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Borrowing in Unsettled Times and Cash Holdings Afterwards*

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Abstract

We find firms which successfully obtained a bank loan in a crisis reduced their cash holdings post-crisis, using Japanese data from the 2008 financial crisis. Firms received loans primarily from non-main banks. This substitution between borrowing and cash holdings applies to firms with an executive who had served as a CEO or financial officer in the crisis. This resulted in a substantial reduction in borrowing costs after the crisis. These findings are consistent with theories of relationship banking that managerial confidence in the availability of non-main bank loans reduces their precautionary cash holdings both to address a liquidity shortage and to mitigate a hold-up by their main bank. We also find that, in the post-crisis period, firms that obtained bank loans during the crisis spent more (over time and in comparison to other firms) on equity investments in their affiliates as well as on R&D among firms with pre-crisis R&D expenses.

JEL classifications: G21, G31, G32

Keywords: Financial Crisis; Cash Holdings; Relationship Banking; Hold-up Problem; Bank Consolidation

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1. Introduction

Since the seminal work of Almeida, Campello, and Weisbach (2004), previous studies have established that liquidity-constrained firms maintain precautionary cash holdings to avoid premature liquidation of projects (e.g., Bates, Kahle, and Stulz 2009; Duchin, Ozbas and Sensoy 2010; Acharya, Davydenko and Strebulaev 2012; Lin and Paravisini 2012; Hugonnier, Malamud and Morellec 2014, 2015; Berg 2018). These studies imply that a reduction in liquidity constraints decreases cash holdings.

The literature, however, has paid little attention to a twist added by theories of relationship banking. Whether a loosened liquidity constraint reduces cash holdings can depend on the nature of the potential liquidity provider. A theory focusing on the implicit insurance of relationship banking predicts that relational lenders or main banks are willing to flexibly renegotiate with and refinance temporary distressed firms to establish their reputation as an implicit liquidity insurer (Chemmanur and Fulghieri 1994; Dinç 2000). It predicts that a firm will reduce its cash holdings if it is confident in the availability of loans from its main bank. An alternative theory predicts a dark side to relationship banking: the hold-up problem (Rajan 1992). The relational lender's information advantage over competing lenders keeps borrowers captive and deprives them of bargaining power in the refinancing stage. A countermeasure for firms is to hold cash and avoid refinancing. These theories thus do not necessarily predict that improved availability of main-bank loans decreases cash holdings.

Despite the mixed predictions on credit availability from a relational lender, these theories provide a consistent prediction about that from arm's length lenders, such as a non-main bank. Non-main banks reduce the necessity for insurance due to the diversification of potential lenders and a buffer for liquidity. It also improves the borrower's bargaining position in the refinancing stage and reduces the cash demand to mitigate the hold-up problem. Thus, both theories predict that firms with confidence in credit availability from non-main banks reduce their cash holdings.

We test how a liquidity constraint affects cash holdings, taking into account whether the potential lender is a main or non-main bank. In particular, we ask: i) whether firms finance through their main banks or deal with other banks in the global financial crisis; and ii) the consequences of the financing on their cash policy and investments. We use a dataset of publicly traded companies in Japan from 2006 to 2017, before and after the 2008 global financial crisis. It provides the amounts of loans from main and non-main banks.

The Japanese economy around the 2008 global financial crisis provides an ideal setting.

First, the Japanese financial market, often characterized by the main-bank system (Aoki and Patrick 1994), underwent a radical change around 2000 as a result of the banking crisis in the late 1990s. The drastic reorganization of the whole banking sector, through mergers, nationalization, and re-privatization, was so extensive that none of major banks remained unchanged. Firms that depended on these banks for debt financing prior to the banking crisis had to revise their previous expectations about credit availability in a distressed situation.¹ Using the dataset from the 1970s to the 1990s before this extensive reorganization, Pinkowitz and Williamson (2001) find that firms with a closer relationship with their main bank held more cash than others to avoid the hold-up problem pertaining to the main-bank relationship, in line with Rajan (1992). Japanese data after the 1990s banking crisis and the reorganization provide us with a unique opportunity to examine how the main-bank relationship evolved after the restructuring in the banking sector.

Second, the 2008 global financial crisis in Japan resembles the refinancing stage in the theories of relationship banking. The shock impacted the Japanese financial market as a huge, exogenous surge of demand for bank loans. The Japanese banking sector maintained its financial soundness because it was not substantially exposed to the US securitization market. This is in stark contrast to the US loan market, where the supply contraction by weakened banks was the primary shock. The rapid contraction of operating cash flow due to the evaporation of overseas demand, especially in the US and Europe, the paralysis of the corporate debt market due to the scarcity of foreign institutional investors, and the resulting liquidity shortage pressured firms in Japanese non-financial sectors to tap liquidity from domestic banks.

Third, our data period up to 2017 enables us to examine whether improved confidence in the availability of bank financing changed cash policies for an extended period of time through personal managerial experiences (e.g., Bernile, Bhagwat, and Rau 2017; Feng and Johansson 2018). In Japan, the tenures of CEOs, financial officers, and other executives are relatively long. For example, 93% of the firms in our sample in 2017 still had executives who had experienced the distress of the global financial crisis. We argue that the executives' crisis experiences would make their firms more willing to reduce their cash holdings for a prolonged period.

Fourth, the Japanese setting is advantageous for identification. The overseas crisis induced

¹ For example, a former CEO of Komatsu, a listed manufacturing company, responded, “[merging banks] will be increasingly selective about borrowers. It is tough for the industry, but I dare take it positively for the structural reform of the Japanese industry” to the question about the expected lending stance of large banks after announced bank mergers (“Gekidou Kin’yukai—Sangyoujin Ni Kiku” [“Turbulent Financial Sector: Ask Industrialists” in English] p. 3, August 29, 2000, *The Nikkei Financial Daily*, translation by authors).

an unexpected demand surge for domestic bank loans and thus can serve as an exogenous source of variation. To further mitigate the potential endogeneity of borrowing, we apply an instrumental variable (IV) approach. We follow the idea proposed by Almeida et al. (2011) and an application to Japanese data by Uchino (2013). Our analysis uses an instrument evaluated right before the onset of the crisis: the ratio of bonds maturing within one year to total assets in 2007. We expect it to reflect the unexpected refinancing demand for bank loans caused by the crisis. Since the instrument, which represents the maturity date of a bond, is determined prior to the crisis, it is less likely to be correlated with post-crisis changes in cash holdings after controlling for observable factors. Indeed, we obtain evidence for the validity of the instrumental variable.

We include various control variables in the first and second stage estimation. Some of them are from Bates, Kahle, and Stulz (2009), which study determinants of cash holdings in the US. We also include dummies for bond and equity issuance to control for access to capital markets. We also include governance variables, such as board and ownership structures, to control for the effect of their changes, in particular due to regulatory reforms in our data period (Aoyagi and Ganelli 2014). Following empirical studies on Japanese corporations, we control for business group structures, which are partly rooted in *keiretsu* (historical conglomerates in Japan) structures. The financial advantages of liquidity transfer within business groups can help their members overcome financial difficulties (Masulis, Pham and Zein 2011; Almeida, Kim and Kim 2015) and help them hold less cash than stand-alone firms (Pinkowitz and Williamson 2001; Kim, Park, Ratti and Shin 2004).

In the first stage regression, we find a strong relationship between the instrument and borrowing. This finding implies that firms that were severely liquidity-constrained by the paralysis in the bond market could borrow during the crisis. The second stage estimation shows firms that could borrow in the crisis reduced their cash holdings post-crisis. The estimates are economically significant. For every JPY borrowed, they reduced cash holdings by 0.73 JPY in 2010, 0.82 in 2013, and 0.65 in 2016.

These firms sought liquidity primarily not from their main bank but from non-main banks, another source of arm's length funding. This does not mean that firms switched from their main bank to non-main banks: the average change in borrowing from the main bank is zero, not negative. Our finding implies that they just diversified their pool of lenders. Firms that obtained non-main bank loans faced a lower cost of debt post-crisis. These findings are consistent with the argument that success in the diversification of financing improves their bargaining position

against banks and reduces their concerns about the hold-up problem. This in turn induced them to reduce their precautionary cash holdings. This diversification explains the difference in the results with those in Pinkowitz and Williamson (2001), who report that borrowing increased cash holdings.

We observe this negative association only among firms whose main bank underwent a merger in the early 2000s. These firms should have had greater uncertainty in their relationship with their main bank (e.g., Degryse et al. 2011) and had a higher potential to change their cash holdings. In addition, the negative association is clear among firm-year observations where an executive who was a CEO or a financial officer during the crisis remained an executive. It suggests that their personal experiences affected post-crisis cash policy.

Theories of relationship banking suggest that the improved bank-firm relationship should encourage investment due to fewer concerns about credit availability and the hold-up problem. We empirically examine the following three types of investments: capital expenditures, R&D expenses, and equity investments in affiliates. We find that firms which obtained loans in the crisis increased their equity investments in their subsidiaries. One JPY increase in emergency borrowing led to an increase of 0.72 JPY in equity investments from 2006 to 2012. Those firms with pre-crisis R&D expenses increased these expenses (i.e., intensive margin) in the post-crisis period.

We contribute to the literature in several ways. Recent studies show that precautionary cash holdings of liquidity-constrained firms amplify economic downturns. A constraint confines corporate investments directly and indirectly by prompting firms to hold onto more cash for precautionary motives (Gao, Grinstein, and Wang, 2017; Alfaro, Bloom and Lin, 2018; Berg 2018). Favara, Gao, and Giannetti (2019) argue that easier access to external financing mitigates the effects of uncertainty shocks on cash holdings. Our finding implies that easier access to arm's length financing, such as non-main bank loans, further mitigates the negative effect and encourages firms to use their excess cash more effectively.

We present novel evidence that the availability of non-main bank loans as an arm's length instrument changes publicly traded companies' cash policy. This is a stark contrast with the studies focusing on small and medium-sized enterprises (SMEs), for whom the availability of loans from main banks matters more because of their dependence on the implicit insurance from their main banks (e.g., Bolton, et al. 2016, Nemoto, et al 2016).

Our paper is also related to studies on the impact of executives' experiences regarding corporate conservatism. Recent studies report that directors' adverse experiences, such as past

financial distress, lead to conservative corporate decision-making (e.g., Bernile, Bhagwat, and Rau, 2017; Feng and Johansson, 2018). Berg (2018) finds that failure to obtain a loan results in increased cash holdings. Malmendier and Nagel (2011) show that individuals who experienced macroeconomic shocks early in life rely less on debt financing. Koudijs and Voth (2016) find that adverse experiences can change lenders' beliefs, leading them to become more conservative. Dittmar and Duchin (2016) report that firms become more risk-averse when their managers experienced financial distress sometime in their career. We find that such conservatism is mitigated by the executives' successful experiences with financing, especially as a CEO or financial officer during a crisis.²

In the context of the Japanese economy, our findings suggest that hold-up concerns still affect corporate decisions, as already found by Pinkowitz and Williamson (2001), but in a different manner. In our data period, improved confidence in the availability of non-main bank loans reduced cash holdings, while Pinkowitz and Williamson (2001) find that main-bank dependence increased cash holdings. Our findings also imply the declining power of the traditional bank-oriented *keiretsu* system on firms' financial decisions (Hoshi, Kashyap, and Scharfstein 1991). They are consistent with existing studies showing that a main bank's roles as a lender and a shareholder of listed firms declined after the time period examined in Pinkowitz and Williamson (2001) as a result of several factors in addition to the repeated mergers and extensive reorganizations among major banks beyond *keiretsu* borders: the deregulation in securities issuance in the late 1980s (Hoshi and Kashyap 2000), and the regulatory intervention against cross-shareholding between banks and firms (Miyajima and Kuroki 2007; Montgomery and Takahashi 2018).³

The rest of this paper is organized as follows. We derive our empirical hypotheses from the institutional background and existing theories in Section 2. Section 3 describes the research design and our data. Section 4 shows the results. Section 5 contains the conclusion.

² Our results are in line with Ozkan and Ozkan (2004), who find a negative relationship between cash and bank debt in the UK. They are inconsistent with those of Dittmar and Duchin (2016), who report that firms whose US managers had experienced financial difficulties saved more cash. Our results show that successful emergency financing and the associated improvement in confidence in credit availability effectively mitigates the impact of a financially distressed experience on corporate conservatism.

³ Another well-known phenomenon in Japanese firms is the prevalence of "zombie firms" in the late 1990s (e.g., Caballero, Hoshi, and Kashyap 2008). In our sample period, such firms are not common, at most 1% of our sample, according to the augmented zombie criteria (Fukuda and Nakamura 2011). The criteria include: i) interest payments lower than hypothetical prime-rate payments; ii) EBIT lower than prime-rate interest payments (i.e., hypothetical interest coverage ratio below one); iii) ratio of loans over assets greater than 0.5; iv) new loans obtained. We use one-year TIBOR (Tokyo interbank offered rate) in place of the short-term prime rate, which had not been updated since 2009.

2. Hypothesis and Background

2.1. Institutional Background

2.1.1. Corporate Finance in Japan and the Global Financial Crisis

The 2008 global financial crisis severely damaged the Japanese economy. The decline in real GDP growth rate was greater in Japan than in the US and other industrialized countries: the annual rates in 2009 were -2.8% in the US, -4.4% in EU and -5.4% in Japan, according to data from the World Bank.

