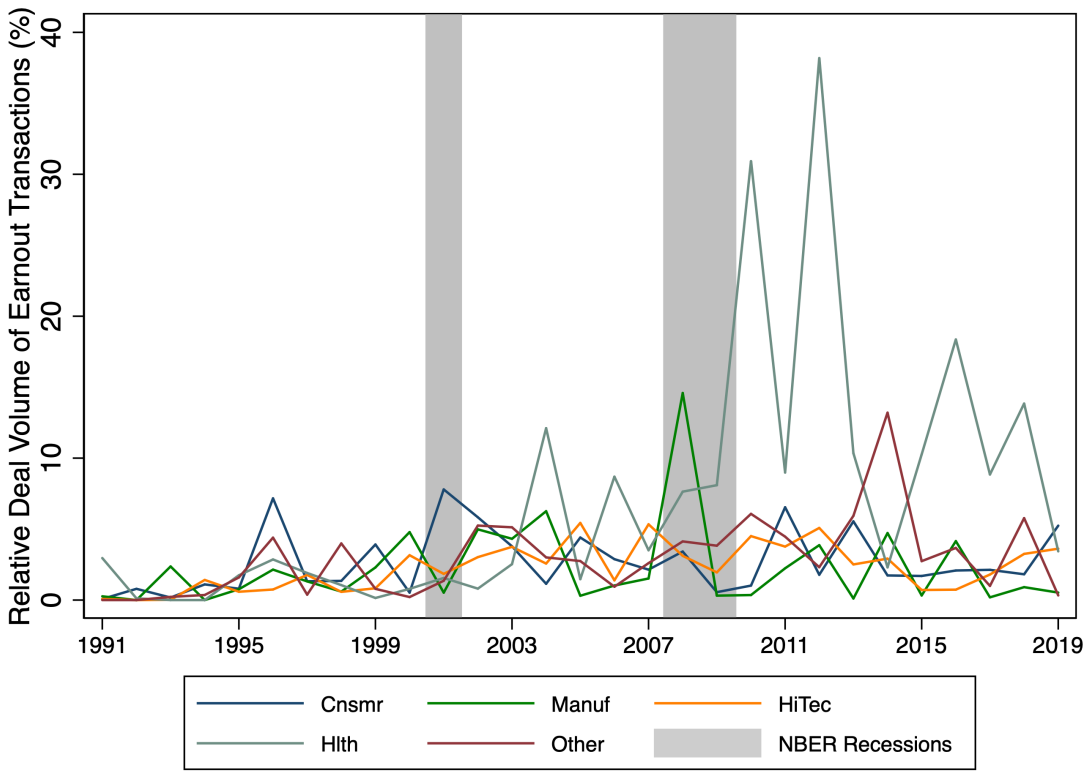
Panel A. Relative Number of M&A Transactions with Earnout

The figure depicts the number of earnout transactions relative to total number of M&A transactions in the sample within each industry. The sample constitutes of completed M&A transactions by U.S. public acquirers over the period 1991-2019. Industries are classified based on Fama-French five industry classifications. The shaded vertical bars represent NBER recessions.



Panel B. Relative Deal Volume of M&A Transactions with Earnout: Within Industry

The figure depicts the deal volume of earnout transactions relative to total deal volume of M&A transactions in the sample within each industry. The sample constitutes of completed M&A transactions by U.S. public acquirers over the period 1991-2019. Industries are classified based on Fama-French five industry classifications. The shaded vertical bars represent NBER recessions.



Panel C. Ratio of Earnout Value to Deal Volume of M&A Transactions: Within Industry

The figure plots the ratio of earnout value to total deal volume of M&A transactions within each industry in the sample. Earnout value is calculated as the sum of earnout payment of the earnout transactions within each industry every year. The sample constitutes of completed M&A transactions by U.S. public acquirers over the period 1991-2019. The shaded vertical bars represent NBER recessions.

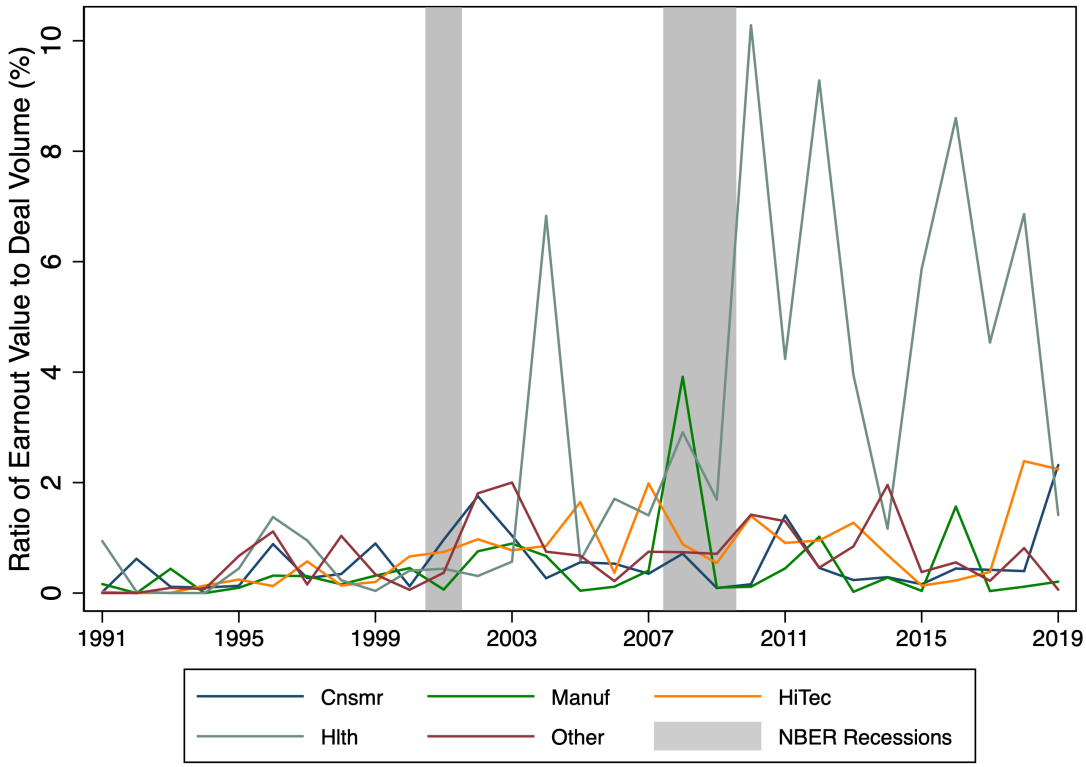
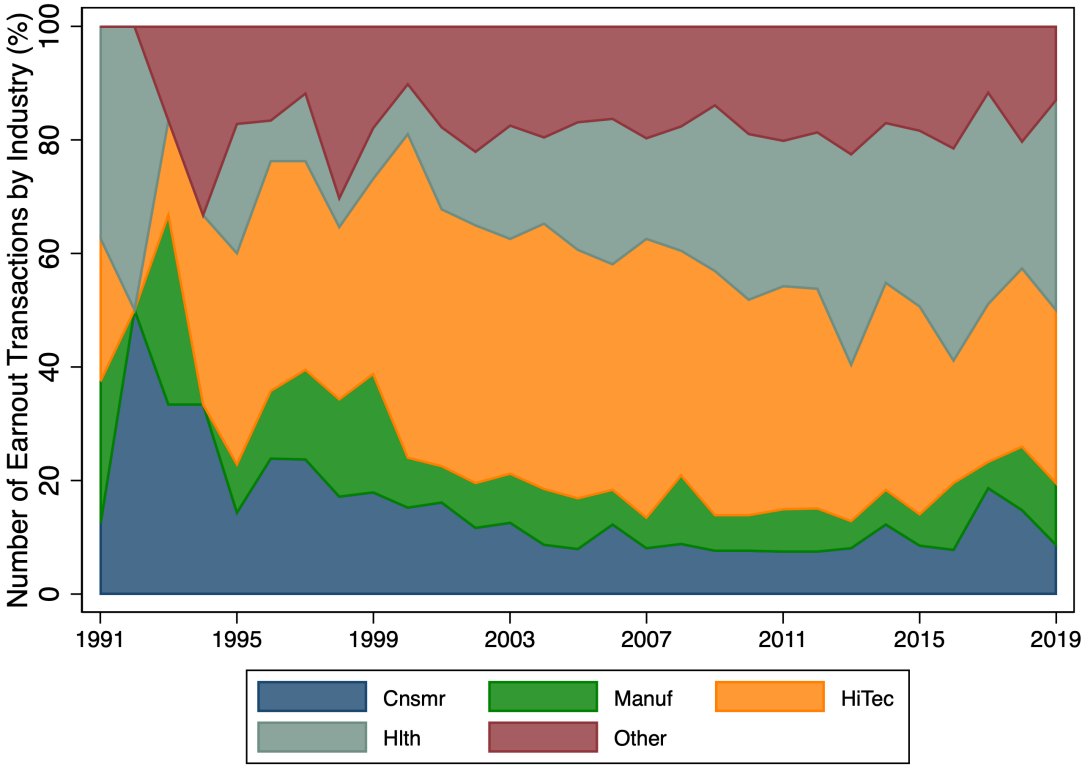


Figure 4.3 Fraction of Earnout Transactions by Industry

Panel A. Number of Earnout Transactions by Industry

The figure plots the number of earnout transactions across industries in the sample. The sample constitutes of completed earnout transactions by U.S. public acquirers over the period 1991-2019. The industries are classified based on Fama-French five industry classifications.



Panel B. Deal Volume of Earnout Transactions by Industry

The figure plots the deal volume of earnout transactions across industries in the sample. The sample constitutes of completed earnout transactions by U.S. public acquirers over the period 1991-2019. The industries are classified based on Fama-French five industry classifications.

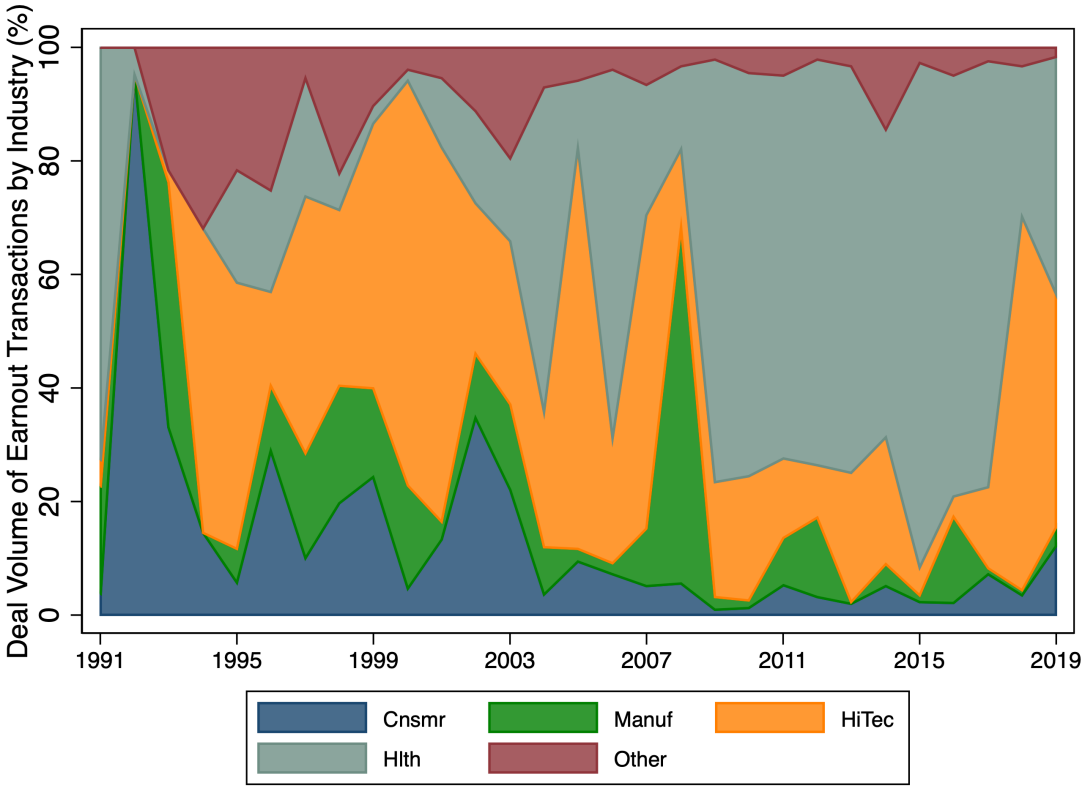


Table 4.1 Descriptive Statistics: Full Sample

Panel A. Summary Statistics of M&A Transactions

The table reports summary statistics for the main variables used in the empirical analysis. The sample includes acquisitions in the Thomson Reuters SDC M&A database announced between January 1, 1991 and December 31, 2019 by U.S. public companies with market capitalization greater than $1 million four weeks prior to announcement. Only deals that worth at least $1 million are included in the sample. The sample is further restricted to deals with a transfer of control, i.e. bidders own less than 50% before the acquisition and own more than 50% after the acquisition. Deals with target companies from the financial and utility industries are excluded from the sample. See Appendix C.1 for variable definitions.