The primary channel of shock propagation to the Japanese economy was a sharp decline in overseas sales, including exports. Overseas sales are a major component of the revenue of Japanese industry. 43.2% of the firms in our sample, amounting to 64.1% of the market capitalization, reported overseas sales on their financial statements in 2007. Japanese trade statistics show that the US was the largest trading partner up to 2008, and exports to the US accounted for 22.5% of all Japanese exports in 2006. That share has remained over 15% since then, although China became the largest trading partner between 2009 and 2012. Figure 1 shows that Japanese overseas sales dropped by 14.1% and 30.5% from 2007 to 2008 and to 2009, respectively.

Despite the shock, the financial soundness of the Japanese banking sector remained almost intact. Koibuchi et al. (2014) report that Japanese banks rarely engage in subprime-related business, and their losses in the crisis were just 4.4% of US losses. The risk-adjusted capital adequacy ratio dropped slightly for those operating internationally from fiscal year 2006 to 2008 (Figure 2). This was likely due to a sharp increase in corporate loans, a typical risk asset in the denominator of the ratio. Massive SEOs in the following year to meet the expected increase in regulatory capital requirements further reinforced the financial soundness of major banks.⁴

Demand for bank loans surged as a result of corporate concerns about the liquidity shortage due to the plummeting overseas sales, the subsequent recession, and the difficulty in funding directly through the securities market.⁵ The majority of lenders for Japanese publicly traded

⁴ The Mizuho Financial Group raised capital of 516 billion JPY on July 24, 2009, and 729.17 billion JPY on July 22, 2010, via SEO. Likewise, the Mitsubishi UFJ Financial Group raised 1 trillion JPY on December 22, 2009, and the Sumitomo Mitsui Banking Corporation 827.4 billion JPY on June 22, 2009, via SEO.

⁵ The Financial System Report, published by the Bank of Japan in March 2009, reported, “The diffusion index (DI) for firms' funding has been increasing at the number of firms that consider their funding

companies are large Japanese banks called city banks, which operate mainly in large cities all over Japan and in the international market. At least until the 1990s, before the banking crisis in the late 1990s, they played a key role in bank-oriented business groups, which are called *keiretsu*, as main banks to finance and monitor affiliated firms (Aoki and Patrick 1995). They accounted for about 60 to 70% of loans to Japanese publicly traded companies in the 2000s (Figure 3). This figure shows a sharp increase in the aggregate amount of loans across all banks to large firms in 2008, concentrated in the latter half of the year. Many firms started their loan negotiations during the time when the crisis was clear and present. The total of aggregated term loans was 18 trillion JPY larger at the end of March 2009 than a year before, according to data from the Bank of Japan.

Corporate funding from other sources did not increase as much as term loans from domestic banks in the crisis. The increase in borrowing was much larger than the drawdowns - about 6 trillion JPY at its peak in December 2008, right after the failure of Lehman Brothers.⁶ Japanese banks thus did not experience the sharp increase in drawdowns from credit lines that US banks did that resulted in severe liquidity constraints (Ivashina and Scharfstein 2010). Foreign banks were more directly hurt by the financial crisis than domestic banks and could not serve as an alternative funding source for Japanese firms either. Outstanding loans from foreign banks decreased by 2.8 trillion JPY from March 2008 to March 2009, according to data from the Bank of Japan.

The issuance of bonds and commercial paper did not increase in 2008 and sharply decreased in 2009 (Figure 4), despite the strong demand arising from the failure of Lehman Brothers, as documented by Uchino (2013) and Koibuchi et al. (2014). Equity issuance also dropped in 2008 (Figure 4). These circumstances led to high demand for domestic bank loans in the first quarter of 2009 (Ogura 2018), which is at the end of the fiscal year 2008 in Japan.

Another financing source in a crisis period is the internal capital market among affiliated companies, such as *keiretsu* until the 1990s or business groups more recently. Business groups consist of firms belonging to the same supply chain network or with broader business

conditions to be tightened since mid-2008. The DI [diffusion index] for firms' demand for loans as seen from the perspective of financial institutions has been showing a sharp increase" in Section I.4-9, p. 9.

⁶ This limited role of lines of credit in the crisis period is consistent with existing studies. Lines of credit usually entail covenants regarding cash flow or profit (Sufi 2009; Lins, Servaes, and Tufano 2010). Firms in financial distress often encounter restrictions in drawing down their credit line following covenant violations (Sufi 2009). They do not necessarily serve as a liquidity buffer in a distress situation, and firms should use them to respond quickly to investment opportunities rather than keep a buffer for negative liquidity shocks. Furthermore, capital costs for firms for renegotiating contracts to increase a draw-down often rise when the necessary amount is unexpectedly large (Campello et al. 2011).

relationships via shareholdings. Affiliated firms can shift their funds from low- to high-return projects within the group in the face of external financing constraints, as described in the model by Stein (1997). Pinkowitz and Williamson (2001) support the prediction that *keiretsu* firms have little need to hold cash for precautionary reasons.⁷ Note that industrial business groups can be different from bank-centered *keiretsu* because firms in business groups can transfer funds through their internal capital markets among group members irrespective of their main banks.

2.1.2. Mergers of Major Banks in Early 2000s Japan

Japanese banks experienced a crisis in the late 1990s. The epicenter was excessive issuing of real estate-backed loans by city banks and the resulting real estate bubble (Hoshi and Kashyap 2000). The crisis erupted with the liquidation of the Hokkaido Takushoku Bank, a city bank, in 1997. All city banks suffered from severe non-performing loans due to sharply declining real estate prices. These problems continued until 2004.

In the process of tackling this crisis, all city banks underwent overhaul and reorganization by mergers, nationalization and re-privatization in the early 2000s. Many mergers were made across the borders of *keiretsu* and among large banks similar in size. No city banks remained as they had been before 2000, as shown in Figure 5. The mergers were extensive enough to pressure managers of industrial firms into reevaluating the viability of their relationship with their main bank, as presented in an interview cited in Footnote 1. Montgomery and Takahashi (2018) report that these merged banks indeed decreased their lending after their merger.

In addition to the avalanche of these mergers, regulations also weakened *keiretsu* ties after the banking crisis through a change in ownership structures, with an increased presence of foreign institutional investors. A Japanese banking regulation prohibits a bank from holding 5 percent or more of the voting rights of industrial firms. Merged banks often had to sell their corporate shares, a key component of *keiretsu*, to comply with this regulation. Furthermore, to restore the financial soundness of banks by reducing the risks due to excessive shareholding, the Act on Limitation on Shareholding by Banks and Other Financial Institutions was enacted

⁷ The literature has discussed trade-offs associated with internal capital markets. On one hand, Stein (1997) emphasizes internal transfers by firms to shift funds from low- to high-return projects. On the other hand, some studies point out the dark side caused by agency conflicts (Scharfstein and Stein 2000). When external capital markets are constrained, advantages of internal capital markets likely increase firm value and the probability of surviving a financial crisis. Previous research has shown that internal capital markets become more important in times of financial crisis (Matvos and Seru 2014; Almeida, Kim and Kim 2015).

in 2001. It prohibited shareholding by a bank exceeding its equity capital. Miyajima and Kuroki (2007) report banks sold as much as 40 percent of their held shares in 2001. A follow-up study by Miyajima and Hoda (2015) reports that the dissolution of cross-shareholding continued and that foreign investors increased their shareholdings in place of banks in the 2000s. Table 1 in their paper reports that the share of companies listed on the Tokyo Stock Exchange held by domestic financial institutions declined from 30.4% in 1991 to 7.6% in 2011, whereas that by foreign institutions drastically increased from 5.4% to 22.8%.⁸ This resulted in the dissolution of cross-shareholding in a *keiretsu*, and increased governance pressure from foreign institutional investors.⁹

2.1.3. Regulatory Change in Corporate Governance

The traditional predominant role of banks in corporate governance has also changed as a result of policy reforms in our data period. First, the government and the Tokyo Stock Exchange introduced two codes of conduct for institutional investors and listed companies: the stewardship code for the former in 2014, and the corporate governance code for the latter in 2015. Second, American-style governance, especially with regard to board structure, was partially introduced by revisions of the Companies Act in 2003 and 2015.

Stewardship Code

Institutional investors, both domestic and foreign, choose whether to adopt the stewardship code. 127 institutional investors adopted the code right after its introduction, 205 in 2015, and 227 in 2017. About 70% of them were asset management companies. No city banks adopted the code, due to the restrictions on their shareholdings. The code thus is unlikely to affect their monitoring behavior directly.

These institutional investors are required to engage in dialogue with firms to enhance firm

⁸ We define the percentage of ownership shares of foreign investors differently than Miyajima and Hoda (2015). They calculate the percentage of the total market capitalization of Japanese firms' stocks held by all foreign investors compared to the total market capitalization of all Japanese firms in their sample, while we use the average of the percentage of individual firms' stocks held by foreign investors across our sample firms. Foreign investors hold stocks of firms with large market capitalization in general. The number in our table is thus smaller than that in Miyajima and Hoda (2015). As an example, we consider firm A with a large market capitalization and firm B with a tiny one. Suppose that foreign investors hold 20% of shares of firm A and 0% of firm B. Miyajima and Hoda (2015) use the weighted average, so their percentage of foreign investors is almost 20%. We use the simple average, which gives about 10%.

⁹ More recently, Sakai (2020) shows that bank shareholdings of small listed companies declined more sharply in the last 30 years.

value. Although the code does not mention cash policy directly, institutional investors may urge firms to spend their excess cash on investments or payouts after the introduction of the code (Wahal and McConnell 2000; Crane, Michenaud, and Weston 2016).

Corporate Governance Code

The corporate governance code lists five general principles and 73 principles in all. The general principles cover (i) securing the rights and equal treatment of shareholders, (ii) appropriate cooperation with stakeholders who are not shareholders, (iii) ensuring appropriate information disclosure and transparency, (iv) responsibilities of the board, and (v) dialogue with shareholders. All firms listed on the Tokyo Stock Exchange are required to either comply with them or explain why they chose non-compliance. The compliance rate of the general principles is almost 100%, according to data from the Tokyo Stock Exchange. Principle 4-8 particularly has affected the corporate governance of Japanese firms. It requires listed firms to have multiple outside directors. After the introduction of this code, board independence, measured by the ratio of the number of outside directors to the total number of directors, increased from 13.8% in 2013 to 20.9% in 2014 and to 27.4% in 2017.

Revisions of the Companies Act in 2003 and 2015

Back in 2003, the Japanese government implemented another governance reform, but did not succeed in changing governance structures. Before this, directors served both as executive officers and monitors of other directors, including CEOs, in all Japanese firms. The law required *company auditors* to monitor them. Most directors and auditors were selected from the employees and thus insiders. The revision of the Companies Act in 2003 introduced an option for firms to adopt the American-style board structure: a company with mandatory nominating, compensation, and auditing committees. It is designated *a company with a nominating committee, etc.* (i.e., a company that has chosen the three-committee option). Firms that adopt this option must establish nominating, compensation, and auditing committees. Each of them consists of at least three directors, with a majority being outside directors. The adoption rate of this system is low: 1.4% in 2006, 1.6% in 2014, and 1.7% in 2017.

This low rate was partly attributable to the heavy burden of setting up three committees. To address this problem, the 2015 revision of the Companies Act introduced another option, *a company with audit and supervisory committee*, which requires only one additional committee. Directors on the audit and supervisory committee monitor the other directors. Unlike company

auditors, directors on the committee have voting rights at board meetings. Although directors not on the committee can serve as both executives and monitors as before, they are expected to focus more on decision making. This system thus enhances the separation of decision-making and monitoring on boards of directors and the appointment of more outside directors. The adoption rate increased quickly: 7.2% in 2014, 19.3% in 2015, 22.4% in 2016, and 24.1% in 2017.

2.2. Theoretical Framework

2.2.1. Cash Holdings for Precautionary Motives

Theories suggest that firms seek their optimal level of cash holdings. They seek to balance the trade-off between the benefit of avoiding premature, inefficient liquidations while temporarily in distress and the opportunity cost of setting aside funds as non-interest-bearing instruments. A large number of theoretical and empirical studies have established the precautionary motives for corporate cash holdings when firms face uncertain cash flows (e.g., Bates, Kahle, and Stulz 2009; Acharya, Davydenko and Strebulaev 2012) and uncertain credit availability (e.g., Almeida, Campello, and Weisbach 2004; Duchin, Ozbas and Sensoy 2010; Lin and Paravisini 2012; Hugonnier, Malamud and Morellec 2014, 2015; Berg 2018).

This trade-off implies that maintaining precautionary cash holdings to avoid missing out on optimal investments should diminish as corporate managers gain confidence in credit availability while in a distressed state. The 2008 global financial crisis, with the constricted access to the corporate debt market, was the first test case for distressed Japanese firms to change their expectations of credit availability after the mergers of major banks and various policy reforms weakening bank-firm relationships and the traditional, bank-centered *keiretsu* system. Our first hypothesis is as follows:

Hypothesis 1. Firms that increased bank borrowing in response to the 2008 global financial crisis reduced their cash holdings in the post-crisis period.

2.2.2. Relationship Banking and Cash Holdings

Existing theories on relationship banking provide a further insight on Hypothesis 1. They predict that a change in cash policy due to improved credit availability depends on the type of lender. They are either relational lenders (i.e., main banks) or non-relational lenders (i.e., non-main banks).

Chemmanur and Fulghieri (1994) demonstrate that a main bank is more willing to flexibly renegotiate with refinancing firms that are temporarily distressed but profitable in the long run, due to its information advantage. A bank can establish a reputation as an implicit insurer by providing efficient refinancing. This reputation gives the main bank a competitive edge in generating excess returns (Dinç 2000). Evidence for relationship banking to improve credit availability is abundant (e.g., Petersen and Rajan 1994, Elsas and Kranen 1998, and Cenni et al. 2015). Among others, Bolton et al. (2016) support the implicit insurance theory using data for SMEs in Italy. Treating the bank-firm relationship as exogenous, they find that relational borrowers were more likely to obtain loans in the 2008 crisis, whereas they paid higher interest rates in normal times. Japanese data for SMEs from 2001 to 2009 also support this theory. Ogawa (2015) finds that those with a closer relationship with their main bank held less precautionary cash.

On the other hand, relationship banking has a dark side: the hold-up problem (Rajan 1992). The hold-up theory provides the opposite prediction about the effect of the main bank relationship on cash holdings with the implicit insurance theory. The information advantage of the main bank imposes a switching cost on borrowers, which reduces competitive pressure from other banks. It places a borrower in a weaker bargaining position in the refinancing stage due to the main bank's threat of costly premature liquidation. Thus, a relational bank can extract a higher premium for loans to these captive borrowers. This theory predicts that a firm with a strong lending relationship with its main bank will hold more cash to avoid the hold-up problem. Pinkowitz and Williamson (2001) find support with Japanese data from an earlier period than ours. They report firms that were more dependent on their main bank and lacked access to the bond market held more cash than others from the 1970s to 1990s to circumvent hold-ups.

These arguments show that the implicit insurance and hold-up theories yield different predictions regarding the impact of main bank loans on post-crisis cash holdings. The former predicts a reduction in cash holdings due to improved expectations through implicit insurance, whereas the latter predicts an increase due to increased concerns about the hold-up problem.

However, these theories provide a consistent prediction about non-main bank loans. If a firm gains confidence in credit availability through borrowing from non-main banks, rather than its main bank, the demand for costly implicit insurance should decline. That also reduces concerns about the hold-up problem. Therefore, both theories predict that a firm reduces cash holdings in response to an increase in non-main bank loans. We test the following hypothesis:

Hypothesis 2. Firms that increased their non-main bank loans reduced their post-crisis cash holdings.

3. Research Design and Data

3.1. Research Design

We regress a change in cash holdings from the pre- to post-crisis period on a change in bank borrowing from fiscal year 2007 to 2008. The regressand runs from 2006 to fiscal year n ($n=2008, 2009, \dots, 2017$) to study whether improved expectations in financing through the in-crisis borrowing exert long-run effects on cash holdings post-crisis. We first examine how a change in borrowing from 2007 to 2008 affects that in cash holdings from 2006 to 2008. We next examine the effect of this borrowing on the change in cash holdings one year ahead, from 2006 to 2009. We repeat this estimation up to 2017. We use 2005 instead of 2006 as the base year for a robustness check and find similar results.

Our identification addresses two broad sources of potential biases: i) endogenous choice of borrowing in the crisis and ii) characteristics that can be correlated with both emergency borrowing and a change in post-crisis cash policy. The global financial crisis serves as a plausibly exogenous shock to the loan demand in Japan and has the potential to address the first issue. A naive OLS regression, however, may not be able to perfectly identify the causal link. For example, unobservable investment opportunities in the near future might simultaneously increase both in-crisis bank borrowing and subsequent cash holdings. This situation would cause an upward bias in the OLS estimates.

Instrumental Variable

We apply an IV approach to address the potential endogeneity from the first source of borrowing. The first-stage regression investigates whether valid instruments and all other exogenous variables determined each firm's borrowing from 2007 to 2008. The second stage examines whether the borrowing induced by the demand on bank credit in the crisis changed cash holdings after the crisis. In our context, instrumental variables must generate exogenous variations in bank borrowing in the crisis (i.e., relevance) and be uncorrelated with the change in cash holdings after the crisis (i.e., exogeneity), conditional on control variables.

We use two instruments in the base estimation: *Maturity07* and *Export07*. The former is the ratio of bonds outstanding with maturity shorter than one year to total assets at the end of fiscal year 2007 (i.e., from April 2007 to March 2008), following Almeida et al. (2011) and Uchino

(2013). This is right before the outbreak of the financial crisis. We conjecture that those with more such bonds were seriously in need of bank loans during the securities market paralysis, as in Figure 4 in the half year after September 2008. The identification assumption is that having issued them was exogenous to any changes in post-crisis cash and other corporate financial policies. Because the maturity of corporate bonds is generally distant, their issuance should have preceded the crisis by several years. Therefore, we can assume that firms with such bonds could not predict the crisis or adjust their cash holdings at the time of issuance.

The second instrument, *Export07*, is the overseas sales-to-total sales ratio as of 2007. We conjecture that firms dependent on exports or overseas sales were more exposed to the shock of the global crisis, as suggested in Figure 1, and so were in greater need of loans to overcome their liquidity shortage. This variable is also pre-determined; thus, it is not likely to be correlated with future changes in cash holdings.

Control Variable

We address the issue of confounding factors that can be correlated with both emergency borrowing and cash policy afterwards (i.e., the second source of potential biases), by including a set of control variables in both the first- and second-stage regressions. It consists of three categories: accounting information, financing activities, and governance structures.

The accounting information includes those widely used in the US literature (e.g., Bates, Kahle, and Stulz 2009): the cash flow-to-assets ratio, tangible assets-to-assets ratio, liabilities-to-assets ratio, net working capital-to-assets ratio, log of assets, market-to-book ratio, dividends-to-assets ratio, and volatility of cash flow across the previous two years.

Controls of financing activities include dummies for bond and equity issuance. We obtain similar results when we alternatively use the outstanding bond-to-asset ratio instead of the bond dummy. These controls help mitigate a concern about the potential substitution between borrowing and financing from capital markets, although we do not expect it to be substantial, as discussed in Section 2.1.1. We furthermore include the amount of bonds and equity issued in 2008 to consider the in-crisis substitution with bank financing.

We control for organizational and governance structures from several perspectives. We first include variables for business group structures: the number of subsidiaries, a parent company dummy that equals one when the firm has a listed parent, and non-financial corporations' ownership shares. They control for the effect of the internal capital market among affiliated firms. It can decrease cash demand relative to non-business group firms or to those with a

smaller number of subsidiaries (Pinkowitz and Williamson 2001; Duchin 2010; Ushijima 2020). The number of subsidiaries is used to capture the size of the internal market (Duchin 2010). The ownership shares held by non-financial corporations control for the influence of fund transfers through equity (Sakai 2020).¹⁰

In a similar vein, we control for ownership shares by financial institutions, including those by main and non-main banks. Creditors may be willing to provide funds at a lower price through an effective reduction of agency costs (Jiang, Li and Shao, 2010). Lower financing costs should reduce cash holdings. In Japan, where banks can hold corporate equity, creditors may monitor managerial expropriations as shareholders (Limpaphayom, Rogers and Yanase, 2019). It can reduce excess cash holdings. In addition, the corporate governance code encourages listed firms to reduce cross-shareholdings with financial institutions. This control can alleviate concerns that the code could affect corporate decisions through changes in ownership as well.

The last component of the governance structure variables deals with board structures. Following the argument in Section 2.1.3, we introduce four variables: board independence, which is defined as the outside directors-to-total directors ratio; a dummy to indicate *a company with audit and supervisory committee*, and another to indicate a company employing the three-committee option; and shares owned by foreign investors. The inclusion as a control variable of the outside director ratio follows Harford, Mansi and Maxwell (2008). These variables capture the cross-sectional and time-series variations of governance structures resulting from a series of the regulatory changes.

Empirical Specification

We include control variables evaluated in 2006 and those differences between 2006 and year n ($n=2008, 2009, \dots, 2017$), respectively normalized by assets in 2006. The former capture observable, cross-sectional differences between firms before the crisis. For example, firms with pre-crisis access to bond markets might have a stronger incentive to reduce their cash holdings

¹⁰ The literature often includes a *keiretsu* dummy to control for the organizational structure, while we alternately include others, such as the number of subsidiaries or ownership shares held by non-financial firms. The literature uses directories of *keiretsu*, such as Industrial Groupings in Japan (Dodwell Consultant) or Kigyo Keiretsu Soran (Toyo Keizai), to identify *keiretsu* structures. They had not been updated since 2001. Furthermore, bank-centered *keiretsu* were given less attention in our data period in the business environment in Japan as well. We count the number of relevant keywords appeared in past articles in the Nikkei, which is the most widely read economic newspaper in Japan, via *Nikkei Telecom*. It reports that the keywords “*keiretsu*” and “bank (*ginko* in Japanese)” appeared in the same article 2090 times in the 1990s, 881 times in the 2000s, and 335 times in the 2010s. More notably, the keywords “*keiretsu*” and “main bank (which is used as it is in Japanese)” appeared in the same article 161 times in the 1990s, 45 times in the 2000s, and only 11 times in the 2010s.

post-crisis due to this additional financing channel than those without access. The latter control for the possibility that observable changes after the crisis can explain a change in cash policy post-crisis. They are not generally included as controls in studies with short time periods, such as one year before and after an event. In our longer time frame, for example, we observe a drastic change in board structures. Controlling just for the 2006 board structures cannot consider the issue of whether the improvement of governance due to the policy change could reduce excess cash post-crisis.

Alternative specifications for robustness checks are: i) control variables evaluated both in 2006 and year n ($n=2008, 2009, \dots, 2017$) and ii) those evaluated both in 2006 and year $n-1$. Both are similar to the original specification, represented below as (1) and (2), because both of them consider controls evaluated both in 2006 and year n or $n-1$.

We normalize both changes in cash holdings and in-crisis borrowing with assets in 2006. Use of common denominators in the regressand and the regressor allows us to interpret the coefficients in a natural way. The models in the first and second stages are given by the following equations:

$$\Delta Bank0708_i = \gamma_0 + \gamma_1 Mature07_i + \gamma_2 Export07_i + \gamma'_3 x_{i06} + \gamma'_4 \Delta x_{in} + v_i, \quad (1)$$

$$\Delta Cash_{in} = \beta_0 + \beta_1 \widehat{\Delta Bank0708}_i + \beta'_2 x_{i06} + \beta'_3 \Delta x_{in} + \epsilon_i, \quad (2)$$

where subscript i is the firm index, $\Delta Bank0708_i$ represents the change in bank borrowing from 2007 to 2008 divided by the total assets in 2006, $\widehat{\Delta Bank0708}_i$ the fitted value from the first stage regression, $\Delta Cash_{in}$ the change in the ratio of cash holdings from 2006 to n ($n=2008, 2009, \dots, 2017$) divided by the total assets in 2006, $Mature07_i$ the ratio of bonds outstanding with maturity shorter than one year divided by the total assets in 2007, $Export07_i$ the exports-to-sales ratio in 2007, x_{i06} the vector of control variables evaluated in 2006 (cash flow-to-assets ratio, tangible assets-to-assets ratio, liabilities-to-assets ratio, net working capital-to-assets ratio, log of assets, market-to-book ratio, dividends-to-assets ratio, volatility of cash flow across the previous two years, bond outstanding dummy, equity issuance dummy, bond issuance in 2008 to-assets-ratio, equity issuance in 2008-to-assets ratio, outside directors-to-total directors ratio, audit-and-supervisory committee dummy, three-committee system dummy, ownership shares held by financial institutions, those by the main bank, those by non-main banks, those by corporations, those by foreign investors, business group dummy, the number of subsidiaries, and industry dummies), Δx_{in} the vector of the difference in the control variables

from 2006 to n , and v_i and ϵ_i , the error terms of the first and second stage regressions, respectively. The standard errors are clustered at the industry level. The coefficient of interest is β_1 in equation (2). We repeat this estimation for each n , where $n = 2008, 2009, \dots, 2017$.

3.2. Data

We use financial data from Nikkei NEEDS-FinancialQUEST and governance data from Nikkei Executive Data. The data cover all listed firms in Japan, as well as how much individual firms borrowed from individual banks. Data from unconsolidated financial statements enable us to focus on the relationship between Japanese firms and domestic banks.¹¹ Our sample is restricted to firms in non-financial industries. We construct balanced panels between 2006 and 2017 to examine the effect of emergency borrowing among the same firms across a long time span. We restrict ourselves to firms whose fiscal month is March, which constitute over 70% of the firms, to maintain the same timing of financial reporting. We also consider firms with data for all fiscal months for robustness. The number of firms and firm-year observations in the final sample is 1954 and 23448, respectively. We winsorize variables used in regression at the top and bottom 0.5%.

Table 1 presents the summary statistics. The average cash-to-assets ratio is 0.14. This is about half of what was reported in the US. For example, Bates, Kahle, and Stulz (2009) report that the ratio was 0.23 in 2006 in the US. This difference partly arises from dissimilar definitions of cash. The Japanese accounting system distinguishes between cash and marketable securities, while US data report only their aggregated value as a common practice.