	Obs.	Mean	SD	P10	P50	P90
Deal Characteristics						
Earnout Usage	23,304	0.085	0.278	0	0	0
Earnout Pct (%)	1,971	33.380	22.559	8.065	28.571	66.667
Earnout Value ($MM)	1,971	44.157	115.689	1.302	8.000	100.000
CAR [-2,+2] (%)	21,103	1.348	8.705	-7.993	0.662	11.463
Deal Completion	23,304	0.906	0.291	1	1	1
Target Characteristics						
Target Industry Uncertainty Shock	17,074	-0.002	0.057	-0.048	0.000	0.007
Public Target	23,304	0.171	0.377	0	0	1
Private Target	23,304	0.503	0.500	0	1	1
Subsidiary Target	23,304	0.325	0.468	0	0	1
Hi-tech Target	23,304	0.228	0.419	0	0	1
Log Deal Value ($MM)	23,304	3.915	1.930	1.500	3.738	6.526
Same Industry	23,304	0.626	0.484	0	1	1
Cross Border	23,304	0.171	0.376	0	0	1
Acquirer Characteristics						
Acquirer Log Assets ($MM)	22,027	6.423	2.056	3.795	6.330	9.210
Acquirer Log MB	20,967	4.955	1.999	2.562	4.861	7.565
Acquirer ROA	22,020	0.004	0.178	-0.141	0.045	0.125
Acquirer Leverage Ratio	21,771	0.469	0.241	0.155	0.467	0.767

Panel B. Comparison of M&A Transactions with and without Earnout

The table compares deal, target, and acquirer characteristics between M&A transactions with and without earnout in the sample. The sample includes acquisitions in the Thomson Reuters SDC M&A database announced between January 1, 1991 and December 31, 2019 by U.S. public companies with market capitalization greater than $1 million four weeks prior to announcement. Only deals that worth at least $1 million are included in the sample. The sample is further restricted to deals with a transfer of control, i.e. bidders own less than 50% before the acquisition and own more than 50% after the acquisition. Deals with target companies from the financial and utility industries are excluded from the sample. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variables are defined in Appendix C.1.

	With Earnout		Without Earnout		
	Mean	SD	Mean	SD	Difference
Deal Characteristics					
CAR [-2,+2] (%)	1.289	8.699	1.353	8.706	-0.065
Deal Completion	0.938	0.242	0.903	0.295	0.034***
Target Characteristics					
Target Industry Uncertainty Shock	-0.001	0.064	-0.003	0.056	0.002
Public Target	0.022	0.146	0.185	0.389	-0.163***
Private Target	0.751	0.432	0.481	0.500	0.271***
Subsidiary Target	0.227	0.419	0.334	0.472	-0.107***
Hi-tech Target	0.255	0.436	0.225	0.418	0.030**
Log Deal Value ($MM)	3.625	1.605	3.942	1.955	-0.317***
Same Industry	0.612	0.487	0.628	0.483	-0.016
Cross Border	0.187	0.390	0.169	0.375	0.017
Acquirer Characteristics					
Acquirer Log Assets ($MM)	5.852	1.930	6.476	2.060	-0.624***
Acquirer Log MB	4.548	1.871	4.993	2.007	-0.445***
Acquirer ROA	-0.016	0.198	0.006	0.176	-0.022***
Acquirer Leverage Ratio	0.400	0.234	0.476	0.241	-0.075***
Observations	1,971		21,333		23,304

Table 4.2 Earnout and M&A Deal Completion

The table reports results from the logistic regression of deal completion on the usage and fraction of earnout payment, estimated using Equation (4.2). The sample includes M&A transactions announced by U.S. public acquirers from 1991 to 2019. The dependent variable is an indicator variable that equals one if a deal is completed, and zero if a deal is withdrawn. Earnout usage is an indicator variable which equals one if an earnout agreement is included in the M&A transaction. Earnout pct is the ratio of earnout value to deal value. Columns (5) to (8) include deal-specific control variables. Columns (7) and (8) include additional acquirer-specific control variables. All columns include year fixed effects. Columns (2), (4), (6) and (8) include acquirer and target SIC 2-digit industry fixed effects. See Appendix C.1 for variable definitions. The standard errors (in parentheses) are clustered at acquirer industry (2-digit SIC) level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Earnout Usage	0.24*	0.16	0.76***	0.65***	0.75***	0.65***	0.66***	0.60***
	(0.13)	(0.11)	(0.17)	(0.14)	(0.16)	(0.14)	(0.13)	(0.12)
Earnout Pct (%)			-0.01***	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Private Target	0.90***	0.83***	0.90***	0.84***	1.15***	1.16***	1.20***	1.21***
	(0.09)	(0.11)	(0.09)	(0.11)	(0.09)	(0.10)	(0.09)	(0.09)
Subsidiary Target	0.46***	0.55***	0.46***	0.55***	0.71***	0.82***	0.73***	0.82***
	(0.12)	(0.10)	(0.12)	(0.10)	(0.10)	(0.08)	(0.08)	(0.08)
Hi-tech Target					0.47***	0.14	0.42***	0.06
					(0.11)	(0.12)	(0.11)	(0.14)
Log Deal Value ($MM)					0.13***	0.15***	0.11**	0.12**
					(0.02)	(0.02)	(0.05)	(0.05)
Same Industry					-0.16	-0.05	-0.20	-0.09
					(0.14)	(0.06)	(0.15)	(0.07)
Cross Border					-0.21**	-0.26***	-0.25**	-0.31***
					(0.08)	(0.06)	(0.10)	(0.07)
Acquirer Log Assets ($MM)							0.01	0.05
							(0.06)	(0.04)
Acquirer Log MB							0.03*	0.02
							(0.02)	(0.02)

Table 4.2 Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Acquirer ROA							0.64***	0.49***
							(0.16)	(0.13)
Acquirer Leverage Ratio							-0.80***	-0.58***
							(0.15)	(0.18)
Deal Control Variables	No	No	No	No	Yes	Yes	Yes	Yes
Acquirer Control Variables	No	No	No	No	No	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer, Target Industry FE	No	Yes	No	Yes	No	Yes	No	Yes
Pseudo R^2	0.03	0.06	0.03	0.06	0.04	0.07	0.05	0.07
Observations	23,304	23,258	23,304	23,258	23,304	23,258	20,966	20,892
Observations with Earnout	1,971	1,968	1,971	1,968	1,971	1,968	1,810	1,803

Table 4.3 Earnout and Acquirer Announcement Returns of M&A Transactions

The table reports results from the OLS regression of acquirer announcement returns on the usage and fraction of earnout payment, estimated using Equation (4.2). The sample includes M&A transactions announced by U.S. public acquirers from 1991 to 2019. The dependent variable is acquirer CAR [-2,+2] (%), which is the cumulative abnormal return of the acquirer in the 5-day event window centered around the announcement date. Earnout usage is an indicator variable which equals one if an earnout agreement is included in the M&A transaction. Earnout pct is the ratio of earnout value to deal value. Columns (5) to (8) include deal-specific control variables. Columns (7) and (8) include additional acquirer-specific control variables. All columns include year fixed effects. Columns (2), (4), (6) and (8) include acquirer and target SIC 2-digit industry fixed effects. See Appendix C.1 for variable definitions. The standard errors (in parentheses) are clustered at acquirer industry (2-digit SIC) level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Earnout Usage	-0.33	-0.37	0.40	0.33	0.43	0.33	0.15	0.10
	(0.22)	(0.22)	(0.28)	(0.29)	(0.28)	(0.29)	(0.26)	(0.27)
Earnout Pct (%)			-0.02***	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***
			(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Private Target	2.45***	2.44***	2.45***	2.45***	2.50***	2.49***	2.54***	2.52***
	(0.19)	(0.21)	(0.19)	(0.21)	(0.21)	(0.22)	(0.21)	(0.21)
Subsidiary Target	2.83***	2.84***	2.83***	2.84***	2.80***	2.88***	2.95***	3.05***
	(0.22)	(0.21)	(0.22)	(0.21)	(0.22)	(0.21)	(0.21)	(0.20)
Hi-tech Target					-0.62***	-0.68**	-0.52***	-0.51*
					(0.13)	(0.26)	(0.17)	(0.27)
Log Deal Value ($MM)					0.00	0.02	0.39***	0.40***
					(0.04)	(0.04)	(0.06)	(0.06)
Same Industry					0.01	0.10	-0.07	0.07
					(0.10)	(0.10)	(0.14)	(0.09)
Cross Border					-0.38	-0.38	-0.10	-0.13
					(0.25)	(0.25)	(0.24)	(0.25)
Acquirer Log Assets ($MM)							-0.62***	-0.62***
							(0.10)	(0.09)
Acquirer Log MB							-0.08**	-0.06

Table 4.3 Continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
							(0.04)	(0.04)
Acquirer ROA							-0.47	-0.76
							(0.61)	(0.62)
Acquirer Leverage Ratio							1.81***	1.88***
							(0.30)	(0.26)
Deal Control Variables	No	No	No	No	Yes	Yes	Yes	Yes
Acquirer Control Variables	No	No	No	No	No	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer, Target Industry FE	No	Yes	No	Yes	No	Yes	No	Yes
Adjusted R^2	0.01	0.02	0.02	0.02	0.02	0.02	0.03	0.03
Observations	21,103	21,103	21,103	21,103	21,103	21,103	19,339	19,339
Observations with Earnout	1,809	1,809	1,809	1,809	1,809	1,809	1,695	1,695

Table 4.4 Earnout and Target Industry Uncertainty Shock

The table reports the impact of target industry uncertainty on earnout agreements. Panel A reports results from the logistic regression of earnout usage on target industry uncertainty, estimated using Equation (4.5). Panel B reports results from the OLS regression of earnout fraction on target industry uncertainty, estimated using Equation (4.6).The sample includes M&A transactions announced by U.S. public acquirers from 1991 to 2019. The dependent variable in Panel A is an indicator variable that equals one if an earnout agreement is included. The dependent variable in Panel B is the ratio of earnout value to deal value. The independent variable is the normalized target industry uncertainty shock described in Section 4.2.2. Columns (3) to (6) include deal-specific control variables. Columns (5) and (6) include additional acquirer-specific control variables. All columns include year fixed effects. Columns (2), (4), and (6) include acquirer and target SIC 2-digit industry fixed effects. See Appendix C.1 for variable definitions. The standard errors (in parentheses) are clustered at acquirer industry (2-digit SIC) level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Earnout Usage and Target Industry Uncertainty Shock

	(1)	(2)	(3)	(4)	(5)	(6)
Target Industry Uncertainty Shock	0.13***	0.13**	0.13***	0.13**	0.15***	0.15**
	(0.05)	(0.06)	(0.05)	(0.06)	(0.05)	(0.06)
Private Target	2.59***	2.65***	2.53***	2.65***	2.86***	2.98***
	(0.45)	(0.41)	(0.39)	(0.37)	(0.46)	(0.45)
Subsidiary Target	1.72***	1.90***	1.67***	1.91***	2.09***	2.28***
	(0.42)	(0.40)	(0.38)	(0.36)	(0.45)	(0.45)
Hi-tech Target			-0.02	-0.21***	-0.08	-0.19*
			(0.14)	(0.08)	(0.14)	(0.10)
Log Deal Value ($MM)			-0.03	-0.00	0.17***	0.18***
			(0.04)	(0.03)	(0.03)	(0.03)
Same Industry			0.06	0.06	0.01	0.02
			(0.14)	(0.07)	(0.14)	(0.07)
Cross Border			-0.05	-0.19*	0.07	-0.05
			(0.10)	(0.10)	(0.08)	(0.09)
Acquirer Log Assets ($MM)					-0.25***	-0.21***
					(0.04)	(0.04)
Acquirer Log MB					-0.01	-0.06
					(0.05)	(0.05)

Panel A. Continued

	(1)	(2)	(3)	(4)	(5)	(6)
Acquirer ROA					0.04	0.23
					(0.28)	(0.21)
Acquirer Leverage Ratio					-0.99***	-0.47***
					(0.23)	(0.17)
Deal Control Variables	No	No	Yes	Yes	Yes	Yes
Acquirer Control Variables	No	No	No	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer, Target Industry FE	No	Yes	No	Yes	No	Yes
Pseudo R^2	0.08	0.12	0.08	0.13	0.11	0.15
Observations	17,074	16,799	17,074	16,799	15,865	15,438
Observations with Earnout	1,565	1,565	1,565	1,565	1,470	1,470

Panel B. Earnout Percentage and Target Industry Uncertainty Shock

	(1)	(2)	(3)	(4)	(5)	(6)
Target Industry Uncertainty Shock	0.54***	0.40**	0.55***	0.42**	0.56***	0.47**
	(0.19)	(0.17)	(0.20)	(0.17)	(0.21)	(0.19)
Private Target	4.11***	4.18***	3.74***	3.95***	3.92***	4.13***
	(0.41)	(0.58)	(0.66)	(0.75)	(0.74)	(0.81)
Subsidiary Target	1.53***	1.97***	1.18***	1.78***	1.72***	2.15***
	(0.34)	(0.36)	(0.44)	(0.51)	(0.56)	(0.58)
Hi-tech Target			-0.42	-0.80**	-0.88	-0.90**
			(0.52)	(0.38)	(0.61)	(0.41)
Log Deal Value ($MM)			-0.19	-0.11	0.23*	0.25**
			(0.14)	(0.12)	(0.14)	(0.11)
Same Industry			0.47	0.49**	0.21	0.32
			(0.51)	(0.21)	(0.48)	(0.22)
Cross Border			-0.16	-0.49	0.10	-0.21
			(0.29)	(0.31)	(0.27)	(0.29)
Acquirer Log Assets ($MM)					-0.61***	-0.49***
					(0.08)	(0.09)
Acquirer Log MB					0.21	0.03
					(0.18)	(0.15)
Acquirer ROA					-2.09	-1.42
					(1.76)	(1.36)
Acquirer Leverage Ratio					-3.10***	-1.53**
					(0.97)	(0.71)
Deal Control Variables	No	No	Yes	Yes	Yes	Yes
Acquirer Control Variables	No	No	No	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer, Target Industry FE	No	Yes	No	Yes	No	Yes

Panel B. Continued

	(1)	(2)	(3)	(4)	(5)	(6)
Adjusted R^2	0.03	0.05	0.03	0.05	0.04	0.06
Observations	17,074	17,074	17,074	17,074	15,865	15,865
Observations with Earnout	1,565	1,565	1,565	1,565	1,470	1,470

Table 4.5 Matching Analysis

Panel A. Comparison of M&A Deal Characteristics with and without Earnout: Matching Sample

The table compares deal, target, and acquirer characteristics between M&A transactions with and without earnout in the sample. The earnout sample constitutes of earnout acquisitions announced by U.S. public acquirers from 1991 to 2019. The control sample is constructed based on a one-to-two propensity score matching on deal announcement year, target status, deal value, and acquirer characteristics including total assets, market to book ratio, return on assets, and leverage ratio. Deals with target companies from the financial and utility industries are excluded from the sample. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variables are defined in Appendix C.1.