This table provides key insights regarding the financing pattern in the global financial crisis. The average in-crisis borrowing-to-assets ratio is 0.018, and that from non-main banks is also 0.018, where main bank is defined as the bank that provided the largest loans to the firm in 2007. This implies that firms relied on non-main banks. This finding, however, does not demonstrate that firms switched from their main bank to non-main banks. The in-crisis borrowing from the main bank is zero, not negative (i.e., no reduction in borrowing), on average. The median of *Bank0708* is zero, and 46.8% of the firms were able to borrow. This suggests that there was a considerable variation in the outcomes of emergency borrowing. The average

¹¹ Some data items (export, R&D expenses, bond issuance, and equity issuance) were obtained from consolidated financial statements when they were not reported in unconsolidated statements. *Export07* (i.e., the exports-to-sales ratio) can have a value greater than one for this reason.

interest rate was 2.4%.¹²

Table 1 also shows other characteristics of our sample firms. The average number of subsidiaries, 20.5, suggests that Japanese firms have access to internal capital markets. Financial institutions own 18.7% of Japanese firms' stocks. This does not imply, however, that banks were major owners: main banks owned 1.3% of the shares, while non-main banks had 1.7%. We also notice considerable holdings of ownership shares by corporations (26.9%) and foreign investors (9.8%). The bond outstanding dummy suggests that a quarter of firms had access to bond markets. In the crisis, the percentages of firms that issued bonds and equity are 15.1% and 7.3%, respectively.¹³ They are substantially lower than the corresponding figures for firms that relied on banks (46.8%). Board independence was 14.9% on average in our data period, trending upward after the governance reforms and reaching 27.4% in 2017.

In our sample from 2006 to 2017, the mean logarithm of total assets in US dollars in 1994 is about 7.6. This is greater than the sample mean of 6.35 from 1974 to 1995 in Pinkowitz and Williamson (2001), reflecting firm growth and M&As.¹⁴ The median is, by contrast, smaller in our sample than theirs. The sample size of our data is larger and covers relatively small firms. Pinkowitz and Williamson (2001) report that the long- and short-term borrowing-to-assets ratios are 0.103 and 0.187, respectively, while our data show smaller values: 0.077 and 0.064, respectively. The mean of cash holdings is also lower in our sample (0.140) than in theirs (0.185). The market to book ratio is smaller in our sample, which suggests lower growth prospects. Larger dividends in our sample than theirs can be interpreted as a sign that managers pay more attention to shareholders than before.

4. Results

4.1. OLS Estimation

¹² It is calculated as the interest payments divided by total bank borrowing across the previous three years. This ratio can take an unreasonably large value, for example, if the firm paid down its debt before the end of the fiscal year. We cap the rate at 10%. Changing this threshold does not affect our results qualitatively.

¹³ Note that the "bond/equity issuance in 2008" in the Table 1 is the bond/equity issuance-to-assets ratio, not a dummy indicating the bond/equity issuance in 2008. We use the former in regression because our main regressor is the ratio of borrowing from 2007 to 2008 relative to assets, not an emergency borrowing dummy, and controlling for the amount of financing from other sources appears to be suitable.

¹⁴ Arikawa and Miyajima (2007) argue that the merger boom in Japan was mainly driven by economic shocks, such as technological innovation and sales declines.

Table 2 reports the results of OLS estimations.¹⁵ It shows that emergency borrowing is negatively associated with cash holdings in 2010 (Panels A and B), 2011 (Panel C) and later years. All panels include control variables evaluated in 2006. In addition, Panel A includes their differences from 2006 to year n , Panel B their level in year n , and Panel C their level in year $n-1$. The quantitative and qualitative similarities in the estimates across all the panels suggest that the timing of the control variables is not critical. Significant effects lasted up to 2017 in all panels and tended to become larger over time. For example, in Panel A, the coefficient is -0.05 for 2010 and -0.21 for 2016. They suggest a long-term impact of successful funding on cash holdings afterwards.

Panel A shows that differences in control variables explain the change in cash holdings more significantly than their levels in 2006. For example, the number of subsidiaries as of 2006 do not necessarily affect post-crisis cash holdings, while its increase is negatively associated with cash holdings. This is consistent with the argument that wide availability of internal capital markets can reduce precautionary cash holdings (Pinkowitz and Williamson 2001; Duchin 2010; Ushijima 2020). We also observe a positive association between the difference in cash flows and that in cash holdings. The cash flow sensitivity of cash supports the existence of financial constraints (Almeida, Campello and Weisbach 2004).

We observe a limited association between governance structures and cash holdings, different from the relatively clear association of organizational structures. One of the concerns was that a change in corporate governance can be a confounding factor between in-crisis borrowing and post-crisis cash holdings. A change in ownership shares by financial institutions was positively associated with a reduction in post-crisis cash holdings from 2012. In contrast, ownership by main or non-main banks did not affect changes in cash holdings except for some year periods. Board structures did not affect changes in cash policy either.

4.2. The First Stage Regression

Table 3 reports the first-stage estimation results of the IV regression: i.e., the impact of *Mature07* and *Export07* on *Bank0708* after controlling for all other covariates.¹⁶ We observe positive and significant effects only for *Mature07* on *Bank0708* at the 1% level. One JPY in

¹⁵ Due to the large number of control variables, we only report the coefficients of *Bank0708* in all tables. The online appendix contains tables with complete sets of control variables for Panel A of Table 2, for Table 3, and for Panel A of Table 4.

¹⁶ We use data of 2006-08 in this table. All the relevant variables (*Bank0708*, *Mature07*, and *Export07*) are time-invariant. Thus, the use of different data periods does not affect our argument.

refinancing demand leads to 0.62 JPY of emergency borrowing. This large effect is in line with Massa, Yasuda and Zhang (2013), who find that bond supply uncertainty has a positive effect on a firm's probability of borrowing. The identical magnitudes of the estimates of the coefficients on *Mature07* between columns (1) and (2) suggest that the refinancing demand due to the bond maturity affects emergency borrowing, irrespective of consideration of exposure to declining exports.

Export07 marginally affects emergency borrowing significantly at the 10% level. The relatively weak effect of *Export07* may be explained by the international internal capital markets. Manova, Wei and Zhang (2015) find that multinationals are less liquidity-constrained compared to standalone domestic firms because only the former can access internal markets, and suggest that exporters could utilize internal funding rather than domestic banks.¹⁷ This interpretation is consistent with the summary statistics in Table 1 showing the large average number of subsidiaries. Although the addition of the instrument *Export07* to *Mature07* lowers the joint significance of the instruments from 31.65 to 25.47, both values are larger than the widely accepted rule of thumb of 10.

4.3. Main Result: Bank Borrowing and Cash Holdings

Panels A and B of Table 4 list the results with the base specification in equation (2) and report that emergency borrowing reduced cash holdings significantly from 2008 to 2016 relative to 2006. It supports Hypothesis 1 regarding the effect of emergency borrowing on precautionary motives for cash holdings. This table also suggests that the OLS results in Table 2 are qualitatively robust to potential endogeneity concerns. The magnitudes of the estimates differ over time and are larger than the OLS case: -0.73 in 2010, -0.82 in 2013, and -0.65 in 2016 in Panel A. The overidentification test in Panel B, which includes both *Maturity07* and *Export07*, provides reassurance regarding the exclusion restrictions: i.e., our instrumental variables are not correlated with the residuals of the second-stage regression.

The results are qualitatively and quantitatively similar when we use only *Maturity07* as the instrument in Panel A and both *Maturity07* and *Export07* in Panel B. Including both instruments makes the first stage F-value of the excluded instruments smaller, possibly due to the marginally significant effect of *Export07* on *Bank0708* in Panel 3. Thus, we will hereafter report results using only *Maturity07* as the instrument.

¹⁷ For example, the Nikkei on October 17, 2000, reported that Matsushita Electric Works established a financial firm to allocate funds internally across their 185 affiliates. The article states that they aimed to reduce their bank debt.

We also notice from Panel A that firms that could have issued bonds or CP in the market paralysis of 2008 reduced their cash holdings afterwards, while those could have issued equity did not. This finding is partly in line with our argument that in-crisis success in funding reduces precautionary cash holdings. The economic significance, however, is not as substantial as borrowing: the percentages of firms that issued securities, either equity or bonds, in the crisis are substantially lower than those of firms which borrowed from banks.

Panels C-F provide further support for our main finding in Panel A. Panels C and D use different structures of control variables and provide similar estimates: the former includes controls in 2006 and year n , the latter those in 2006 and year $n-1$. Panel E shows that the results are similar when we use 2005 to evaluate the pre-crisis cash holdings. Panel F includes all firms, not only those with a fiscal month of March, and reports similar results.

The results are not necessarily clear-cut or are statistically a little weaker (i.e., at the 10% level) in 2008 or 2009 in some panels. The economy was still in the midst of the crisis in these years, and so many firms faced significant uncertainty. This result is in line with Duong et al. (2020), who find that firms increase cash holdings in response to high macro-level policy uncertainty. Once such uncertainty is resolved, we see long-lasting effects up to 2016.

4.4. Increment of Borrowing

We change the definition of “borrowing” in Table 5 from that in Table 4 and replace the negative values with zero. In other words, we treat both unchanged and reduced borrowing the same way in order to focus on increased borrowing. This specification reflects our argument that success in emergency borrowing causes a reduction in cash holdings.

Table 5 shows qualitatively similar results to Panel A of Table 4. The magnitude of the coefficients is larger in Table 5 for every period. For example, the absolute values of the coefficients in 2011-15 are over one in Table 5, but less than one in Table 4. This finding suggests that an increase in borrowing and a reduction in cash holdings, not a decline in the former and an increase in the latter, explains our main results in Table 4.

4.5. Main Bank versus Non-main Bank: Hold-up Hypothesis

We next test Hypothesis 2 regarding the impact of non-main bank loans on cash holdings. We replace *Bank0708*, the change in total bank loans from 2007 to 2008, with main-bank loans in Panel A and non-main bank loans in Panel B. Table 1 shows the average change is zero in the amount borrowed from the main bank-to-assets ratio, while that from non-main banks is

0.018. They suggest that firms relied more on non-main banks than main banks in the crisis and that the instrument, which reflects the in-crisis loan demand, did not induce (or reduce) main bank loans.

Table 6 shows that borrowing from non-main banks led to a reduction in cash holdings in Panel B. The result supports Hypothesis 2. It suggests that a diversified pool of lenders reduces firms' concerns about the hold-up problem and allows them to reduce cash holdings further. This result reinforces existing evidence for the hold-up concerns in relationship banking (e.g., Farinha and Santos 2002). In Panel A, the F-value of the excluded instrument is far less than 10 due to a small variation in main bank borrowing. Thus, we cannot make a statistical inference in the second stage regression in this panel.

Panels C and D demonstrate that successful borrowing reduced the cost of debt after the crisis. The magnitudes of the estimates are larger when firms borrowed from non-main banks (Panel D) than from banks on average (Panel C). The estimates are economically significant. Successful borrowing from non-main banks resulted in a drop of 0.24 – 0.28 percentage points of the cost from 2012 compared to that before the crisis. The reduced cost of debt is a beneficial consequence of emergency borrowing. This is also consistent with the hold-up hypothesis that the availability of arm's length funding improves a firm's bargaining position.

Our findings are also closely related to Khwaja and Mian's (2008) assessment of the impact of liquidity shocks on bank lending, focusing on the same firm's borrowing from two distinct banks. Crucially, they assume that firms do not develop new bank-firm relationships, and firm-fixed effects can control for benefits from relationships with banks in their framework. According to our results, firms may seek alternative lending relationships to overcome credit-supply shocks. Considering such relationships helps avoid a potential downward bias in estimating the impact of such shocks. Our argument is in line with that of Jiménez et al. (2020), holding that harmed firms may pursue other sources of bank funding, thus falling credit availability due to negative shocks on bank balance sheets may not be detrimental to firms.

4.6. Main Bank Mergers

This subsection focuses on bank mergers to provide further support for our main finding in Table 4 about Hypothesis 1. We interpret it as evidence of firms' improved expectations for credit availability. Our theoretical framework implies that the substitution between in-crisis borrowing and post-crisis reduction in cash holdings should be clear among firms with higher uncertainty regarding pre-crisis credit availability relative to others, because a change in expectations should be larger among the former than the latter.

A merger is likely to terminate the relationship between a firm and its main bank (Sapienza, 2002; Karceski et al. 2005; Degryse et al. 2011; Fraisse et al. 2018). The literature also points out the possibility that banks could curtail borrowers' bargaining power through mergers (Carow, Kane, and Narayanan 2006; Fraser et al. 2011). We argue that firms whose main bank merged in the merger wave around 2000 faced high uncertainty in bank financing. In fact, our data show that firms whose main bank had undergone a merger up to 2002 increased their cash holdings-to-assets ratio from 0.102 in 2002 to 0.113 in 2004. In contrast, firms whose main bank did not merge increased their ratio from 0.096 in 2002 to 0.100 in 2004. The former therefore increased their cash holdings more than the latter after the bank merger wave and before the crisis.

Table 7 shows a negative association in Panel A between emergency borrowing and post-crisis cash holdings only among firms whose main bank experienced a merger.¹⁸ This finding is consistent with our argument that firms facing high uncertainty as a result of a bank merger wave reduced their cash holdings after borrowing. The magnitudes of the estimates are similar to those in Panel A of Table 4.

This result helps us rule out the possibility that differing financial management skills drive our main finding. One might be concerned that financially astute firms could borrow during the crisis and reduce excess cash holdings for greater efficiency. Alternatively, firms with poor financial management might have to borrow during the crisis and suboptimally reduce their cash holdings afterwards. Since mergers of main banks have no connection to the quality of corporate financial management, this test can mitigate such concerns.