	With Earnout		Without Earnout		
	Mean	SD	Mean	SD	Difference
Deal Characteristics					
CAR [-2,+2] (%)	1.268	8.700	2.180	9.231	-0.912**
Deal Completion	0.938	0.240	0.939	0.239	-0.001
Target Characteristics					
Target Industry Uncertainty Shock	-0.001	0.064	-0.005	0.064	0.004
Public Target	0.020	0.141	0.025	0.156	-0.005
Private Target	0.753	0.432	0.720	0.449	0.033*
Subsidiary Target	0.227	0.419	0.255	0.436	-0.028*
Hi-tech Target	0.259	0.438	0.250	0.433	0.009
Log Deal Value ($MM)	3.666	1.579	3.667	1.611	-0.000
Same Industry	0.613	0.487	0.629	0.483	-0.016
Cross Border	0.188	0.391	0.162	0.369	0.026*
Acquirer Characteristics					
Acquirer Log Assets ($MM)	5.857	1.905	5.696	1.964	0.161**
Acquirer Log MB	4.527	1.857	4.246	1.886	0.282***
Acquirer ROA	-0.017	0.199	-0.023	0.212	0.007
Acquirer Leverage Ratio	0.399	0.234	0.434	0.255	-0.035***
Observations	1,836		2,835		4,671

Panel B. Earnout and M&A Deal Completion Rate: Matching Sample

The table reports results from the logistic regression of deal completion on the usage and fraction of earnout payment, estimated using Equation (4.2). The sample includes earnout transactions announced by U.S. public acquirers from 1991 to 2019, and a matched sample of non-earnout transactions. The control sample in columns (1) and (2) is matched on deal announcement year and target status. The control sample in columns (3) and (4) is matched on deal announcement year, target status, and +/-20% of deal value. The control sample in columns (5) and (6) is matched on deal announcement year, target status, and +/-20% of deal value and acquirer total assets. The control sample in columns (7) and (8) is constructed based on a one-to-two propensity score matching on deal announcement year, target status, deal value, and acquirer characteristics including total assets, market to book ratio, return on assets, and leverage ratio. The dependent variable is an indicator variable that equals one if the deal is completed. Earnout usage is an indicator variable which equals one if an earnout agreement is employed. Earnout pct is the ratio of earnout value to deal value. Deal- and acquirer-specific control variables are included in all specifications. All columns include year, acquirer and target SIC 2-digit industry fixed effects. See Appendix C.1 for variable definitions. The standard errors (in parentheses) are clustered at acquirer industry (2-digit SIC) level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Year & Status		Year, Status & DV		Year, Status, DV & Assets		Propensity Score	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Earnout Usage	0.65***	0.59***	0.61***	0.54***	0.60***	0.53***	0.40***	0.30**
	(0.13)	(0.13)	(0.13)	(0.14)	(0.12)	(0.13)	(0.12)	(0.14)
Earnout Pct (%)	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Private Target	1.20***	1.22***	1.14***	1.17***	1.27***	1.34***	1.15***	1.11***
	(0.09)	(0.10)	(0.15)	(0.15)	(0.12)	(0.13)	(0.41)	(0.39)
Subsidiary Target	0.72***	0.81***	0.66***	0.78***	0.80***	0.94***	0.80**	0.77**
	(0.09)	(0.09)	(0.12)	(0.12)	(0.12)	(0.13)	(0.35)	(0.35)
Deal & Acquirer Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year, Acquirer, Target Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.05	0.08	0.05	0.08	0.04	0.08	0.05	0.11
Observations	20,565	20,463	17,707	17,611	13,951	13,824	4,484	4,201
Observations with Earnout	1,810	1,801	1,809	1,800	1,768	1,758	1,783	1,684

Panel C. Earnout and Acquirer Announcement Returns of M&A Transactions: Matching Sample

The table reports results from the OLS regression of the acquirer announcement returns on the usage and fraction of earnout payment, estimated using Equation (4.4). The sample includes earnout transactions announced by U.S. public acquirers from 1991 to 2019, and a matched sample of non-earnout transactions. The dependent variable is acquirer CAR [-2,+2] (%), which is the cumulative abnormal return of the acquirer in the 5-day event window centered around the announcement date. Earnout usage is an indicator variable which equals one if an earnout agreement is included in the M&A transaction. Earnout pct is the ratio of earnout value to deal value. Deal- and acquirer-specific control variables are included in all specifications. All columns include year, acquirer and target SIC 2-digit industry fixed effects. See Appendix C.1 for variable definitions. The standard errors (in parentheses) are clustered at acquirer industry (2-digit SIC) level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Year & Status		Year, Status & DV		Year, Status, DV & Assets		Propensity Score	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Earnout Usage	0.16	0.11	0.10	0.07	0.01	-0.04	0.05	-0.03
	(0.26)	(0.27)	(0.26)	(0.27)	(0.27)	(0.28)	(0.33)	(0.37)
Earnout Pct (%)	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***	-0.02***	-0.02**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Private Target	2.58***	2.58***	2.34***	2.32***	1.93**	1.92**	3.07***	2.97***
	(0.21)	(0.21)	(0.25)	(0.24)	(0.83)	(0.83)	(0.72)	(0.75)
Subsidiary Target	3.02***	3.12***	2.79***	2.88***	2.54***	2.64***	3.82***	3.81***
	(0.21)	(0.20)	(0.28)	(0.27)	(0.84)	(0.86)	(0.71)	(0.72)
Deal & Acquirer Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year, Acquirer, Target Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04
Observations	18,962	18,962	16,281	16,281	12,821	12,821	4,165	4,165
Observations with Earnout	1,695	1,695	1,695	1,695	1,663	1,663	1,673	1,673

Panel D. Earnout Usage and Target Industry Uncertainty Shock: Matching Sample

The table reports results from the logistic regression of earnout usage on target industry uncertainty, estimated using Equation (4.5). The sample includes earnout transactions announced by U.S. public acquirers from 1991 to 2019, and a matched sample of non-earnout transactions. The dependent variable is an indicator variable that equals one if an earnout agreement is included in the M&A transaction. The independent variable is the normalized target industry uncertainty shock described in Section 4.2.2. Deal- and acquirer-specific control variables are included in all specifications. All columns include year, acquirer and target SIC 2-digit industry fixed effects. See Appendix C.1 for variable definitions. The standard errors (in parentheses) are clustered at acquirer industry (2-digit SIC) level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Year & Status		Year, Status & DV		Year, Status, DV & Assets		Propensity Score	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Target Industry Uncertainty Shock	0.14***	0.15**	0.15***	0.15**	0.15***	0.14**	0.25***	0.22***
	(0.05)	(0.06)	(0.05)	(0.06)	(0.05)	(0.06)	(0.07)	(0.07)
Private Target	2.73***	2.85***	1.79***	1.91***	0.60	0.73	0.44	0.60
	(0.46)	(0.45)	(0.50)	(0.50)	(0.57)	(0.56)	(0.50)	(0.48)
Subsidiary Target	1.96***	2.15***	1.05**	1.23**	-0.01	0.19	0.30	0.56
	(0.46)	(0.45)	(0.50)	(0.50)	(0.57)	(0.56)	(0.47)	(0.46)
Deal & Acquirer Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year, Acquirer, Target Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.11	0.15	0.08	0.12	0.06	0.10	0.01	0.07
Observations	15,696	15,272	13,754	13,392	11,002	10,738	3,664	3,599
Observations with Earnout	1,470	1,470	1,470	1,470	1,451	1,451	1,458	1,452

Panel E. Earnout Percentage and Target Industry Uncertainty Shock: Matching Sample

The table reports results from the OLS regression of earnout fraction on target industry uncertainty, estimated using Equation (4.6). The sample includes earnout transactions announced by U.S. public acquirers from 1991 to 2019, and a matched sample of non-earnout transactions. The dependent variable is the ratio of earnout value to deal value. The independent variable is the normalized target industry uncertainty shock described in Section 4.2.2. Deal- and acquirer-specific control variables are included in all specifications. All columns include year, acquirer and target SIC 2-digit industry fixed effects. See Appendix C.1 for variable definitions. The standard errors (in parentheses) are clustered at acquirer industry (2-digit SIC) level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Year & Status		Year, Status & DV		Year, Status, DV & Assets		Propensity Score	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Target Industry Uncertainty Shock	0.56**	0.47**	0.63**	0.51**	0.71**	0.50	2.16**	1.50**
	(0.21)	(0.20)	(0.24)	(0.22)	(0.33)	(0.30)	(0.84)	(0.73)
Private Target	3.71***	3.94***	3.41***	3.63***	1.51	1.96	1.90	4.14
	(0.69)	(0.77)	(0.49)	(0.54)	(1.90)	(1.69)	(3.37)	(2.64)
Subsidiary Target	1.51***	1.96***	1.26**	1.74***	-0.64	0.14	0.36	3.50
	(0.52)	(0.55)	(0.48)	(0.48)	(2.10)	(1.91)	(3.51)	(2.82)
Deal & Acquirer Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year, Acquirer, Target Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.04	0.06	0.04	0.06	0.03	0.06	0.02	0.08
Observations	15,696	15,696	13,754	13,754	11,002	11,002	3,664	3,664
Observations with Earnout	1,470	1,470	1,470	1,470	1,451	1,451	1,458	1,458

Table 4.6 Earnout Misuse and Acquirer Announcement Returns of M&A Transactions

The table reports results from the OLS regression of the acquirer announcement returns on the earnout misuse, estimated using Equation (4.7). The sample includes earnout transactions announced by U.S. public acquirers from 1991 to 2019. The dependent variable is acquirer CAR [-2,+2] (%), which is the cumulative abnormal return of the acquirer in the 5-day event window centered around the announcement date. Earnout misusage is an indicator variable which equals one if an earnout agreement is improperly used. See Section 4.3.5 for a detailed definition on Earnout misuse. Columns (3) to (6) include deal-specific control variables. Columns (5) and (6) include additional acquirer-specific control variables. All columns include year fixed effects. Columns (2), (4), and (6) include acquirer and target SIC 2-digit industry fixed effects. See Appendix C.1 for variable definitions. The standard errors (in parentheses) are clustered at acquirer industry (2-digit SIC) level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Earnout Misuse	-1.32***	-1.83***	-1.23***	-1.81***	-0.71	-1.16**
	(0.33)	(0.39)	(0.36)	(0.42)	(0.49)	(0.54)
Private Target	0.09	0.45	0.02	0.19	0.85	1.08
	(3.33)	(2.96)	(3.55)	(3.11)	(3.61)	(3.16)
Subsidiary Target	1.37	1.53	1.27	1.26	1.97	1.99
	(3.06)	(2.61)	(3.22)	(2.75)	(3.22)	(2.74)
Deal Control Variables	No	No	Yes	Yes	Yes	Yes
Acquirer Control Variables	No	No	No	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer, Target Industry FE	No	Yes	No	Yes	No	Yes
Adjusted R^2	0.01	0.02	0.01	0.02	0.02	0.03
Observations	1,385	1,385	1,385	1,385	1,385	1,385

Chapter 5

Conclusion

The thesis is a collection of three essays studying the impacts of economic uncertainty on the financial markets. Economic uncertainty has been increasingly high in recent years. The thesis seeks to understand the vital role uncertainty plays in economic activities.

In Chapter 2, I study the impact of economic uncertainty on going private transactions through the corporate governance channel. The chapter shows that companies are more likely to go private following uncertainty shocks. The effects are more prominent for companies with severe conflicts between shareholders, e.g., companies with dual-class structure and less institutional ownership. The effects are also stronger for companies facing large conflicts between shareholders and creditors: firms with lower asset redeployability, lower loan-to-bond ratio, and firms in financial distress. The results are consistent with the corporate governance hypothesis. Uncertainty exacerbates the agency problems of public companies. Companies go private to restructure their capital and align the interests between new shareholders, creditors, and managers. This chapter finds that companies receive a lower cost of debt after the agency problems are mitigated through going private.

Chapter 3 investigates how economic uncertainty shocks can transform into shocks to investors' information production costs and affect firms' relative cost of bank loans vs. corporate bonds. The financial intermediation theories suggest that, in order for banks to create safe money which are liquid and can be redeemable at par, banks should keep information about their assets secret. The chapter argues that this, in turn, translates into a comparative advantage when banks lend to more opaque firms. Using a sample of firms that issue bank loans and corporate bonds simultaneously, the chapter documents that firms pay a relatively lower cost

of bank loans when they experience uncertainty shocks. In other words, banks offer an opacity discount to opaque firms. The chapter finds that the opacity discount is offered more by banks that rely more on the money creation function, e.g., banks that experience uninsured deposit outflows, or banks that do not receive implicit government guarantees after the financial crisis.