4.7. Personal Experiences

Recent empirical studies show that managers' personal experiences affect corporate financial decisions.¹⁹ We expect that firms with executives who had successful experiences in a crisis are more likely to reduce cash holdings. In this subsection, we demonstrate the role of improved expectations after a crisis along this line of research.

We divide firm-year observations into three groups by the in-crisis positions of the executives involved: i) those with a crisis-period executive, ii) those with a crisis-period CEO,

¹⁸ We exclude firms if their top lender was not a bank, such as an insurance company, or if they had not borrowed before the crisis.

¹⁹ Related studies include Koudijs and Voth (2016) and Gopalan, Gormley and Kalda (2019). The former considers lenders' expectations about borrowers' debt-serving capacity, and the latter directors' expectations about the cost of defaulting.

and iii) those with a crisis-period financial officer. For example, if a crisis-period CEO resigned in 2013 and remained as an executive from 2013 to 2015, the firm was classified as being in the second group up to 2012, in the first group from 2013 and 2015, and in none of them from 2016. Executives include CEOs, other officers, directors, and auditors.

Figure 6 shows the ratio of firms in each of the three groups. 93.2% of firms included at least one executive who had experienced distress in the 2008 crisis up to 2017. It provides support to the contention that firms in our sample were likely to believe that uncertainty in financing decreased because of these executives' personal experiences. Half of the crisis-period CEOs were still executives in 2017. A caveat about financial officers is that only 42.5% of our entire sample reported who was in charge of financing during the crisis. The percentages of these reporting firms which still had their in-crisis financial officer as an executive were 50.5% in 2013 and 26.4% in 2017.

Table 8 shows that the personal experiences of CEOs (Panel A) and financial officers (Panel B) affected cash holdings. Panel A reports that firms with in-crisis CEOs reduced their cash holdings significantly in all years up to 2017. The magnitudes of the estimates are broadly comparable with those in Table 4. Panel B shows significantly reduced cash holdings in most years except for 2016. The small sample size in Panel B decreases the F-value of the excluded instrument: it is less than ten in 2015 and 2017. The statistical inference is therefore suspect in later periods in Panel B. Note that we do not include a table for firm-year observations with a crisis-period executives because they are mostly the same as the full sample.

4.8. Does Bank Capital Affect Lending?

Our instrumental variable has only considered an exogenous demand shifter, bonds maturing in 2008. Another candidate is a supply shifter, such as banks' capital or liquidity constraints. Although the overall Japanese banking sector maintained its health in the global financial crisis, constrained banks might not have been able to meet the credit demands of their clients. In this subsection, we test whether including a supply factor in the first stage regression affected emergency borrowing during the crisis and post-crisis cash holdings.

We construct three measures evaluated in 2007 from financial information about each firm's main bank. Our primary measure is *Capital*, the ratio of the book value of equity to total assets. A higher capital ratio indicates a higher loss absorption buffer, that is, more risk-taking capacity. Undercapitalized banks need to reduce their lending to meet the regulatory minimum (Watanabe, 2007). We also use *CapitalBis*, the risk-adjusted capital adequacy ratio based on

the BIS requirement, and *Liquid*, the ratio of the book value of liquid assets to total assets for robustness.²⁰ A higher liquidity ratio implies higher capacity for liquidity provisions (Kashyap and Stein, 2000). All these variables are widely accepted as indicators of banks' risk-taking or loan supply capacity. If the main banks' capital or liquidity during the crisis affected their lending, these variables should positively affect corporate borrowing. It is plausible that they do not affect post-crisis corporate cash policy directly other than through lending, since the financial soundness of a bank affects the cash policy of its borrowers only through its lending attitude.

Panel A of Table 9 shows that *Capital* increases emergency borrowing at the 1% level in column (2). Column (3) does not show any significant effect of *CapitalBis* or *Liquid* on borrowing.²¹ Both columns support our main finding that bank loan demand, measured by *Mature07*, significantly increases bank borrowing. When we include additional instruments, the estimates are larger in columns (2) and (3) than in (1). These findings suggest that loan demand shifters affected the decision to borrow in the crisis in Japan even after considering supply shifters. Panels B shows the second stage estimation results when we include *Capital* as an additional instrument. The estimates are similar to those of our main result in Table 4.

Financial constraints of the main bank might have driven firms to increase borrowing from non-main banks. To examine this possibility, we run the first-stage regression, represented in Panel A, with either main or non-main bank loans as the regressand in Panel C. The coefficients of *Capital* (the main bank's capital ratio) are positive and statistically significant in the regression for main-bank loans in columns (1) and (2); they are positive and marginally significant in column (3), and insignificant in column (4) for non-main bank loans. If the deteriorated financial soundness of the main bank caused the growing dependency on non-main banks, the coefficients of *Capital* in the non-main-bank loan regression should be negative. Our findings from Panel C imply that financial constraints do not explain our primary findings.

4.9. Evidence from Non-Crisis Periods

4.9.1. Exclusion Restriction

Considering a data period prior to the global financial crisis allows two tests, in Sections

²⁰ Liquid assets are the sum of cash and amounts due from banks, call loans, receivables under resale agreements, receivables under securities borrowing transactions, bills bought, monetary claims bought, securities (government bonds, corporate bonds, stocks, and others), and money held in trust.

²¹ The sample size is smaller in columns 2-4 than in column 1. The former only includes firms with main banks in our definition.

4.9.1 and 4.9.2. The first mitigates a concern about the exclusion restriction, apart from the overidentification test in Panel B of Table 4. Our identification strategy relies on the assumption that the level of long-term bonds maturing in 2007 was exogenous to firms' unobservable characteristics that would affect their post-crisis (i.e., future) cash policy. In this subsection, we provide evidence that the level of bonds maturing in some year prior to the crisis (e.g., 2005) does not directly explain a future cash policy (e.g., 2010). This assertion suggests that the relationship between the instrument and a future cash policy develops only indirectly through the emergency borrowing induced by a financing demand and that the exclusion restriction is not violated. In other words, data from the pre-crisis period can isolate the direct effect, if any, of bond maturity on future cash policy. Giroud, et al. (2012) also use this approach to test the validity of the instrument.

We test whether $Mature05_i$, the ratio of bonds outstanding with maturity shorter than one year in 2005 divided by the total assets in 2004, predicted a change in future cash policy, $\Delta Cash_{in}$, from 2004 to n ($n=2006, 2007, \dots, 2015$). If $Mature05_i$ has an unobservable characteristic that decreased cash holdings afterwards, we should observe a negative and significant association between $Mature05_i$ and $\Delta Cash_{in}$. Similarly, we use $Mature04_i$ as the main regressor, and the regressand of $\Delta Cash_{in}$ is the change in the ratio of cash holdings from 2003 to n ($n=2005, 2006, \dots, 2014$) in another estimation. We estimate based on the following reduced form equation:

$$\Delta Cash_{in} = \delta_0 + \delta_1 Mature0N_i + \delta_2 x_{i0N-1} + \delta_3 \Delta x_{in} + \xi_i,$$

where ξ_i is the error term, and $Mature0N_i$ is either $Mature05_i$ or $Mature04_i$.²²

Table 10 shows that all the coefficients indicate there are insignificant effects on the change in cash holdings. These findings provide support for our assumption on the exclusion restriction that bond maturity structures do not directly predict a future change in cash policy.

4.9.2. Falsification Test

This subsection provides a falsification test to demonstrate that our finding is unique in the global financial crisis, using the pre-crisis period data. We estimate equations (1) and (2) with

²² We exclude the following three variables in Tables 10 and 11 due to a lack of data before the crisis: the ratio of outside directors; the company with audit and supervisory committee system dummy; and the company with three committee system dummy. Omitting them in the regression in Table 4 does not change our findings.

the period moved back some years. We replace $\Delta Bank0708_i$ with $\Delta Bank0506_i$ and $Mature07$ with $Mature05$, respectively. Firms with high $Mature05_i$ may have borrowed for refinancing and increased $\Delta Bank0506_i$ in the first stage regression. This borrowing, however, is less likely to have reduced cash holdings in the second stage because borrowing in normal times should not affect expectations in financing based on theories of relationship banking. We also replace $\Delta Bank0708_i$ in equations (1) and (2) with $\Delta Bank0405_i$ and $Mature07$ in equation (1) with $Mature04$. Almeida, Campello, Laranjeira and Weisbenner (2009) and Schnabl (2012), among others, also use pre-shock data for a falsification test.

Table 11 reports no systematic negative effects of borrowing on a subsequent change in cash holdings. In addition, the first stage F-value of the excluded instrument is mostly less than 10. It suggests that the incentive to tap liquidity from banks is not necessarily great in non-crisis periods, possibly due to the availability of other financing sources.

4.10. Impact on Post-crisis Investments

Theories of relationship banking predict that in-crisis borrowing and the associated improvement of expectations of bank credit availability should encourage post-crisis investment. The implicit insurance theory implies that successful borrowing in a crisis encourages firms to take on risk because of the insurance in financially constrained situations. The hold-up theory also implies that borrowing from banks, especially non-main banks, encourages investment through reduced concerns about a hold-up. In this section, we test this prediction. We examine the impact on three types of investment: capital expenditures, R&D, and equity investments in affiliates. For this purpose, we replace $\Delta Cash_{in}$ in equation (2) with $\Delta Investment_{in}$, one of the three types, to examine how post-crisis investments responded to the borrowing experience in the crisis.

Figure 7 shows a time-series plot of the changes in these three types of investment for each year relative to 2006.²³ Each value is normalized by the total assets in 2006. This figure shows a constant increase in equity investments in firms' affiliates: the values are always over zero on the right axis and increase over time. In contrast, until 2012 firms reduced their capital expenditures and R&D expenses relative to the 2006 levels (i.e., less than zero on the left axis), then increased both since 2013 (i.e., greater than zero). The estimates we present below need

²³ The magnitudes of the changes of R&D expenses and capital expenditures (left axis) are larger than that of equity investments in affiliates (right axis). This is because the former are changes in flow variables and the latter a change in a stock variable.

careful interpretation. For example, even if there is a positive coefficient of *Bank0708* for capital expenditures in 2011, this may only indicate that successful borrowers spent more compared to others; overall expenditures may not necessarily grow compared to their 2006 levels.

We find positive and significant coefficients of *Bank0708* in Panel C of Table 12 for equity investments across all the data periods. Panel B does not show significant coefficients for R&D on average, except in 2015 at the 10% level. We examine the intensive margin of R&D in Panel D, considering only firms that reported R&D expenses in 2006 (67.9% of our sample).²⁴ It shows positive and significant coefficients from 2013 to 2016, when aggregated R&D increased relative to the 2006 level (Figure 7). Panel E further shows that the findings in Panel D on R&D are clustered among small firms, whose assets were below the median in 2006. These findings are not consistent with the literature on financing R&D that reports that financing using banks is not suitable for R&D due to lack of collateral value (Brown, Fazzari, and Petersen 2009; Brown, Martinsson, Petersen 2012). Our findings suggest that improved confidence in bank credit availability, which is likely to support long-term investment like R&D, can encourage R&D despite the potential disadvantage.

We do not find evidence for capital expenditures in Panel A. It shows that a change in profitability is associated with an increase in capital expenditures. We observe this positive association in many years after the crisis. This result suggests that part of the capital expenditures is financed by the internal funds generated by operating cash flow. This is widely reported in the literature regarding cash flow sensitivity of investment. Recent studies include Lewellen and Lewellen (2016) and Sakai (2020). Readers might conjecture that loan covenants or loan repayments hamper these investment activities. However, it is uncommon that loan covenants restrict capital investment or R&D in Japan.²⁵ Firms in these periods did not pay down their debt, as Figure 2 indicates that borrowing did not decrease relative to pre-crisis levels.

Our findings on increased equity investments can be explained by theories about internal capital markets. One possibility is that they transferred cash to high-growth subsidiaries using

²⁴ Reporting R&D expenses is mandatory in Japanese Generally Accepted Accounting Practice (JGAAP). In March 1998, the Japanese Institute of Certified Public Accountants published a guideline: “Kenkyu Kaihatsu Hi Oyobi Sohutoeua No Kaikei Shori Ni Kansuru Jitsumu Shishin (Practical Guidelines for Accounting for Research and Development Costs and Software)”.

²⁵ Kochiyama and Nakamura (2019) find that loans with such a covenant account for merely 2.2% in their hand-collected data of 2,596 loan covenants of Japanese listed companies. The data are from 2004 to 2013.

cross-firm equity investments (Almeida, Kim and Kim, 2015; Stein, 1997). Alternatively, it might be just a reflection of an agency problem if the affiliates did not increase their investments (Scharfstein and Stein, 2000).

Aggregated data and a recent study support the former possibility. The Survey on Overseas Business Activities, which is conducted annually by the Japanese Ministry of Economy, Trade and Industry, reports aggregated data of Japanese multinationals' foreign affiliates'/subsidiaries' capital expenditures. Figure 8 shows a sharp increase in their capital expenditures from 2009 through the entire post-crisis period. Kim, Wilcox, and Yasuda (2020) find from the dataset of Japanese listed firms that parent companies lent more to their subsidiaries when subsidiaries' capital expenditures increased relative to those of their parents. Their finding suggests that Japanese multinationals invested in affiliates, especially those abroad, with potentially high-growth opportunities.

5. Conclusion

The 2008 global financial crisis created a loan demand surge for Japanese firms, while the banking sector maintained its health right after the drastic reorganizations arising from a series of mergers. We find that firms that were affected by the crisis successfully obtained bank loans, mostly from non-main banks. They faced lower borrowing costs, reduced their cash holdings, and spent more on equity investments in their affiliates, presumably foreign direct investments, after the crisis. We interpret that to indicate the successful diversification of financing sources mitigated corporate managers' concerns about the hold-up problem, as well as the demand for implicit liquidity insurance. Our finding implies that managerial expectations regarding credit availability from the entire banking sector, rather than a specific main bank, help reduce conservative decision-making.

Our findings also suggest the traditional main-bank relationship of publicly traded companies in Japan substantially weakened after the global financial crisis. The sharp increase in non-main bank loans could accelerate the dissolution of this relationship, which had already started as a result of policy changes and bank mergers. This may benefit the Japanese economy in light of the assertions of John, Litov, and Yeung (2008) that bank-oriented governance structures discourage corporate risk-taking and limit corporate growth.

References

- Acharya, Viral, Sergei A. Davydenko, and Ilya A. Strebulaev, 2012, Cash holdings and credit risk, *Review of Financial Studies*, 25: 3572-3609.
- Alfaro, Ivan, Nicholas Bloom, and Xiaoji Lin, 2018, The finance uncertainty multiplier, *NBER Working Paper*, 24571.
- Almeida, Heitor, Murillo Campello, Bruno Laranjeira, and Scott Weisbenner, 2011, Corporate debt maturity and the real effects of the 2007 credit crisis, *Critical Finance Review*, 1: 3-58.
- Almeida, Heitor, Chang-Soo Kim, and Hwanki Brian Kim, 2015, Internal capital markets in business groups: Evidence from the Asian financial crisis, *Journal of Finance*, 70: 2539-2586.
- Almeida, Heitor, Murillo Campello, and Michael S. Weisbach, 2004, The cash flow sensitivity of cash, *Journal of Finance*, 59: 1777-1804.
- Alonso-Borrego, César, and Francisco Javier Forcadell, 2010, Related diversification and R&D intensity dynamics, *Research Policy*, 39.4: 537-548.
- Aoki, Masahiko, and Hue Patrick, eds., 1995, *The Japanese Main Bank System: Its Relevance for Developing and Transforming*, Clarendon Press, Oxford.
- Aoyagi, Chie, and Giovanni Ganelli, 2014, Unstash the Cash! Corporate Governance Reform in Japan, *IMF Working Paper*, 14/140 (2014).
- Arikawa, Yasuhiro and Miyajima, Hideaki, 2007, Understanding the M&A boom in Japan: What drives Japanese M&A?, Discussion papers, Research Institute of Economy, Trade and Industry (RIETI) Discussion Paper Series 07E042.
- Bates, Thomas W., Kathleen M. Kahle, and René M. Stulz, 2009, Why do US firms hold so much more cash than they used to?, *Journal of Finance*, 64: 1985-2021.
- Berg, Tobias, 2018, Got rejected? Real effects of not getting a loan, *Review of Financial Studies*, 31: 4912-4957.
- Bernile, Gennaro, Vineet Bhagwat, and P. Raghavendra Rau, 2017, What doesn't kill you will only make you more risk-loving: Early-life disasters and CEO behavior, *Journal of Finance*, 72: 167-206.
- Bolton, Patrick, Xavier Freixas, Leonardo Gambacorta, and Paolo E. Mistrulli, 2016, Relationship and transaction lending in a crisis, *Review of Financial Studies*, 29: 2643-2676.
- Caballero, R. J., T. Hoshi, and A. K. Kashyap, 2008, Zombie Lending and Depressed Restructuring in Japan, *American Economic Review*, 98, 1943-1977.
- Campello, Murillo, Erasmo Giambona, John R. Graham, Campbell R. Harvey, 2011, Liquidity management and corporate investment during a financial crisis, *Review of Financial Studies*, 24: 1944-1979.
- Carow, Kenneth A., Edward J. Kane, and Rajesh P. Narayanan, 2006, How have borrowers fared in banking megamergers?, *Journal of Money, Credit and Banking*, 38: 821-836.
- Cenni, Stefano, Stefano Monferrà, Valentina Salotti, Marco Sangiorgi, and Giuseppe Torluccio. 2015, Credit Rationing and Relationship Lending. Does Firm Size Matter? *Journal of Banking and Finance* 53: 249-65.
- Chemmanur, Thomas J., and Paolo Fulghieri, 1994, Reputation, renegotiation, and the choice between bank loans and publicly traded debt, *Review of Financial Studies*, 7: 475-506.
- Crane, Alan D., Sébastien Michenaud, and James P. Weston, 2016, The effect of institutional ownership on payout policy: Evidence from index thresholds, *Review of Financial Studies*, 29(6): 1377-1408.
- Degryse, Hans, Nancy Masschelein, and Janet Mitchell, 2011, Staying, dropping, or switching: the impacts of bank mergers on small firms, *Review of Financial Studies*, 24: 1102-1140.

- Dinç, I.S., 2000, Bank Reputation, Bank Commitment, and the Effects of Competition in Credit Markets, *Review of Financial Studies*, 13: 781–812.
- Dittmar, Amy and Ran Duchin, 2016, Looking in the rearview mirror: The effect of managers' professional experience on corporate financial policy, *Review of Financial Studies*, 29: 565–602.
- Duchin, Ran, 2010, Cash holdings and corporate diversification, *Journal of Finance*, 65: 955–992.
- Duchin, Ran, Oguzhan Ozbas, and Berk A. Sensoy, 2010, Costly external finance, corporate investment, and the subprime mortgage credit crisis, *Journal of Financial Economics*, 97: 418–435.
- Duong, Huu Nhan, Justin Hung Nguyen, My Nguyen, and S. Ghon Rhee, 2020, Navigating through economic policy uncertainty: The role of corporate cash holdings, *Journal of Corporate Finance*, 62: 101607.
- Elsas, Ralf, and Jan Pieter Krahnen, 1998, Is relationship lending special? Evidence from credit-file data in Germany, *Journal of Banking and Finance* 22 (10-11): 1283–1316.
- Farinha, Luisa A., and Joao AC Santos, 2002, Switching from Single to Multiple Bank Lending Relationships: Determinants and Implications, *Journal of Financial Intermediation*, 11: 124–151.
- Favara, Giovanni, Janet Gao, and Mariassunta Giannetti, 2019, Uncertainty, access to external finance, and firm precautionary behavior, unpublished manuscript.
- Feng, Xunan and Anders C. Johansson, 2018, Living through the Great Chinese Famine: Early-life experiences and managerial decisions, *Journal of Corporate Finance*, 48: 638–657.
- Fraisse, Henri, Johan Hombert, and Mathias Lé, 2018, The competitive effect of a bank megamerger on credit supply, *Journal of Banking & Finance*, 93: 151–161.
- Fraser, Donald R., James W. Kolari, Seppo Pynnönen, and T. Kyle Tippens, 2011, Market power, bank megamergers, and the welfare of bank borrowers, *Journal of Financial Research*, 34: 641–658.
- Fukuda, S. and J. Nakamura, 2011, Why did 'zombie' firms recover in Japan?, *The World Economy*, 34, 1124–1137.
- Gao, Janet, Yaniv Grinstein, and Wenyu Wang, 2017, Cash holdings, precautionary motives, and systematic uncertainty, unpublished manuscript.
- Giroud, Xavier and Mueller, Holger M and Stomper, Alex and Westerkamp, Arne, Snow and leverage, *The Review of Financial Studies*, 25.3: 680–710.
- Gopalan, Radhakrishnan, Todd A. Gormley, and Ankit Kalda, 2019, It's not so bad: Director bankruptcy experience and corporate risk taking, unpublished manuscript.
- Hugonnier, Julien, Semyon Malamud, and Erwan Morellec, 2014, Capital supply uncertainty, cash holdings, and investment, *Review of Financial Studies*, 28: 391–445.
- Hugonnier, Julien, Semyon Malamud, and Erwan Morellec, 2015, Credit market frictions and capital structure dynamics, *Journal of Economic Theory*, 157: 1130–1158.
- Hoshi, Takeo, and Anil Kashyap, 2000, The Japanese banking crisis: Where did it come from and how will it end?, *NBER Macroeconomics Annual 1999*, Vol.14, Ben Bernanke and Julio J. Rotemberg eds., MIT Press, 129–212.
- Hoshi, Takeo, Anil Kashyap, and David Scharfstein, 1990, The role of banks in reducing the costs of financial distress in Japan, *Journal of Financial Economics*, 27.1: 67–88.
- Hoshi, Takeo, Anil Kashyap, and David Scharfstein, 1991, Corporate structure, liquidity, and investment: Evidence from Japanese industrial groups, *Quarterly Journal of Economics*, 106: 33–60.
- Jiang, Wei, Kai Li, and Pei Shao, 2010, When shareholders are creditors: Effects of the simultaneous holding of equity and debt by non-commercial banking institutions, *Review of Financial Studies*, 23: 3595–3637.

- Jiménez, Gabriel, Atif Mian, José-Luis Peydró, and Jesús Saurina, 2020, The real effects of the bank lending channel, *Journal of Monetary Economics* 115: 162-179.
- John, Kose, Lubomir Litov, and Bernard Yeung, 2008, Corporate governance and risk-taking, *Journal of Finance* 63: 1679–1728.
- Kasahara, Hiroyuki, Katsumi Shimotsu, and Michio Suzuki, 2014, Does an R&D tax credit affect R&D expenditure? The Japanese R&D tax credit reform in 2003, *Journal of the Japanese and International Economies*, 31: 72-97.
- Kashyap, Anil K., and Jeremy C. Stein, 2000, What do a million observations on banks say about the transmission of monetary policy?, *American Economic Review*, 90: 407-428.
- Karceski, Jason, Steven Ongena, and David C. Smith, 2005, The impact of bank consolidation on commercial borrower welfare, *Journal of Finance*, 60: 2043-2082.
- Kim, Kevin Y., Park, Kwangwoo, Ratti, Ronald A., and Shin, Hyun-Han, 2004, Do main banks extract rents from their client firms? Evidence from Korean Chaebol, *Hitotsubashi Journal of Economics*, 15-45.
- Kim, Hyonok, James A. Wilcox, and Yukihiro Yasuda, 2020, Internal and external lending by nonfinancial businesses, Working Paper Series, No. G-1-23, Hitotsubashi University Center for Financial Research.
- Kochiyama, Takuma, and Ryosuke Nakamura, 2019, Debt covenants in Japanese loan markets: in comparison with the traditional relationship banking, *Accounting & Finance*, Forthcoming.
- Koibuchi, Ken, Masaya Sakuragawa, Kimie Harada, Takeo Hoshi, and Kaoru Hosono, 2014, Japan in the global financial crisis, *Japan Society of Monetary Economics*, 36: 1-23. (In Japanese)
- Kondo, Yoshihiro, Nakazono, Yoshiyuki, Ota, Rui, and Sui, Qing, Yuan, 2020, Heterogeneous impacts of Abenomics on the stock market: A Fund flow analysis, *Journal of the Japanese and International Economies*, 55, 101053.
- Koudijs, Peter, and Hans-Joachim Voth, 2016, Leverage and beliefs: Personal experience and risk-taking in margin lending, *American Economic Review*, 106: 3367-3400.
- Khwaja, Asim I. and Atif Mian, 2008, Tracing the impact of bank liquidity shocks: Evidence from an emerging market, *American Economic Review* 98: 1413-42.
- Lewellen, Jonathan, and Katharina Lewellen, 2016, Investment and cash flow: New evidence, *Journal of Financial and Quantitative Analysis* 51: 1135-1164.
- Lin, Huidan, and Daniel Paravisini, 2012, The effect of financing constraints on risk, *Review of Finance*, 17: 229-259.
- Limpaphayom, Piman, Daniel A. Rogers, Noriyoshi Yanase, 2019, Bank equity ownership and corporate hedging: Evidence from Japan, *Journal of Corporate Finance*, 58: 765-783.
- Lins, V. Karl, Henri Servaes, and Peter Tufano, 2010, What drives corporate liquidity? An international survey of cash holdings and lines of credit, *Journal of Financial Economics*, 98: 160-176.
- Ivashina, Victoria, and David Scharfstein, 2010, Bank lending during the financial crisis of 2008, *Journal of Financial Economics*, 97: 319-338.
- Malmendier, Ulrike, and Stefan Nagel, 2011, Depression babies: Do macroeconomic experiences affect risk taking?, *Quarterly Journal of Economics*, 126: 373-416.
- Manova, Kalina, Shang-Jin Wei, and Zhiwei Zhang, 2015, Firm exports and multinational activity under credit constraints, *Review of Economics and Statistics*, 97: 574-588.
- Massa, Massimo, Ayako Yasuda, and Lei Zhang, 2013, Supply uncertainty of the bond investor base and the leverage of the firm, *Journal of Financial Economics*, 110: 185-214.
- Masulis, Ronald W., Peter Kien Pham, and Jason Zein, 2011, Family business groups around the world: Financing advantages, control motivations, and organizational choices, *The Review of Financial Studies*, 24: 3556-3600.