In Chapter 4, I investigate how companies use earnout agreement, a contingent payment contract, to manage the elevated valuation risks following uncertainty shocks. Earnouts are widely applied in M&A transactions with private targets, increasing from almost 0 to more than 30% in the past twenty years. In this chapter, I investigate the trade-offs of using an earnout agreement. On one hand, earnout bridges the valuation gap between the buyer and the seller and helps facilitate deal completion. I show that earnouts are more likely to be used when target industry uncertainty is high. The probability of deal completion increases significantly when an earnout agreement is employed. On the other hand, earnout can introduce incentive misalignment problems in the post-transaction period. The acquirer's objective is to maximize firm value, while the target's objective is to maximize earnout payments. Such incentive misalignment can destroy firm value. I find the acquirer CARs to be significantly lower when earnouts are misused, i.e., when they are not used to manage the valuation risks. The chapter suggests that the costs of earnout should not be neglected and earnout should be used with caution.

To sum up, Chapter 2 and 3 of the thesis study how economic uncertainty affects firms' cost of capital in the equity and debt market respectively. The results suggest that the costs of private equity and private debt are relatively lower compared to the public market in the presence of uncertainty shocks. Chapter 4 focuses on the impacts of economic uncertainty in mergers and acquisitions. It shows how firms use contingent payment contracts to manage the valuation risks after uncertainty shocks, and highlights the potential problems associated with such contracts. The thesis provides a deep understanding of the impacts of uncertainty on the financial markets, which is an important finance question, especially under the current economic turmoil.

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Appendices

Appendix A. Appendix to Chapter 2

A.1 Variable Definition

Δ ***Volatility*** is the change in annualized stock return volatility $(\sigma_{i,t} - \sigma_{i,t-1})/(\frac{1}{2}\sigma_{i,t} + \frac{1}{2}\sigma_{i,t-1})$ for firm i at a given year t.

Analyst Coverage is the number of analysts following the company.

Asset Redeployability is the value weighted asset redeployability index from Kim and Kung (2017).

Dual Class is an indicator variable which equals to one if the firm has dual class structure.

Financial Distress is an indicator variable which equals to one if the Altman Z-score if lower than 1.8. Altman Z-Score = 1.2*(working capital / total assets) + 1.4*(retained earnings / total assets) + 3.3*(earnings before interest and tax / total assets) + 0.6*(market value of equity / total liabilities) + 1.0*(sales / total assets)

GDP Growth is the percent change of gross domestic product from FRED.

Institutional Ownership is the percentage ownership by institutional blockholders from SEC 13F holdings.

Intangible Assets is total intangible assets divided by total assets from Compustat.

Leverage is total long term debt divided by total assets from Compustat.

Loan to Bond Ratio is the ratio of bank loans to corporate bonds from Capital IQ.

Log ERC is the log of earnings response coefficient. Earnings response coefficient is estimated as the coefficient of regressing size-adjusted CAR around the three day window of the earning announcement on unexpected earnings. Unexpected earning is the actual earning per share minus the median earning forecast from I/B/E/S database. ERC is estimated at SIC 3-digit industry level.

Log Relative Tobin's Q is the log of firm Tobin's Q divided by industry Tobin's Q, which is the size-weighted average of Tobin's Q for each 3-digit SIC industry.

Log Sales is the log of sales from Compustat.

Recession is the recession indicators defined by NBER.

Return on Assets is net income divided by total assets from Compustat.

Sentiment is the investor sentiment sf1 measure from Baker and Wurgler (2006).

Stock Return is the compounded return within a fiscal year, using CRSP daily dividend cumulative stock returns.

Tax Ratio is (federal income taxes + foreign income taxes - total interest and related expense + state income tax)/ market capitalization from Crsp/Compustat Merged Database.

Term Premium is the yield spread between 10 years and 1 year Treasury bond.

Tobin's Q is (stock price * common shares used to calculate earnings per share + preferred stock/liquidating value + total long term debt + total debt in current liabilities - deferred taxes and investment tax credit) divided by total assets at the beginning of the fiscal year from Compustat.

VIX is the CBOE volatility index from Bloomberg.

Volatility is the standard deviation of daily dividend cumulative stock returns (from CRSP) within a fiscal year, multiplied by $\sqrt{252}$.

A.2 Additional Tables

Table A.2.1 Sample Description

Panel A. Sample Composition by Industry

The table reports the industry distribution of the firms that filed for Schedule 13E-3 and delisted within two years after the filing from 1994 to 2017. Firms in financial and utilities industries are excluded from the sample. Industries are based on Fama-French twelve industry classifications from http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_12_ind_port.html.

No.	Description	No. of Going Private Firms	Percentage
1	Consumer Nondurables	77	8.23
2	Consumer Durables	27	2.89
3	Manufacturing	94	10.05
4	Energy	46	4.92
5	Chemicals	15	1.60
6	Business Equipment	190	20.32
7	Telecom	52	5.56
9	Shops	148	15.83
10	Healthcare	53	5.67
12	Other	233	24.92
	Total	935	100.00

Panel B. Sample Composition by Year

The table reports the time-series distribution of the firms that filed for schedule 13E-3 and delisted within two years after filing from 1994 to 2017. Firms in financial and utilities industries are excluded from the sample. Percentage indicates the number of going private firms in that year out of the total number of going private firms.

Year	No. of Going Private Firms	Percentage
1994	4	0.43
1995	12	1.28
1996	27	2.89
1997	42	4.49
1998	51	5.45
1999	77	8.24
2000	54	5.78
2001	69	7.38
2002	53	5.67
2003	66	7.06
2004	51	5.45
2005	53	5.67
2006	43	4.60
2007	36	3.85
2008	24	2.57
2009	38	4.06
2010	39	4.17
2011	28	2.99
2012	24	2.57
2013	39	4.17
2014	20	2.14
2015	24	2.57
2016	44	4.71
2017	17	1.82
Total	935	100.00

Table A.2.2 Cox Proportional Hazards Models for Time to Go Private: First Stage Results

This table reports first stage results of the Cox proportional hazards models for time to go private with control functions. Columns (1)-(4) correspond to the first stage results in Table 2.2 columns (3)-(6) respectively. The sample includes going-private firms over the period of 1994-2017 and a group of control firms that remain public. The dependent variable is $\Delta\text{Volatility}_{i,t-1}$. Standard errors (in parentheses) are clustered at SIC 3-digit level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variables are defined in Appendix A.1.

	Cox Proportional Hazards Model with Control Function: First Stage			
	(1)	(2)	(3)	(4)
Δ Vol Exposure $\text{CAD}_{i,t-1}$	1.11***	1.32***	1.30***	1.14***
	(0.38)	(0.37)	(0.38)	(0.35)
Δ Vol Exposure $\text{EUR}_{i,t-1}$	1.84***	1.69***	1.72***	1.56***
	(0.61)	(0.59)	(0.60)	(0.39)
Δ Vol Exposure $\text{JPY}_{i,t-1}$	1.62***	0.99*	1.02*	1.97***
	(0.61)	(0.52)	(0.52)	(0.42)
Δ Vol Exposure $\text{AUD}_{i,t-1}$	4.41***	3.39***	3.22***	2.08***
	(0.89)	(0.90)	(0.90)	(0.47)
Δ Vol Exposure $\text{SEK}_{i,t-1}$	3.53***	4.22***	4.16***	2.94***
	(0.46)	(0.53)	(0.53)	(0.43)
Δ Vol Exposure $\text{CHF}_{i,t-1}$	3.85***	3.51***	3.54***	1.98***
	(0.68)	(0.59)	(0.61)	(0.37)
Δ Vol Exposure $\text{GBP}_{i,t-1}$	-0.05	0.43	0.57	0.86
	(0.89)	(0.95)	(0.96)	(0.62)
Δ Vol Exposure $\text{Oil}_{i,t-1}$	4.28***	3.92***	3.96***	2.70***
	(0.28)	(0.24)	(0.24)	(0.25)
Δ Vol Exposure $\text{Policy}_{i,t-1}$	415.78**	507.70**	532.83**	418.46***
	(176.01)	(207.15)	(208.78)	(152.18)
Δ Vol Exposure $\text{Treasury}_{i,t-1}$	57.65***	61.83***	62.69***	36.88***
	(4.95)	(5.46)	(5.41)	(4.69)
Control Variables	No	Yes	Yes	Yes
1^{st} Moment 10 $\text{IV}_{i,t-1}$	No	Yes	Yes	Yes
Industry FE	No	No	Yes	Yes
Year FE	No	No	No	Yes
Firm-year Observations	33,711	26,034	26,034	26,034
F statistic Cragg-Donald	287.4	209.7	210.8	75.5
F statistic Kleibergen-Paap	130.4	102.6	104.3	33.3
p-val Kleib.-P Underidentification Test	0.000	0.000	0.000	0.000
p-val Sargan-H J Overidentification Test	0.412	0.342	0.307	0.495

Table A.2.3 Uncertainty Shocks and Going Private Transactions: Impacts of Macroeconomic Factors

This table reports results of the Cox proportional hazards models with control functions, controlling for macroeconomic factors. The sample includes going-private firms over the period of 1994-2017 and a group of control firms that remain public. The dependent variable is the hazard rate of going private. In the Cox proportional hazards models, the firm-year observations are treated as recurring censored events until the firm goes private or the end of the sample period. Standard errors (in parentheses) are clustered at SIC 3-digit level and bootstrapped with 300 replications. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variables are defined in Appendix A.1.

	Cox Proportional Hazards Model with Control Function				
	(1)	(2)	(3)	(4)	(5)
ΔVolatility$_{i,t\text{-}1}$	1.63***	1.40***	1.82***	1.29***	1.40***
	(0.25)	(0.25)	(0.23)	(0.26)	(0.26)
Volatility$_{i,t\text{-}2}$	1.17***	0.73***	1.04***	0.78***	0.77***
	(0.19)	(0.18)	(0.20)	(0.21)	(0.19)
Stock Return$_{i,t\text{-}1}$	-0.42***	-0.48***	-0.43***	-0.43***	-0.44***
	(0.10)	(0.11)	(0.10)	(0.10)	(0.10)
GDP growth$_{t\text{-}1}$	0.16***				
	(0.05)				
Sentiment$_{t\text{-}1}$		0.36***			
		(0.10)			
Term Premium$_{t\text{-}1}$			-0.23**		
			(0.09)		
VIX$_{t\text{-}1}$				0.02**	
				(0.01)	
Recession$_{t\text{-}1}$					-0.13
					(0.23)
Control Variables	Yes	Yes	Yes	Yes	Yes
1st Moment 10 IV$_{i,t-1}$	Yes	Yes	Yes	Yes	Yes
Indystry FE	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	No	No	No
Firm-year Observations	26,034	21,875	25,896	25,300	21,917
No. of Firms	2,620	2,216	2,482	2,466	2,216
No. of Going Private Firms	252	206	222	222	206
Wald χ^2	394.9***	325.0***	332.8***	363.4***	307.1***

Table A.2.4 Cox Proportional Hazards Models for Time to Go Private: Instruments with Alternative Risk Models

Panel A. First Stage Results

This table reports first stage results of the Cox proportional hazards models for time to go private with control functions, with the instruments constructed using alternative risk models. The sample includes going-private firms over the period of 1994-2017 and a group of control firms that remain public. The dependent variable is $\Delta\text{Volatility}_{i,t-1}$. Standard errors (in parentheses) are clustered at SIC 3-digit level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variables are defined in Appendix A.1.

	Cox Proportional Hazards Model with Control Function: First Stage			
	Raw Return	CAPM	FF3F	FF5F
	(1)	(2)	(3)	(4)
Δ Vol Exposure $\text{CAD}_{i,t-1}$	0.78***	0.68***	1.36***	1.37***
	(0.10)	(0.20)	(0.39)	(0.37)
Δ Vol Exposure $\text{EUR}_{i,t-1}$	1.77**	1.16***	1.59***	1.69***
	(0.69)	(0.33)	(0.31)	(0.39)
Δ Vol Exposure $\text{JPY}_{i,t-1}$	1.19***	1.37***	1.60***	1.86***
	(0.42)	(0.27)	(0.47)	(0.42)
Δ Vol Exposure $\text{AUD}_{i,t-1}$	-0.07	1.76***	1.83***	1.96***
	(0.17)	(0.42)	(0.38)	(0.39)
Δ Vol Exposure $\text{SEK}_{i,t-1}$	-0.44**	1.99***	2.53***	2.84***
	(0.17)	(0.35)	(0.43)	(0.41)
Δ Vol Exposure $\text{CHF}_{i,t-1}$	0.88***	1.94***	1.45***	1.70***
	(0.15)	(0.30)	(0.35)	(0.32)
Δ Vol Exposure $\text{GBP}_{i,t-1}$	1.32	0.79	1.54***	1.25*
	(1.48)	(0.75)	(0.56)	(0.69)
Δ Vol Exposure $\text{Oil}_{i,t-1}$	3.23***	2.29***	2.39***	2.58***
	(0.58)	(0.20)	(0.24)	(0.26)
Δ Vol Exposure $\text{Policy}_{i,t-1}$	1142.33***	473.89*	421.46**	617.05***
	(359.57)	(269.49)	(183.15)	(165.06)
Δ Vol Exposure $\text{Treasury}_{i,t-1}$	12.24***	29.62***	37.15***	33.86***
	(1.65)	(2.12)	(3.95)	(4.81)
Control variables	Yes	Yes	Yes	Yes
1^{st} Moment 10 $\text{IV}_{i,t-1}$	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm-year Observations	25,814	25,214	25,173	25,300
F statistic Cragg-Donald	72.9	85.8	72.6	73.5
F statistic Kleibergen-Paap	35.9	57.2	44.1	37.5
p-val Kleib.-P Underidentification Test	0.000	0.000	0.000	0.000
p-val Sargan-H J Overidentification Test	0.791	0.386	0.328	0.307

Panel B. Cox Proportional Hazards Models with Control Functions

This table reports results of the Cox proportional hazards models for time to go private, with the instruments constructed using alternative risk models. The sample includes going-private firms over the period of 1994-2017 and a group of control firms that remain public. The dependent variable is the hazard rate of going private. In the Cox proportional hazards models, the firm-year observations are treated as recurring censored events until the firm goes private or the end of the sample period. Standard errors (in parentheses) are clustered at SIC 3-digit level and bootstrapped with 300 replications. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variables are defined in Appendix A.1.

	Cox Proportional Hazards Model with Control Function			
	Raw Return	CAPM	FF3F	FF5F
	(1)	(2)	(3)	(4)
ΔVolatility$_{i,t\text{-}1}$	1.07***	1.06***	0.93***	1.13***
	(0.27)	(0.25)	(0.26)	(0.24)
Volatility$_{i,t\text{-}2}$	0.68***	0.73***	0.68***	0.71***
	(0.22)	(0.20)	(0.19)	(0.21)
Stock Return$_{i,t\text{-}1}$	-0.45***	-0.48***	-0.48***	-0.45***
	(0.11)	(0.11)	(0.11)	(0.10)
Control Variables	Yes	Yes	Yes	Yes
1st Moment 10 IV$_{i,t-1}$	Yes	Yes	Yes	Yes
Indystry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm-year Observations	25,814	25,214	25,173	25,300
No. of Firms	2,650	2,635	2,609	2,600
No. of Going Private Firms	258	248	245	246
Wald χ^2	2165.9***	3354.3***	3228.7***	2750.9***

Table A.2.5 Cox Proportional Hazards Models for Time to Go Private: Matching Analysis on IPO Characteristics

This table reports results of the Cox proportional hazards models for time to go private, estimated using Equation (2.1). The sample includes going-private firms over the period of 1994-2017 and control firms that matched on firm characteristics one year after IPO. The dependent variable is the hazard rate of going private. In the Cox proportional hazards models, the firm-year observations are treated as recurring censored events until the firm goes private or the end of the sample period. The control samples in columns (1)-(4) are matched on SIC 2-digit industry, log sales, Tobin's Q, and stock return respectively. The control sample in column (5) is constructed with propensity score matching on Fama-French 12 industry, log sales, Tobin's Q and stock return. Standard errors (in parentheses) are clustered at SIC 3-digit level and bootstrapped with 300 replications. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Variables are defined in Appendix A.1.

	Cox Proportional Hazards Model with Control Function				
	SIC2	Log Sales	Tobin's Q	Stock Return	P-score
	(1)	(2)	(3)	(4)	(5)
ΔVolatility$_{i,t\text{-}1}$	0.98***	1.14***	1.59***	1.46**	0.75**
	(0.38)	(0.38)	(0.40)	(0.67)	(0.32)
Volatility$_{i,t\text{-}2}$	0.72**	0.71***	0.96***	1.11*	0.46***
	(0.30)	(0.24)	(0.31)	(0.65)	(0.29)
Stock Return$_{i,t\text{-}1}$	-0.41***	-0.49***	-0.48***	-0.55***	-0.58***
	(0.14)	(0.13)	(0.14)	(0.21)	(0.14)
Log Sales$_{i,t\text{-}1}$	-0.10*	-0.19***	-0.13***	-0.13*	-0.04
	(0.06)	(0.06)	(0.05)	(0.08)	(0.05)
Tobin's Q$_{i,t\text{-}1}$	-0.19**	-0.10	-0.22***	0.00	-0.08
	(0.10)	(0.07)	(0.08)	(0.10)	(0.06)
Tax$_{i,t\text{-}1}$	4.45	4.38	3.68	3.80	4.20
	(3.29)	(2.68)	(2.73)	(4.52)	(3.10)
Leverage$_{i,t\text{-}1}$	0.08	0.26	0.10	1.80**	-0.03
	(0.44)	(0.43)	(0.44)	(0.70)	(0.47)
Return on Assets$_{i,t\text{-}1}$	0.60*	0.31	0.84**	0.47	0.25
	(0.35)	(0.28)	(0.36)	(1.11)	(0.32)
Intangible Assets$_{i,t\text{-}1}$	0.19	0.49	0.35	1.07	0.64
	(0.70)	(0.65)	(0.63)	(1.08)	(0.65)
Control Variables	Yes	Yes	Yes	Yes	Yes
1st Moment 10 IV$_{i,t-1}$	Yes	Yes	Yes	Yes	Yes
Indystry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Firm-year Observations	13,151	17,127	17,993	6,149	10,132
No. of Firms	1,271	1,715	1,651	536	958
No. of Going Private Firms	171	198	174	71	171
Wald χ^2	6436.2***	1325.3***	4030.8***	88220.3***	136504.5***

Appendix B. Appendix to Chapter 3

B.1 Variable Definition

Loan-Bond Pair Characteristics	
Loan-Bond Spread	All-in-drawn loan spread minus bond spread (Dealscan and FISD).
Total Borrowing	The sum of loan facility amount and bond face value ($MM) (Dealscan and FISD).
Log Total Borrowing	The logarithm of the sum of loan facility amount and bond face value (Dealscan and FISD).
Δ Maturity	Loan maturity minus bond maturity in years (Dealscan and FISD).
Loan Share	The loan facility amount divided by the sum of loan facility amount and bond face value (Dealscan and FISD).
Information Cost	
Uncertainty Shock ($\Delta\sigma_{t-1}$)	The difference between annualized stock return volatility estimated 5 quarters and 1 quarter before the loan origination date (CRSP).
Opacity Index	Sum of quintiles based on bid-ask spread, trading volume, analyst coverage, and analyst forecast errors, normalized by 20. (CRSP and IBES)
Rating Gap	The absolute rating gap between bond ratings at issuance by Standard & Poor's and Moody's (FISD).
Rating Disagreement	A dummy variable that equals to one if the rating gap is greater or equal to two (FISD).
Firm Characteristics	
Volatility (σ_{t-5})	Annualized stock return volatility, estimated 5 quarters before the loan origination date (CRSP).
Stock Return (r_{t-1})	Annual stock return, estimated 1 quarter before the loan origination date (CRSP).
Total Assets	Asset size ($B) (Compustat).
Profitability	Ratio of operating income before depreciation to book assets (Compustat).
Implied Prob. Default	Implied probability of default from Bharath and Shumway (2008).
Asset Market-to-book	Ratio of quasi-market assets to book assets. (Compustat)
Quasi-market Leverage	Ratio of book debt to quasi-market assets. (Compustat)
Loan Characteristics	
Facility Amount	Loan facility amount ($MM) (Dealscan).
Log Facility Amount	The logarithm of the loan facility amount (Dealscan).
All-in-drawn Spread	The all-in-drawn spread of loan facilities (Dealscan).
Syndicated Loan	An indicator variable that equals one if a loan is a syndicated loan (Dealscan).
Term Loan	An indicator variable that equals one if a loan is a term loan (Dealscan).
Secured Loan	An indicator variable that equals one if a loan is a secured loan (Dealscan).

Bond Characteristics

Face Value	Face amount of a bond ($MM) (FISD).
Bond Spread	Yield to maturity of the bond at issuance (bps) (FISD).
Bond Rating	Average bond rating at issuance by Moody's and S&P (FISD)
Secured Bond	An indicator variable that equals one if a bond is a secured bond (FISD).
Redeemable Bond	An indicator variable that equals one if a bond is a redeemable bond (FISD).
Embedded Investor Option	An indicator variable that equals one if a bond is putable, convertible or exchangeable (FISD).
Bondholder protective Covenant	An indicator variable that equals one if a bond has cross default or cross acceleration covenants (FISD).
Negative Pledge Covenant	An indicator variable that equals one if a bond has negative pledge covenants (FISD).

Bank Characteristics

Udep	Ratio of uninsured deposits to total assets of the bank holding company, estimated five quarters before the loan origination date (FR Y-9C).
Outflow	A dummy variable which equals to one if the change in uninsured deposits of the bank is in the bottom 5 percentile of the sample, estimated 1 quarter before the loan origination date (FR Y-9C).
European Bank	The fraction of European banks among lead banks in a loan syndicate.
Non-GSIBs	The fraction of non-global systemically important banks among lead banks in the loan syndicate.

B.2 Instrument Variables Construction

We construct the instruments for firm uncertainty shocks following Alfaro, Bloom, and Lin (2019) on a quarterly basis. The instruments are constructed exploiting firms' differential exposures to volatility shocks of multiple aggregate variables. For each aggregate variable c, we construct an instrument

$$IV^c_{k,t} = \left|\beta^c_{k,t-2}\right| \cdot \Delta\sigma^c_t, \tag{B.2.1}$$

where c is crude oil, three currencies (Canadian Dollar, British Pound and Australian Dollar), 10-year U.S. Treasury note, or economic policy uncertainty. $\beta^c_{k,t-2}$ is the sensitivity of stock returns to changes in these aggregate variables estimated at for each 3-digit SIC industry k. $\Delta\sigma^c_t$ is aggregate volatility shock for quantity c, which is measured using year-on-year change in the annualized standard deviation of daily price changes of c, or year-on-year change in the average annual daily implied volatility of c. We use changes in both realized volatility and implied volatility to capture volatility shocks based on past events as well as expected shocks in the future. For economic policy uncertainty, $\Delta\sigma^c_t$ is the year-on-year change in the 365-day average of economic policy uncertainty. The idea behind the instruments is that when there is a volatility shock to aggregate quantity c, firms with different levels of exposure to c, captured by sensitivities $\beta^c_{k,t-2}$, experience different opacity shocks.

Sensitivities $\beta^c_{k,t-2}$ are estimated using:

$$r^{risk\_adj}_{i,t} = \alpha_{k,t} + \sum_c \beta^c_{k,t-2} r^c_t + \epsilon_{i,t}, \tag{B.2.2}$$

where $r^{risk\_adj}_{i,t}$ is firm i's daily risk adjusted stock return and r^c_t is the daily price change of c. We estimate the sensitivities for each 3-digit SIC industry k using a 10-year rolling window. The estimated sensitivities are weight adjusted by their statistical significance levels. The adjusted sensitivities are lagged by two years to ensure that they pre-date the opacity shocks, both in the aggregate and firm level. The sensitivities are unlikely to be correlated with firm specific characteristics two years from now. Aggregate volatility shocks,$\Delta\sigma^c_t$, are also unlikely to be driven by firm characteristics. For this reason, the instruments, by construction, do not correlate with any unobservable firm characteristics.

We include the aggregate first moment effects, $Agg^c_{k,t}$ to control for the direct impact of changes in aggregate quantities on firm opacity. For each aggregate variable of c, $Agg^c_{k,t} = \beta^c_{k,t-2} \cdot r^c_t$, where r^c_t is the average annual return of c, and $\beta^c_{k,t-2}$ is the weighted sensitivity of c estimated in Equation (B.2.2). Controlling for $Agg^c_{k,t}$ allows us to isolate the second moment effects of aggregate volatility shocks on firm opacity, from the first moment effects of changes in levels of aggregate quantities on firm opacity.

B.3 Additional Tables

Table B.3.1 Sample Construction Process

The table illustrates our sample construction process. The starting point is the intersection of DealScan and Compustat from 1995 to 2019 with the loan denominated in U.S. dollars by non-financial U.S. public firms. The sample of loans is restricted to senior loans with non-missing all-in-drawn spread. Each loan is paired with the closest senior bond issued by the same firm within 60 days. We restrict the loan-bond pairs to those with investment grade bond rating. We further restrict the loan-bond pairs to those with the same maturity category, i.e. short-term, mid-term or long-term in maturity.