- Matvos, Gregor, and Amit Seru, 2014, Resource allocation within firms and financial market dislocation: Evidence from diversified conglomerates, *Review of Financial Studies*, 27: 1143-1189.
- Miyajima, Hideaki, and Fumiaki Kuroki, 2007, The Unwinding of Cross-Shareholding in Japan: Causes, Effects, and Implications, Ch. 3 in *Corporate Governance in Japan: Institutional Change and Organizational Diversity*, Edited by Aoki, M., G. Jackson, and H. Miyajima, Oxford University Press, New York.
- Miyajima, Hideaki, and Takaaki Hoda, 2015, Ownership Structure and Corporate Governance: Has an Increase in Institutional Investors' Ownership Improved Business Performance? *Public Policy Review*, 11: 361-393.
- Montgomery, Heather, and Yuki Takahashi, 2018, Effect of Bank Mergers on Client Firms: Evidence from the Credit Supply Channel, *Japanese Economic Review*, 69:438-449.
- Nemoto, Tadanobu, Yoshiaki Ogura, and Wako Watanabe, 2016, Inside Bank Premiums as Liquidity Insurance, *Journal of the Japanese and International Economies* 42: 61-76.
- Ogawa, Kazuo, 2015, What do cash holdings tell us about bank-firm relationships? A case study of Japanese firms, 215-235, *The Economics of Interfirm Networks*. Springer, Tokyo.
- Ogura, Yoshiaki, 2018, The objective function of government-controlled banks in a financial crisis, *Journal of Banking & Finance*, 89: 78-93.
- Ozkan, Aydin, and Neslihan Ozkan, 2004, Corporate cash holdings: An empirical investigation of UK companies, *Journal of Banking & Finance*, 28: 2103-2134.
- Petersen, Mitchell A., and Raghuram G. Rajan, 1994, The benefits of lending relationships: Evidence from small business data, *Journal of Finance* 49: 3-37.
- Pinkowitz, Lee, and Rohan Williamson, 2001, Bank power and cash holdings: Evidence from Japan, *Review of Financial Studies*, 14: 1059-1082.
- Rajan, Raghuram G., 1992, Insiders and outsiders: The choice between informed and arm's-length debt, *Journal of Finance*, 47: 1367-1400.
- Rajan, Raghuram, Henri Servaes, and Luigi Zingales, 2000, The cost of diversity: The diversification discount and inefficient investment, *Journal of Finance*, 55: 35-80.
- Sakai, Hirotugu, 2020, Did financing constraints cause investment stagnation in Japan after the 1990s?, *Journal of Corporate Finance*, 64: 101673.
- Sapienza, Paola, 2002, The effects of banking mergers on loan contracts, *Journal of Finance*, 57: 329-367.
- Seru, Amit, 2014, Firm boundaries matter: Evidence from conglomerates and R&D activity, *Journal of Financial Economics*, 111: 381-405.
- Scharfstein, David S. and Jeremy C. Stein, 2000, The dark side of internal capital markets: divisional rent-seeking and inefficient investment, *Journal of Finance* 55: 2537-2564.
- Schnabl, Philipp, 2012, The international transmission of bank liquidity shocks: Evidence from an emerging market, *Journal of Finance*, 67: 897-932.
- Stein, Jeremy C, 1997, Internal capital markets and the competition for corporate resources, *Journal of Finance* 52: 111-133.
- Sufi, Amir, 2009, Bank lines of credit in corporate finance: An empirical analysis, *Review of Financial Studies*, 22: 1057-1088.
- Uchino, Taisuke, 2013, Bank dependence and financial constraints on investment: Evidence from the corporate bond market paralysis in Japan, *Journal of the Japanese and International Economies*, 29: 74-97.
- Ushijima, Tatsuo, 2020, More-money and less-cash effects of diversification: Evidence from Japanese firms, *Japan and the World Economy*, 56: 101040.
- Wahal, Sunil and John J. McConnell, 2000, Do institutional investors exacerbate managerial myopia? *Journal of Corporate Finance*, 6(3): 307-329.
- Watanabe, Wako, 2007, Prudential regulation and the "credit crunch": Evidence from

Japan, *Journal of Money, Credit and Banking*, 39: 639-665.

Figure 1: Overseas Sales around the 2008 Financial Crisis

This graph shows the average value of overseas sales, including exports, among Japanese listed firms at the end of each fiscal year (e.g., the value in 2002 is that at the end of March 2003).

Source: Nikkei NEEDS FinancialQUEST.

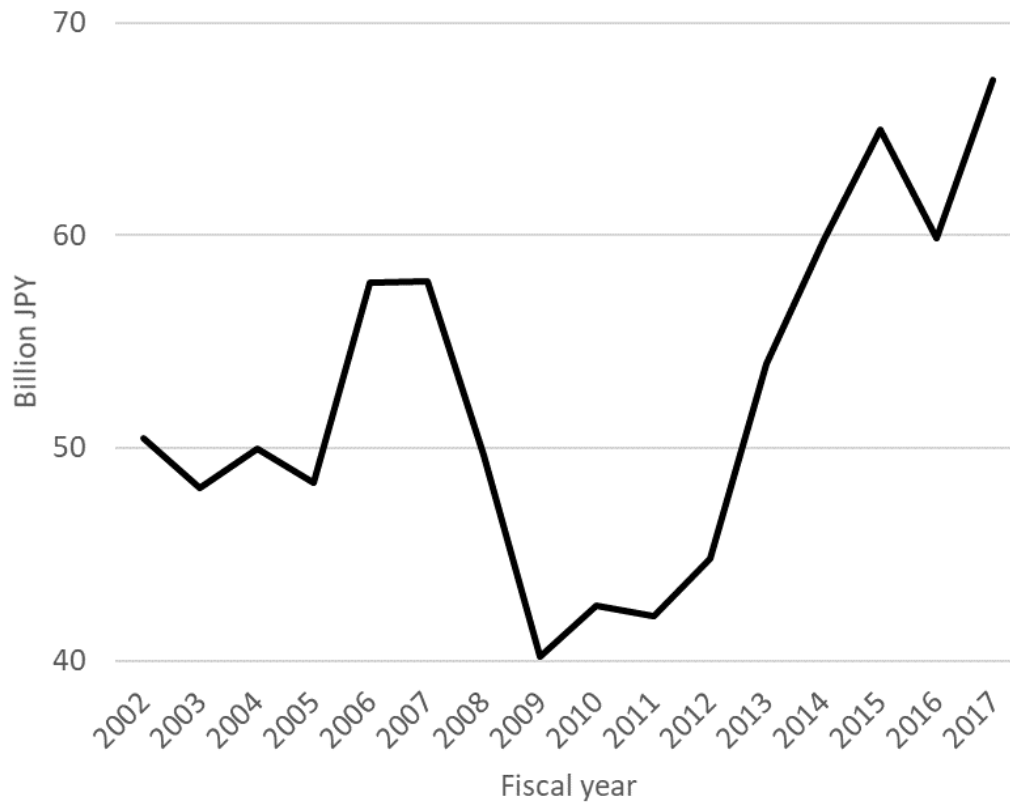


Figure 2: Risk-adjusted Capital Ratios of Japanese Banks

This figure reports the average risk-adjusted capital ratio on the BIS and domestic basis, respectively, at the end of each fiscal year. The sample includes city, regional, and second-tier regional banks. It excludes trust and bridge banks. City banks and some of the regional banks report the BIS-basis ratio. The other regional banks and second-tier regional banks, which operate domestically, report the domestic-basis ratio.

Source: Nikkei NEEDS FinancialQUEST. Unconsolidated basis. Augmented by the database on the Japanese Bankers Association website.

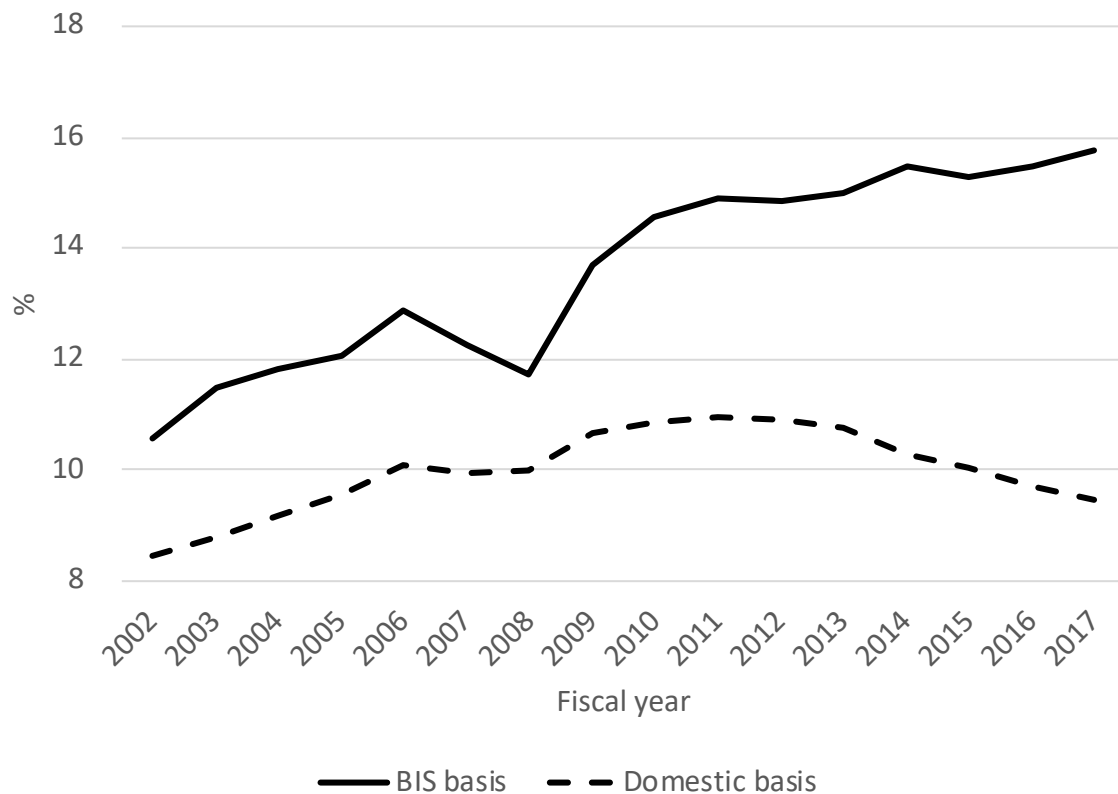


Figure 3: Loans to Large Firms by Bank Type

This figure presents loans to large firms at the end of each fiscal year. The values are calculated by subtracting the total loans and bills discounted for small and medium-sized enterprises from the total loans and bills discounted for all firms. The borrowers include financial firms. Regional banks include second-tier regional banks.

Source: Bank of Japan. Outstanding loans and bills discounted, banking accounts.

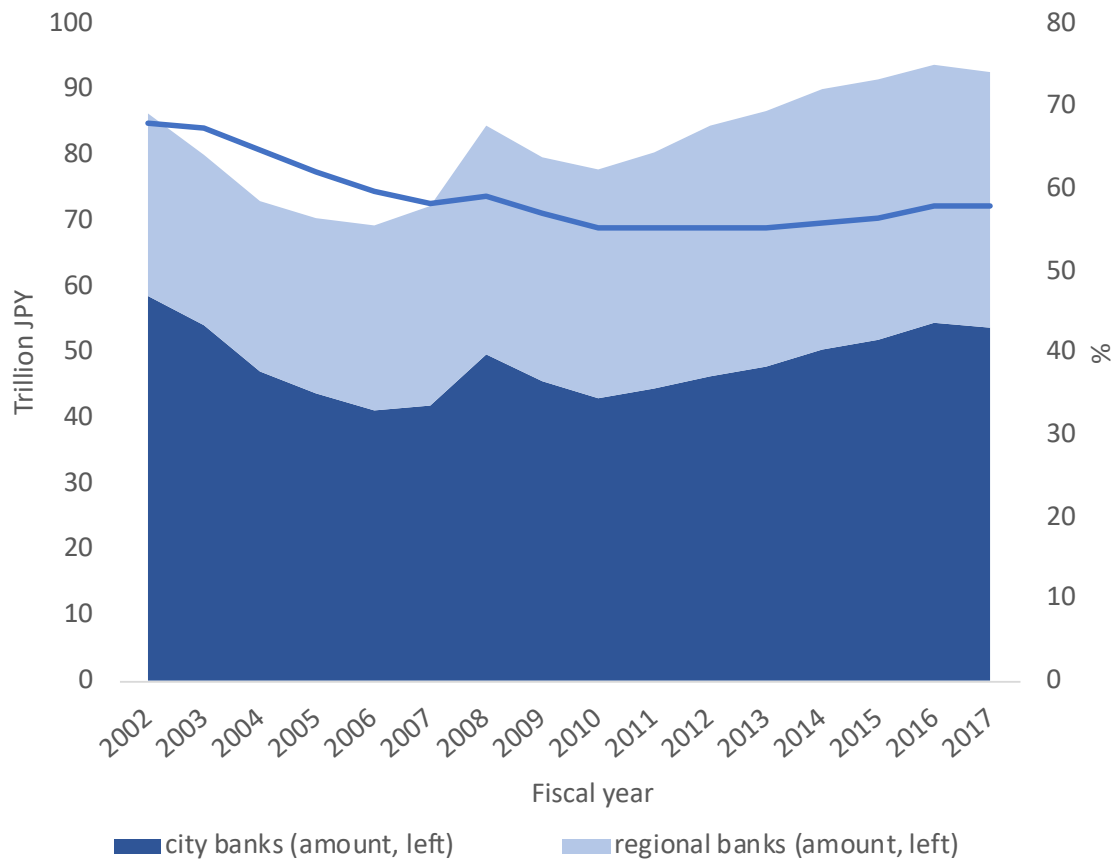


Figure 4: Bond (including Commercial Paper) and Equity Issuance

This figure reports the amount financed from equity and bonds including commercial paper (CP). The data are aggregated across all sample firms year by year.