Process	No. of Observations
Senior USD denominated loan facilities by non-financial U.S. public firms	67,967
Senior USD denominated bond issuances by non-financial U.S. public firms	15,422
Loan-bond pairs issued by the same firm within 60 days	8,686
Keeping the bond with closest starting date for each loan facility	7,825
Less loan-bond pairs by non-investment bond grading	4,015
Less loan-bond pairs with different maturity	2,379
Less loan-bond pairs with missing data	1,597

Table B.3.2 First Stage of the IV Estimation

The table presents the first stage regression results of the IV estimation. The first stage results are estimated as follows: $\Delta\sigma_{i,t-1} = \beta_1 + \beta_2 IV^c_{k,t-1} + \beta_3\sigma_{i,t-5} + \beta_4 r_{i,t-1} + \beta_5 Bond_{i,t} + \beta_6 Loan_{i,t} + \beta_7 Agg^c_{k,t} + \phi_j + \psi_t + \epsilon_{i,j,t}$. $\Delta\sigma_{i,t-1}$ is the year-on-year change in the annualized stock return volatility lagged by one quarter before loan origination. We instrument firm opacity shock using aggregate volatility shocks to currency, energy, policy and U.S. Treasury notes together with firms' exposures to these aggregate volatility shocks. Instruments in columns (1)-(3) are constructed using aggregate realized volatility shocks, and instruments in columns (4)-(6) are constructed aggregate implied volatility shocks. Columns (1) to (6) report the first stage regression results for the corresponding second stage results in columns (1) to (6) of Table 3. The standard errors (in parentheses) are clustered at firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Realized			Implied		
	(1)	(2)	(3)	(4)	(5)	(6)
Exposure ΔVol Cad	4.85**	5.27**	4.27*	4.97	9.55**	6.62
	(2.37)	(2.29)	(2.35)	(4.86)	(4.73)	(5.22)
Exposure ΔVol Gbp	7.34**	15.21***	7.62*	14.34	19.12*	21.09**
	(3.31)	(5.09)	(4.23)	(8.89)	(10.65)	(9.00)
Exposure ΔVol Aud	3.98	3.43	4.46	0.61	-1.77	0.72
	(2.50)	(2.16)	(2.84)	(4.23)	(3.39)	(4.10)
Exposure ΔVol Tbill	33.86	32.55	33.90	342.75***	349.40***	316.14***
	(35.60)	(32.57)	(30.99)	(132.17)	(113.99)	(122.07)
Exposure ΔVol Oil	0.87	0.74	0.47	2.49***	2.49***	2.07**
	(0.79)	(0.75)	(0.68)	(0.89)	(0.91)	(0.86)
Exposure ΔVol EPU	870.54***	1051.22***	684.92**	1868.49***	1767.07***	1407.31**
	(309.67)	(294.08)	(331.03)	(662.98)	(631.90)	(711.05)
Observations	797	750	794	515	482	513

Table B.3.3 Information Cost and the Loan-Bond Spread: Alternative Samples
The table reports results from the OLS regressions of the loan-bond spread on firm information cost with alternative samples. The dependent variable is the difference between loan rate and bond yield. Uncertainty shock is the year-on-year change in the annualized stock return volatility lagged by one quarter before loan origination. All columns include year by quarter fixed effects. In Panel A-E, column (2) and (5) include bank holding company fixed effects, and column (3) and (6) include lender fixed effects. See Appendix B.1 for variable definitions. The standard errors (in parentheses) are clustered at firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Excluding the Financial Crisis
The sample includes loan facility and investment-grade bond pairs issued by U.S. non-financial public firms within 60 days from 1995 to 2019, excluding 2007-09.

	(1)	(2)	(3)	(4)	(5)	(6)
Uncertainty Shock	-0.58**	-0.59**	-0.50**	-0.80***	-0.69**	-0.74***
	(0.29)	(0.24)	(0.21)	(0.30)	(0.27)	(0.24)
Volatility	-2.36***	-1.66***	-1.74***	-2.67***	-2.28***	-2.51***
	(0.69)	(0.57)	(0.54)	(0.62)	(0.60)	(0.57)
Stock Return	0.49**	0.33**	0.39**	0.67***	0.53***	0.38**
	(0.22)	(0.16)	(0.16)	(0.24)	(0.19)	(0.17)
Control Variables	No	No	No	Yes	Yes	Yes
Year×Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Holding Company FE	No	Yes	No	No	Yes	No
Lender FE	No	No	Yes	No	No	Yes
Adjusted R^2	0.35	0.41	0.51	0.62	0.66	0.73
Observations	1,500	1,243	1,491	901	778	898

Panel B. Loan-Bond Pairs within 30 Days

The sample includes loan facility and investment-grade bond pairs issued by U.S. non-financial public firms within 30 days from 1995 to 2019.

	(1)	(2)	(3)	(4)	(5)	(6)
Uncertainty Shock	-0.62	-0.81***	-0.70***	-0.68	-0.90***	-0.69**
	(0.44)	(0.29)	(0.26)	(0.43)	(0.34)	(0.32)
Volatility	-2.76***	-2.42***	-2.34***	-2.88***	-2.80***	-2.85***
	(0.85)	(0.60)	(0.60)	(0.78)	(0.65)	(0.60)
Stock Return	0.73***	0.54***	0.55***	0.67**	0.30	0.43**
	(0.26)	(0.21)	(0.18)	(0.30)	(0.19)	(0.20)
Control Variables	No	No	No	Yes	Yes	Yes
Year×Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Holding Company FE	No	Yes	No	No	Yes	No
Lender FE	No	No	Yes	No	No	Yes
Adjusted R^2	0.37	0.45	0.57	0.62	0.73	0.77
Observations	1,042	876	1,038	647	559	647

Panel C. Loan-bond Pairs within 10 Days

The sample includes loan facility and investment-grade bond pairs issued by U.S. non-financial public firms within 10 days from 1995 to 2019.

	(1)	(2)	(3)	(4)	(5)	(6)
Uncertainty Shock	-0.85*	-0.73	-0.51	-2.61***	-1.47**	-1.64**
	(0.51)	(0.50)	(0.42)	(0.90)	(0.68)	(0.78)
Volatility	-2.38**	-2.74***	-2.00**	-2.55	-4.28***	-5.90***
	(1.18)	(0.99)	(0.91)	(2.02)	(1.41)	(2.20)
Stock Return	-0.12	0.25	-0.24	-0.60	-0.97*	-0.71
	(0.44)	(0.48)	(0.36)	(0.98)	(0.54)	(0.59)
Control Variables	No	No	No	Yes	Yes	Yes
Year×Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Holding Company FE	No	Yes	No	No	Yes	No
Lender FE	No	No	Yes	No	No	Yes
Adjusted R^2	0.40	0.52	0.63	0.53	0.70	0.75
Observations	395	324	391	241	219	241

Panel D. Loan-bond Pairs without Matching on Maturity

The sample includes loan facility and investment-grade bond pairs issued by U.S. non-financial public firms with no restriction on maturity from 1995 to 2019.

	(1)	(2)	(3)	(4)	(5)	(6)
Uncertainty Shock	-0.89***	-0.95***	-0.80***	-0.56***	-0.50**	-0.53**
	(0.18)	(0.20)	(0.18)	(0.21)	(0.24)	(0.21)
Volatility	-2.18***	-2.03***	-2.16***	-0.48	-0.40	-0.45
	(0.31)	(0.32)	(0.30)	(0.35)	(0.39)	(0.38)
Stock Return	0.36***	0.36***	0.41***	0.47***	0.48***	0.49***
	(0.09)	(0.11)	(0.10)	(0.10)	(0.12)	(0.11)
Control Variables	No	No	No	Yes	Yes	Yes
Year×Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Holding Company FE	No	Yes	No	No	Yes	No
Lender FE	No	No	Yes	No	No	Yes
Adjusted R^2	0.31	0.34	0.38	0.48	0.49	0.54
Observations	5,522	4,638	5,500	3,107	2,697	3,091

Panel E. Loan-bond Pairs Matched on Effective Maturity

The sample includes loan facility and investment-grade bond pairs issued by U.S. non-financial public firms matched on effective maturity from 1995 to 2019.

	(1)	(2)	(3)	(4)	(5)	(6)
Uncertainty Shock	-0.61**	-0.63***	-0.51**	-0.77**	-0.71**	-0.73***
	(0.27)	(0.23)	(0.21)	(0.31)	(0.28)	(0.25)
Volatility	-2.29***	-1.57***	-1.59***	-2.28***	-1.91***	-2.30***
	(0.66)	(0.53)	(0.52)	(0.65)	(0.65)	(0.62)
Stock Return	0.53***	0.42**	0.47***	0.66***	0.54**	0.44**
	(0.20)	(0.17)	(0.16)	(0.25)	(0.21)	(0.18)
Control Variables	No	No	No	Yes	Yes	Yes
Year×Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Holding Company FE	No	Yes	No	No	Yes	No
Lender FE	No	No	Yes	No	No	Yes
Adjusted R^2	0.36	0.43	0.52	0.54	0.57	0.65
Observations	1,599	1,339	1,590	956	830	953

Panel F. Firm Information Cost and the Loan-Bond Spread: Alternative Samples with Alternative Measures

The table reports results from the OLS regression of the loan-bond spread on firm information shock with alternative samples, estimated using alternative measures. The sample includes loan facilities and investment-grade bond pairs issued by U.S. non-financial public firms from 1995 to 2019: a. excluding the financial crisis; b. loan-bond pairs issued within 30 days; c. loan-bond pairs with no restriction on maturity; d. loan-bond pairs matched on effective maturity. The dependent variable is the difference between loan rate and bond yield for each matched loan-bond pair in the sample. Opacity index is constructed following Anderson et al.(2009). Rating gap is the absolute rating gap between bond ratings by Standard & Poor's and Moody's. Rating disagreement is a dummy variable that equals to one if the rating gap is greater or equal to two. Column (1), (3) and (5) include bank holding company fixed effects. Column (2), (4) and (6) include lender fixed effects. Control variables are included in all columns.

a. Excluding the Financial Crisis 2007-09						
	Opacity Index		Rating Gap		Rating Disagreement	
	(1)	(2)	(3)	(4)	(5)	(6)
Information Cost	-0.82***	-0.79***	-1.71***	-1.45***	-0.16*	-0.17*
	(0.29)	(0.27)	(0.46)	(0.45)	(0.09)	(0.09)
Adjusted R^2	0.68	0.74	0.69	0.74	0.68	0.74
Observations	838	960	823	945	675	736
b. Loan-bond Pairs within 30 Days						
	(1)	(2)	(3)	(4)	(5)	(6)
Information Cost	-0.96***	-0.85***	-1.06**	-1.04*	-0.21*	-0.19*
	(0.32)	(0.33)	(0.51)	(0.54)	(0.11)	(0.11)
Adjusted R^2	0.68	0.73	0.68	0.73	0.68	0.73
Observations	838	960	823	945	675	736
c. Loan-bond Pairs without Matching on Maturity						
	(1)	(2)	(3)	(4)	(5)	(6)
Information Cost	-0.96***	-0.85***	-1.06**	-1.04*	-0.21*	-0.19*
	(0.32)	(0.33)	(0.51)	(0.54)	(0.11)	(0.11)
Adjusted R^2	0.68	0.73	0.68	0.73	0.68	0.73
Observations	838	960	823	945	675	736
d. Loan-bond Pairs Matched on Effective Maturity						
	(1)	(2)	(3)	(4)	(5)	(6)
Information Cost	-0.96***	-0.85***	-1.06**	-1.04*	-0.21*	-0.19*
	(0.32)	(0.33)	(0.51)	(0.54)	(0.11)	(0.11)
Adjusted R^2	0.68	0.73	0.68	0.73	0.68	0.73
Observations	838	960	823	945	675	736
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Year×Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Holding Company FE	Yes	No	Yes	No	Yes	No
Lender FE	No	Yes	No	Yes	No	Yes

Table B.3.4 Firm Information Cost and the Loan-Bond Spread: Alternative Control Variables

The table reports the robustness results from the OLS regression of the loan-bond spread on firm information shock, with alternative control variables. The sample includes loan facility and investment-grade bond pairs issued by U.S. non-financial public firms within 60 days from 1995 to 2019. The dependent variable is the difference between loan rate and bond yield. All columns include year by quarter fixed effects. See Appendix B.1 for variable definitions. The standard errors (in parentheses) are clustered at firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Controlling for Additional Bond and Firm Characteristics

The table reports results from the OLS regression of the loan-bond spread on firm uncertainty shock controlling for a variety of firm and contract characteristics that can affect the loan-bond spread. Uncertainty Shock is the year-on-year change in the annualized stock return volatility lagged by one quarter before loan origination. Additional variables (quasi-market assets, asset tangibility, total number of banks in a loan syndicate, indicators for bonds with asset sale restriction, credit enhancement, or tender offer) are included in the regressions (results not reported). Column (2) and (5) include bank holding company fixed effects. Column (3) and (6) include lender fixed effects.

	(1)	(2)	(3)	(4)	(5)	(6)
Uncertainty Shock	-0.62**	-0.63***	-0.52**	-1.08***	-0.67**	-0.72***
	(0.27)	(0.23)	(0.20)	(0.29)	(0.26)	(0.24)
Volatility	-2.29***	-1.57***	-1.60***	-3.80***	-3.34***	-3.51***
	(0.66)	(0.53)	(0.52)	(0.72)	(0.59)	(0.58)
Stock Return	0.53***	0.42**	0.47***	0.58*	0.60**	0.77***
	(0.20)	(0.17)	(0.16)	(0.30)	(0.27)	(0.25)
Quasi-market Leverage				-1.49**	-1.26*	-1.37**
				(0.66)	(0.64)	(0.65)
Implied Prob. Default				-5.46	-5.60**	-5.62**
				(4.17)	(2.62)	(2.67)
Asset Market-to-book				-0.31***	-0.18*	-0.19**
				(0.09)	(0.09)	(0.09)
Profitability				-0.13	-4.68	-4.31
				(3.18)	(3.33)	(3.26)
Log Borrowing Amount				10.07***	9.58***	9.03***
				(2.08)	(2.10)	(2.11)
Δ Maturity (years)				0.08***	0.08***	0.08***
				(0.00)	(0.00)	(0.00)
Secured Loan				0.58***	0.23	0.30*
				(0.20)	(0.22)	(0.18)
Bond Rating				0.23***	0.15***	0.13***
				(0.05)	(0.05)	(0.04)
Redeemable Bond				-1.88***	-0.71	-0.70
				(0.52)	(0.62)	(0.67)
Secured Bond				-0.36	-0.26	-0.06
				(0.28)	(0.27)	(0.24)
Putable Bond				5.84***	5.60***	5.61***
				(0.64)	(0.54)	(0.61)
Cross Acceleration Covenant				-0.15	-0.19*	-0.09
				(0.13)	(0.11)	(0.11)

Panel A. Continued

	(1)	(2)	(3)	(4)	(5)	(6)
Year×Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Holding Company FE	No	Yes	No	No	Yes	No
Lender FE	No	No	Yes	No	No	Yes
Adjusted R^2	0.36	0.43	0.52	0.73	0.74	0.80
Observations	1,597	1,338	1,588	529	435	527

Panel B. Excluding Stock Return as a Control Variable

The table reports results from the OLS regression of the loan-bond spread on firm uncertainty cost, excluding stock return as a control variable.

	(1)	(2)	(3)	(4)	(5)	(6)
Uncertainty Shock	-0.67**	-0.65***	-0.56***	-0.85***	-0.71***	-0.78***
	(0.26)	(0.22)	(0.20)	(0.31)	(0.25)	(0.24)
Volatility	-2.31***	-1.55***	-1.61***	-2.62***	-2.12***	-2.28***
	(0.66)	(0.54)	(0.52)	(0.60)	(0.58)	(0.57)
Control Variables	No	No	No	Yes	Yes	Yes
Year×Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Holding Company FE	No	Yes	No	No	Yes	No
Lender FE	No	No	Yes	No	No	Yes
Adjusted R^2	0.36	0.42	0.51	0.62	0.67	0.73
Observations	1,597	1,338	1,588	963	838	960

Panel C. Alternative Measures excluding Stock Return Volatility as a Control Variable

The table reports results from the OLS regression of the loan-bond spread on firm information cost, estimated using alternative measures without controlling for stock return volatility. Opacity index is constructed following Anderson et al.(2009). Rating gap is the absolute rating gap between bond ratings by Standard & Poor's and Moody's. Rating disagreement is a dummy variable that equals to one if the rating gap is greater or equal to two. Column (1), (3) and (5) include bank holding company fixed effects. Column (2), (4) and (6) include lender fixed effects. Control variables are included in all columns.

	Opacity Index		Rating Gap		Rating Disagreement	
	(1)	(2)	(3)	(4)	(5)	(6)
Information Cost	-1.49***	-1.31***	-0.11	-0.16**	-0.29	-0.40**
	(0.35)	(0.34)	(0.07)	(0.06)	(0.19)	(0.16)
Stock Return	0.62***	0.50***	0.49**	0.36*	0.50**	0.36*
	(0.21)	(0.17)	(0.23)	(0.20)	(0.23)	(0.20)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Year×Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Holding Company FE	Yes	No	Yes	No	Yes	No
Lender FE	No	Yes	No	Yes	No	Yes
Adjusted R^2	0.67	0.73	0.66	0.74	0.66	0.74
Observations	829	959	681	750	681	750

Table B.3.5 Uninsured Deposits Outflow and the Loan-Bond Spread

The table presents results of the robustness tests of the money creation mechanism using heterogeneity in banks' reliance on uninsured deposits. Panel A and Panel B include log asset of the bank holding company or the borrower as an additional control variable. Panel C excludes stock return volatility as a control variable. The sample includes matched loan facilities and investment-grade bond pairs issued by U.S. non-financial public firms within 60 days from 1995 to 2019. The dependent variable is the difference between loan rate and bond yield for each matched loan-bond pair in the sample. Uncertainty shock is the year-on-year change in the annualized stock return volatility lagged by one quarter before the loan origination. Opacity index is constructed following Anderson et al. (2009). Rating gap is the absolute rating gap between bond ratings by Standard & Poor's and Moody's. Outflow is a dummy variable which equals to one if the bank experiences large uninsured deposits outflow in the past year (banks in the bottom 5 percentile of the sample in terms of changes in uninsured deposits, representing a decrease in uninsured deposits of more than 25%), lagged by one quarter before loan origination. Udep is the ratio of uninsured deposits to total assets of the bank holding company before the uninsured deposits outflow. All columns include year by quarter fixed effects. Column (1), (3) and (5) include bank holding company fixed effects. Column (2), (4) and (6) include lender fixed effects. Control variables are included in all columns. See Appendix B.1 for variable definitions. The standard errors (in parentheses) are clustered at firm level. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Controlling for Bank Size

	Uncertainty Shock		Opacity Index		Rating Gap	
	(1)	(2)	(3)	(4)	(5)	(6)
Info. Cost × Udep × Outflow	-2.78*	-2.46**	-3.77**	-3.88**	-1.34***	-1.05***
	(1.46)	(1.23)	(1.83)	(1.58)	(0.28)	(0.24)
Info. Cost	-0.92***	-0.95***	-1.57***	-1.55***	-0.20***	-0.16***
	(0.30)	(0.29)	(0.46)	(0.48)	(0.06)	(0.06)
Info. Cost × Udep	-0.40	-0.22	2.16**	2.44***	1.64***	1.32***
	(0.48)	(0.33)	(0.91)	(0.81)	(0.28)	(0.30)
Info. Cost × Outflow	-0.07	0.13	0.86	1.03	-0.52	-0.77*
	(1.23)	(1.18)	(1.66)	(1.57)	(0.38)	(0.41)
Udep	0.54*	0.59**	0.83**	0.94***	0.40*	0.40*
	(0.28)	(0.26)	(0.36)	(0.33)	(0.23)	(0.24)
Outflow	1.52*	2.27***	-0.48	-0.17	2.49**	4.26***
	(0.91)	(0.69)	(1.18)	(1.08)	(1.22)	(1.17)
Udep × Outflow	-0.51	-0.41	1.92***	2.09***	1.36***	1.33***
	(0.34)	(0.26)	(0.72)	(0.56)	(0.23)	(0.22)
Volatility	-2.33***	-2.81***	-0.65	-1.12*	-2.03***	-2.25***
	(0.71)	(0.66)	(0.69)	(0.62)	(0.71)	(0.76)
Stock Return	0.72***	0.75***	0.78***	0.88***	0.85***	0.87***
	(0.25)	(0.24)	(0.26)	(0.24)	(0.27)	(0.27)
Log Assets (Bank)	-0.62	-0.22	-0.66	-0.06	-0.18	-0.34
	(0.41)	(0.46)	(0.42)	(0.42)	(0.38)	(0.42)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Year×Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Holding Company FE	Yes	No	Yes	No	Yes	No
Lender FE	No	Yes	No	Yes	No	Yes
Adjusted R^2	0.63	0.65	0.64	0.65	0.64	0.65
Observations	626	626	617	617	503	503

Panel B. Controlling for Firm Size

	Uncertainty Shock		Opacity Index		Rating Gap	
	(1)	(2)	(3)	(4)	(5)	(6)
Info. Cost × Udep× Outflow	-2.98**	-2.77***	-3.48***	-3.57***	-1.24***	-1.18***
	(1.26)	(0.99)	(1.21)	(0.96)	(0.27)	(0.20)
Info. Cost	-0.86***	-0.98***	-1.30***	-1.38***	-0.20***	-0.17***
	(0.25)	(0.25)	(0.40)	(0.45)	(0.06)	(0.06)
Info. Cost × Udep	-0.37*	-0.65***	-0.73**	-0.64**	0.10	0.21***
	(0.22)	(0.21)	(0.35)	(0.32)	(0.06)	(0.08)
Info. Cost × Outflow	-0.13	0.62	0.46	1.35	-0.33	-0.24
	(0.98)	(0.88)	(1.19)	(1.21)	(0.29)	(0.32)
Udep	0.27	0.41**	0.71**	0.82***	0.23*	0.20
	(0.18)	(0.18)	(0.30)	(0.28)	(0.14)	(0.15)
Outflow	1.32**	2.19***	-0.22	-0.39	1.74*	2.60***
	(0.56)	(0.45)	(0.86)	(0.88)	(0.99)	(0.93)
Udep × Outflow	-0.59	-0.53*	1.98***	2.14***	1.44***	1.39***
	(0.36)	(0.28)	(0.72)	(0.56)	(0.24)	(0.21)
Volatility	-2.01***	-2.32***	-0.60	-0.94*	-1.65***	-2.03***
	(0.55)	(0.55)	(0.57)	(0.56)	(0.56)	(0.58)
Stock Return	0.66***	0.55***	0.67***	0.57***	0.61***	0.56***
	(0.19)	(0.19)	(0.18)	(0.18)	(0.18)	(0.19)
Log Assets (Borrower)	0.06	0.08	0.07	0.09	0.15**	0.15**
	(0.08)	(0.07)	(0.08)	(0.08)	(0.07)	(0.06)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Year×Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Holding Company FE	Yes	No	Yes	No	Yes	No
Lender FE	No	Yes	No	Yes	No	Yes
Adjusted R^2	0.65	0.68	0.65	0.67	0.65	0.67
Observations	759	760	748	749	606	606

Panel C. Excluding Stock Return Volatility as a Control Variable

	Uncertainty Shock		Opacity Index		Rating Gap	
	(1)	(2)	(3)	(4)	(5)	(6)
Info. Cost × Udep × Outflow	-4.07***	-3.80***	-3.56***	-3.72***	-1.35***	-1.35***
	(1.36)	(1.18)	(1.18)	(1.05)	(0.23)	(0.20)
Info. Cost	-0.51**	-0.59**	-1.48***	-1.63***	-0.19***	-0.16**
	(0.23)	(0.24)	(0.36)	(0.40)	(0.06)	(0.06)
Info. Cost × Udep	-0.37*	-0.67***	-0.74**	-0.64**	0.09	0.18**
	(0.21)	(0.21)	(0.35)	(0.32)	(0.06)	(0.07)
Info. Cost × Outflow	-1.14	-0.51	0.49	1.38	-0.53*	-0.49
	(1.05)	(0.96)	(1.20)	(1.22)	(0.29)	(0.34)
Udep	0.30*	0.45***	0.72**	0.82***	0.27**	0.25*
	(0.16)	(0.16)	(0.28)	(0.26)	(0.13)	(0.15)
Outflow	1.27**	2.07***	-0.26	-0.50	2.15**	2.94***
	(0.55)	(0.47)	(0.86)	(0.84)	(1.01)	(1.09)
Udep × Outflow	0.32**	0.45***	0.74***	0.84***	0.32**	0.28*
	(0.15)	(0.16)	(0.28)	(0.27)	(0.14)	(0.16)
Stock Return	0.66***	0.54***	0.63***	0.53***	0.54***	0.51***
	(0.19)	(0.19)	(0.18)	(0.18)	(0.19)	(0.19)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Year×Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank Holding Company FE	Yes	No	Yes	No	Yes	No
Lender FE	No	Yes	No	Yes	No	Yes
Adjusted R^2	0.64	0.67	0.65	0.67	0.64	0.66
Observations	760	761	752	753	610	610

Appendix C. Appendix to Chapter 4

C.1 Variable Definition

Deal Characteristics	
Earnout Usage	An indicator variable that equals one if an earnout agreement is employed in the M&A transaction (Thomson Reuters SDC).
Earnout Pct	Ratio of earnout value to deal value (%) (Thomson Reuters SDC).
Earnout Value	The logarithm of the value of the earnout in an M&A transaction ($MM) (Thomson Reuters SDC).
CAR [-2,+2]	Acquirer cumulative abnormal returns (CARs) estimated in the 5-day event window centered around the M&A deal announcement date. (%) (CRSP).
Deal Completion	An indicator variable that equals one if a deal is completed, and zero if a deal is withdrawn (Thomson Reuters SDC).
Target Characteristics	
Target Industry Uncertainty Shock	Value weighted average of the changes in annualized stock return volatility induced by macro uncertainty shocks of the public companies operating in target SIC 3-digit industry (CRSP).
Public Target	An indicator variable that equals one if the target is a public company (Thomson Reuters SDC).
Private Target	An indicator variable that equals one if the target is a private company (Thomson Reuters SDC).
Subsidiary Target	An indicator variable that equals to one if the target is a subsidiary of another company (Thomson Reuters SDC).
Hi-tech Target	An indicator variable that equals one if the target company operates in the hi-tech industry (Thomson Reuters SDC).
Log Deal Value	The logarithm of deal value ($MM) (Thomson Reuters SDC).
Same Industry	An indicator variable that equals one if the target and acquirer operate in the same SIC 2-digit industry (Thomson Reuters SDC).
Cross Border	An indicator variable that equals one if a deal is a cross border acquisition (Thomson Reuters SDC).
Target Industry Sales Growth	The median of the target industry's sales growth.
Target Industry Firm Age	The medium age of the public companies operating in the target industry.
Target Boutique Advisor	An indicator variable that equals to one if the target company hires a boutique bank as M&A advisor.
Acquirer Characteristics	
Acquirer Log Assets	The logarithm of acquirer total assets ($MM) (Thomson Reuters SDC).

Acquirer Log MB	The logarithm of the ratio of acquirer market capitalization 4 weeks prior to announcement to the book value (Thomson Reuters SDC).
Acquirer ROA	Ratio of acquirer net income in the past twelve months to total assets (Thomson Reuters SDC).
Acquirer Leverage Ratio	Ratio of acquirer long term debt to total assets (Thomson Reuters SDC).
Acquirer Boutique Advisor	An indicator variable that equals to one if the acquirer hires a boutique bank as M&A advisor.

C.2 Measuring Macroeconomic Uncertainty

I follow Alfaro et al.(2021) to construct the macroeconomic uncertainty shocks faced by each industry, taking industry's exposure to the uncertainty shocks into account. The variables are constructed exploiting firms' differential exposures to volatility shocks of multiple aggregate variables. For each aggregate factor c, I construct the variable

$$IV^c_{j,t} = \left|\beta^c_{k,j-2}\right| \cdot \Delta\sigma^c_t, \tag{C.2.1}$$

where c is crude oil, seven currencies (Australian Dollar, British pound, Canadian Dollar, the Euro, Japanese Yen, and Swedish Krona), 10-year U.S. Treasury note, or economic policy uncertainty. $\beta^c_{j,t-2}$ is the sensitivity of stock returns to changes in these aggregate variables estimated at for each 3-digit SIC industry j. $\Delta\sigma^c_t$ is aggregate volatility shock for quantity c, which is measured using year-on-year change in the annualized standard deviation of daily price changes of c, or year-on-year change in the average annual daily implied volatility of c. Both changes in realized volatility and implied volatility are used to capture volatility shocks based on past events as well as expected shocks in the future. For economic policy uncertainty, $\Delta\sigma^c_t$ is the year-on-year change in the 365-day average of economic policy uncertainty. The idea behind the instruments is that when there is a volatility shock to aggregate quantity c, firms with different levels of exposure to c, captured by sensitivities $\beta^c_{j,t-2}$, experience different uncertainty shocks.

Sensitivities $\beta^c_{j,t-2}$ are estimated using:

$$r^{risk\_adj}_{a,t} = \alpha_{j,t} + \sum_c \beta^c_{j,t-2} r^c_t + \epsilon_{a,t}, \tag{C.2.2}$$

where $r^{risk\_adj}_{a,t}$ is firm a's daily risk adjusted stock return and r^c_t is the daily price change of c. I estimate the sensitivities for each 3-digit SIC industry j using a 10-year rolling window. The estimated sensitivities are weight adjusted by their statistical significance levels. The adjusted sensitivities are lagged by two years to ensure that they pre-date the opacity shocks, both in the aggregate and firm level. The sensitivities are unlikely to be correlated with firm specific characteristics two years from now. Aggregate volatility shocks,$\Delta\sigma^c_t$, are also unlikely to be driven by firm characteristics. For this reason, the variables, by construction, do not correlate with any unobservable firm characteristics.

C.3 Additional Tables

Table C.3.1 Sample Description

Panel A. Sample Composition by Year

The table reports the annual distribution of earnout transactions in the sample. The sample includes acquisitions in the Thomson Reuters SDC M&A database announced between January 1, 1991 and December 31, 2019 by U.S. public companies with market capitalization greater than $1 million four weeks prior to announcement. Only deals that worth at least $1 million are included in the sample. The sample is further restricted to deals with a transfer of control, i.e. bidders own less than 50% before the acquisition and own more than 50% after the acquisition. Deals with target companies from the financial and utility industries are excluded from the sample.

Year	No. of Earnout Transactions	Percentage
1991	8	0.41
1992	2	0.10
1993	6	0.30
1994	6	0.30
1995	40	2.03
1996	43	2.18
1997	76	3.86
1998	105	5.33
1999	71	3.60
2000	86	4.36
2001	66	3.35
2002	81	4.11
2003	83	4.21
2004	98	4.97
2005	93	4.72
2006	103	5.23
2007	123	6.24
2008	97	4.92
2009	67	3.40
2010	81	4.11
2011	99	5.02
2012	84	4.26
2013	66	3.35
2014	88	4.46
2015	78	3.96
2016	54	2.74
2017	50	2.54
2018	63	3.20
2019	54	2.74
Total	1,971	100.00

Panel B. Sample Composition by Industry

The table reports the industry distribution of the earnout transactions in the sample. The sample includes acquisitions in the Thomson Reuters SDC M&A database announced between January 1, 1991 and December 31, 2019 by U.S. public companies with market capitalization greater than $1 million four weeks prior to announcement. Only deals that worth at least $1 million are included in the sample. The sample is further restricted to deals with a transfer of control, i.e. bidders own less than 50% before the acquisition and own more than 50% after the acquisition. Deals with target companies from the financial and utility industries are excluded from the sample. Industries are classified based on Fama-French twelve industry classifications from http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_12_ind_port.html.

No.	Description	No. of Earnout Transactions	Percentage
1	Consumer Nondurables	78	3.96
2	Consumer Durables	38	1.93
3	Manufacturing	135	6.85
4	Energy	33	1.67
5	Chemicals	22	1.12
6	Business Equipment	685	34.75
7	Telecom	43	2.18
9	Shops	121	6.14
10	Healthcare	421	21.36
12	Other	395	20.04
	Total	1,971	100.00

Table C.3.2 Earnout and M&A Deal Completion: Linear Probability Estimation

The table reports results from the linear probability regression of deal completion on the usage and fraction of earnout payment, estimated using Equation (4.8). The sample includes M&A transactions announced by U.S. public acquirers from 1991 to 2019. The dependent variable is an indicator variable which equals one if the deal is completed, and zero if the deal is withdrawn. Earnout usage is an indicator variable which equals one if an earnout agreement is included in the M&A transaction. Earnout pct is the ratio of earnout payment to deal value. Columns (5) to (8) include deal-specific control variables. Columns (7) and (8) include additional acquirer-specific control variables. All columns include year fixed effects. Columns (2), (4), (6) and (8) include acquirer and target SIC 2-digit industry fixed effects. See Appendix C.1 for variable definitions. The standard errors (in parentheses) are clustered at acquirer industry (2-digit SIC) level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Earnout Usage	0.01*	0.01	0.05***	0.04***	0.04***	0.03***	0.04***	0.03***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Earnout Pct (%)			-0.01***	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Private Target	0.09***	0.08***	0.09***	0.08***	0.11***	0.11***	0.11***	0.11***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Subsidiary Target	0.05***	0.06***	0.05***	0.06***	0.07***	0.08***	0.07***	0.08***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Deal Control Variables	No	No	No	No	Yes	Yes	Yes	Yes
Acquirer Control Variables	No	No	No	No	No	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer, Target Industry FE	No	Yes	No	Yes	No	Yes	No	Yes
Adjusted R^2	0.02	0.03	0.02	0.03	0.02	0.04	0.03	0.04
Observations	23,304	23,304	23,304	23,304	23,304	23,304	20,966	20,966
Observations with Earnout	1,971	1,971	1,971	1,971	1,971	1,971	1,810	1,810

Table C.3.3 Earnout and Target Industry Uncertainty Shock: Linear Probability Estimation

The table reports results from the linear probability regression of earnout usage on target industry uncertainty, estimated using Equation (4.9). The sample includes M&A transactions announced by U.S. public acquirers from 1991 to 2019. The dependent variable is an indicator variable that equals one if an earnout agreement is included. The independent variable is the normalized target industry uncertainty shock described in Section 4.2.2. Columns (3) to (6) include deal-specific control variables. Columns (5) and (6) include additional acquirer-specific control variables. All columns include year fixed effects. Columns (2), (4), and (6) include acquirer and target SIC 2-digit industry fixed effects. See Appendix C.1 for variable definitions. The standard errors (in parentheses) are clustered at acquirer industry (2-digit SIC) level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Target Industry Uncertainty Shock	0.01***	0.01**	0.01***	0.01**	0.01***	0.01**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
Private Target	0.12***	0.12***	0.12***	0.12***	0.12***	0.13***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
Subsidiary Target	0.05***	0.06***	0.05***	0.06***	0.06***	0.07***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Deal Control Variables	No	No	Yes	Yes	Yes	Yes
Acquirer Control Variables	No	No	No	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer, Target Industry FE	No	Yes	No	Yes	No	Yes
Adjusted R^2	0.04	0.06	0.04	0.06	0.06	0.07
Observations	17,074	17,074	17,074	17,074	15,865	15,865
Observations with Earnout	1,565	1,565	1,565	1,565	1,470	1,470

Table C.3.4 Earnout and Target Industry Uncertainty Shock: Robustness Tests
The table reports the robustness results of the impact of target industry uncertainty on earnout agreements, with alternative control variables. Panel A reports the results controlling for the target company's growth prospective. Panel B reports the results controlling for the impacts of M&A advisors. The sample includes M&A transactions announced by U.S. public acquirers from 1991 to 2019. Columns (1) and (2) in Panel A and columns (1) to (3) in Panel B report results from the logistic regression estimated using Equation (4.5). The dependent variable is an indicator variable that equals one if an earnout agreement is included. Columns (3) and (4) in Panel A and columns (4) to (6) in Panel B report the results from the OLS regression estimated using Equation (4.6). The dependent variable is the ratio of earnout value to deal value. The independent variable is the normalized target industry uncertainty shock described in Section 4.2.2. All columns include year fixed effects. Columns (2) and (4) in Panel A and columns (2), (3), (5), and (6) in Panel B include acquirer and target SIC 2-digit industry fixed effects. Columns (3) and (6) in Panel B include acquirer and target M&A advisor fixed effects. See Appendix C.1 for variable definitions. The standard errors (in parentheses) are clustered at acquirer industry (2-digit SIC) level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Controlling for the Target Company's Growth Prospective

	Earnout Usage		Earnout Percentage	
	(1)	(2)	(3)	(4)
Target Industry Uncertainty Shock	0.15***	0.16**	0.60***	0.50**
	(0.05)	(0.07)	(0.22)	(0.20)
Private Target	2.85***	2.98***	3.90***	4.11***
	(0.46)	(0.45)	(0.74)	(0.80)
Subsidiary Target	2.09***	2.29***	1.74***	2.18***
	(0.45)	(0.43)	(0.59)	(0.62)
Hi-tech Target	-0.20	-0.27**	-1.57*	-1.31***
	(0.20)	(0.11)	(0.93)	(0.46)
Log Deal Value ($MM)	0.17***	0.18***	0.23*	0.25**
	(0.03)	(0.03)	(0.13)	(0.11)
Same Industry	-0.02	0.02	0.08	0.32
	(0.12)	(0.07)	(0.41)	(0.20)
Cross Boarder	0.08	-0.04	0.18	-0.17
	(0.08)	(0.09)	(0.27)	(0.28)
Acquirer Log Asset ($MM)	-0.25***	-0.21***	-0.60***	-0.49***
	(0.04)	(0.04)	(0.08)	(0.09)
Acquirer Log MB	-0.02	-0.06	0.17	0.02
	(0.05)	(0.04)	(0.17)	(0.14)
Acquirer ROA	0.15	0.29*	-1.48	-1.12
	(0.20)	(0.17)	(1.33)	(1.15)
Acquirer Leverage Ratio	-0.93***	-0.42***	-2.81***	-1.35**
	(0.22)	(0.14)	(0.82)	(0.58)
Target Industry Sales Growth	-0.44	-0.28	-1.80**	-1.00
	(0.31)	(0.29)	(0.86)	(0.86)
Target Industry Firm Age	-0.05*	-0.06***	-0.27*	-0.29**
	(0.03)	(0.02)	(0.15)	(0.14)

Panel A. Continued

	(1)	(2)	(3)	(4)
Control Variables	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Acquirer, Target Industry FE	No	Yes	No	Yes
Pseudo R^2	0.11	0.15		
Adjusted R^2			0.05	0.06
Observations	15,865	15,438	15,865	15,865
Observations with Earnout	1,470	1,470	1,470	1,470

Panel B. Controlling for M&A advisors

	(1)	(2)	(3)	(4)	(5)	(6)
Target Industry Uncertainty Shock	0.15***	0.16**	0.29	0.56***	0.47**	0.40
	(0.05)	(0.06)	(0.29)	(0.21)	(0.19)	(0.24)
Private Target	2.85***	2.97***	3.78***	3.86***	4.06***	3.55***
	(0.46)	(0.45)	(0.94)	(0.74)	(0.81)	(1.06)
Subsidiary Target	2.09***	2.27***	2.44***	1.67***	2.10***	0.80***
	(0.45)	(0.44)	(0.83)	(0.56)	(0.58)	(0.23)
Hi-tech Target	-0.08	-0.19*	0.66	-0.87	-0.91**	0.19
	(0.14)	(0.10)	(0.58)	(0.61)	(0.42)	(0.48)
Log Deal Value ($MM)	0.18***	0.19***	-0.21	0.26*	0.28**	-0.19
	(0.03)	(0.03)	(0.16)	(0.13)	(0.11)	(0.16)
Same Industry	0.00	0.02	0.96**	0.20	0.31	0.67***
	(0.14)	(0.07)	(0.48)	(0.48)	(0.23)	(0.25)
Cross Boarder	0.06	-0.06	0.67**	0.08	-0.24	0.20
	(0.08)	(0.09)	(0.31)	(0.27)	(0.29)	(0.42)
Acquirer Log Asset ($MM)	-0.25***	-0.22***	-0.03	-0.61***	-0.49***	0.09
	(0.04)	(0.04)	(0.11)	(0.08)	(0.09)	(0.13)
Acquirer Log MB	-0.01	-0.06	-0.03	0.20	0.02	-0.09
	(0.05)	(0.05)	(0.07)	(0.18)	(0.15)	(0.07)
Acquirer ROA	0.04	0.23	1.95	-2.07	-1.40	0.98
	(0.28)	(0.21)	(1.22)	(1.76)	(1.36)	(1.24)
Acquirer Leverage Ratio	-0.99***	-0.47***	-1.69***	-3.11***	-1.54**	-0.60
	(0.23)	(0.17)	(0.61)	(0.97)	(0.72)	(0.54)
Acquirer Boutique Advisor	0.06	-0.02	1.46*	-0.15	-0.42*	1.33
	(0.08)	(0.07)	(0.78)	(0.27)	(0.22)	(0.82)
Target Boutique Advisor	-0.31***	-0.38***	-2.54***	-1.08***	-1.21***	-0.24
	(0.09)	(0.11)	(0.48)	(0.21)	(0.21)	(0.46)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes

Panel B. Continued

	Earnout Usage			Earnout Percentage		
	(1)	(2)	(3)	(4)	(5)	(6)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer, Target Industry FE	No	Yes	Yes	No	Yes	Yes
Acquirer, Target Advisor FE	No	No	Yes	No	No	Yes
Pseudo R^2	0.11	0.15	0.43			
Adjusted R^2				0.04	0.06	0.19
Observations	15,865	15,438	1,545	15,865	15,865	3,790
Observations with Earnout	1,470	1,470	156	1,470	1,470	206