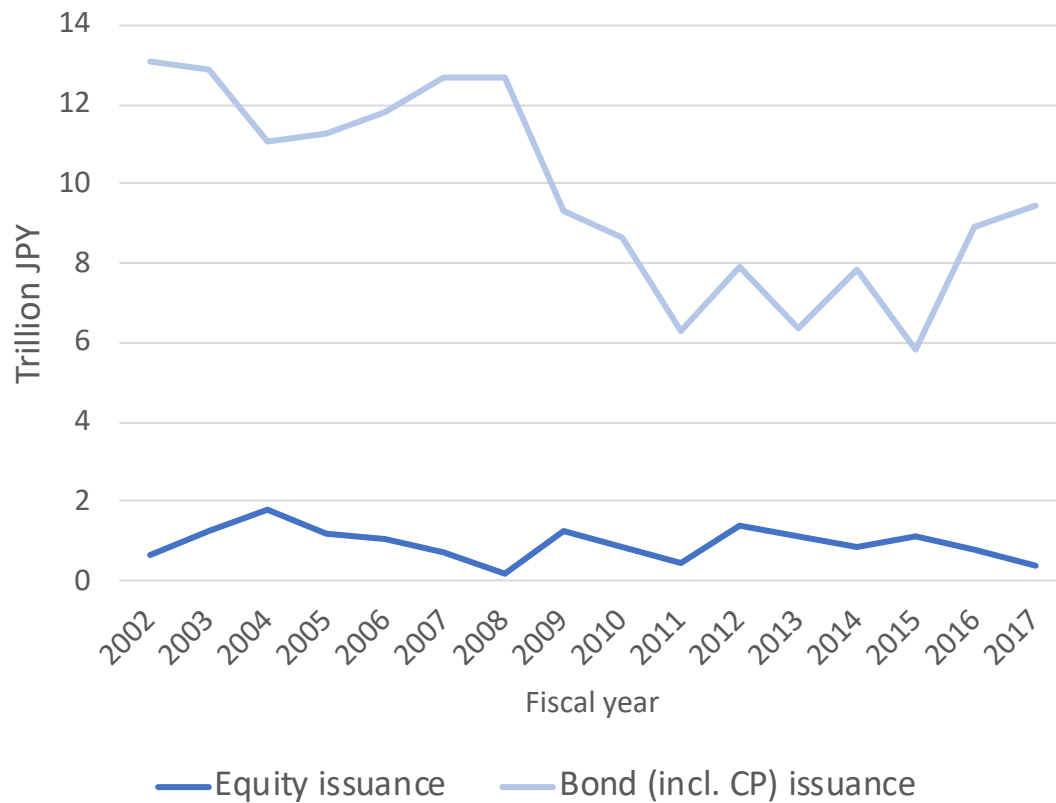


Figure 5: Mergers of Major Japanese Banks

This figure lists all mergers from 2000 to 2007 of city banks and long-term credit banks that existed in March 1999.

Source: Nikkin Shiryo Nen'po, Nihon Kin'yu Tsushinsha.

(List of major banks
as of March 1999)

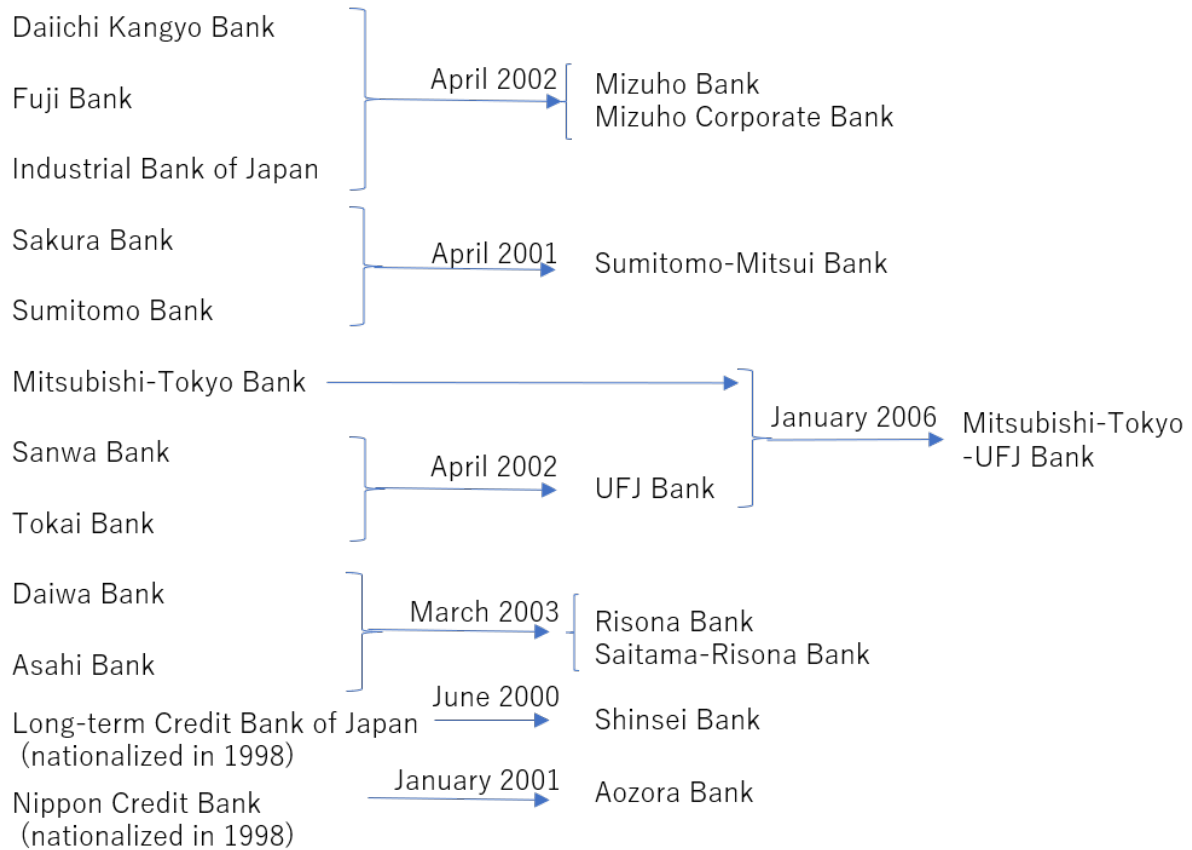


Figure 6: Firms with Crisis-Period Executives

This figure reports the percentage of firm-year observations for firms with executives who were executives, CEOs, or financial officers during the crisis. The percentage is calculated for all firms about executives and CEOs and for only firms that reported who their financial officer with crisis experience was.

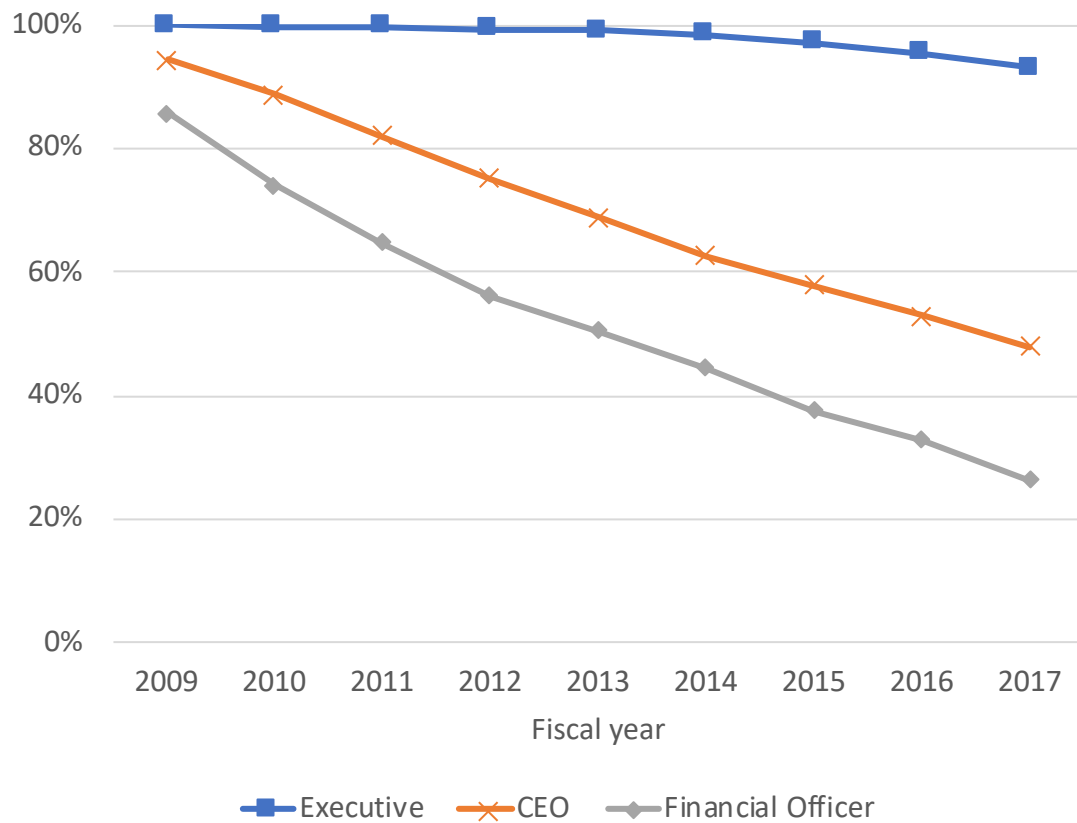


Figure 7: Corporate Investment

This figure reports the difference of the aggregated amount of sample firms' capital expenditures, R&D expenses, and equity investments in affiliates from that in 2006. All values are normalized by the total assets in 2006.

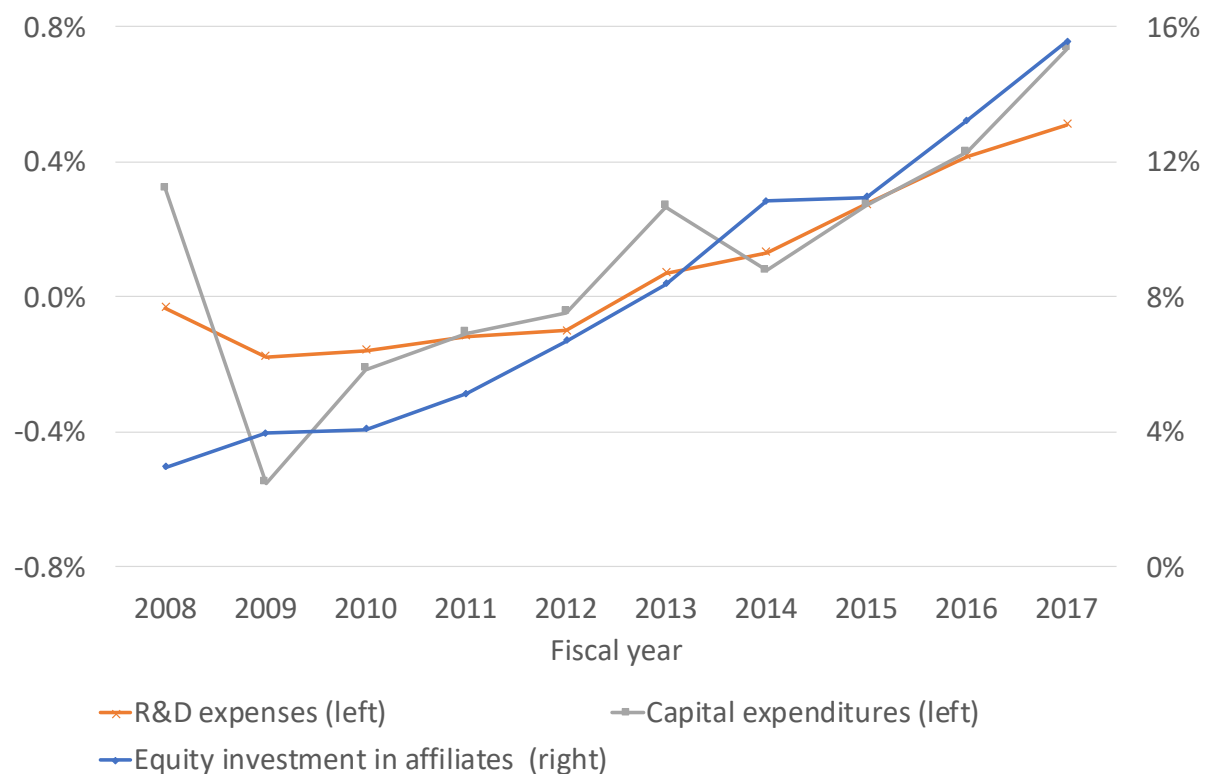


Figure 8: Aggregated Capital Expenditures by Foreign Affiliates of Japanese Multinationals

This figure reports the total amount of capital investment by overseas affiliates of Japanese multinationals in non-financial sectors.

Source: Basic Survey on Overseas Business Activities, collected by the Ministry of Economy, Trade, and Industry, Japan.

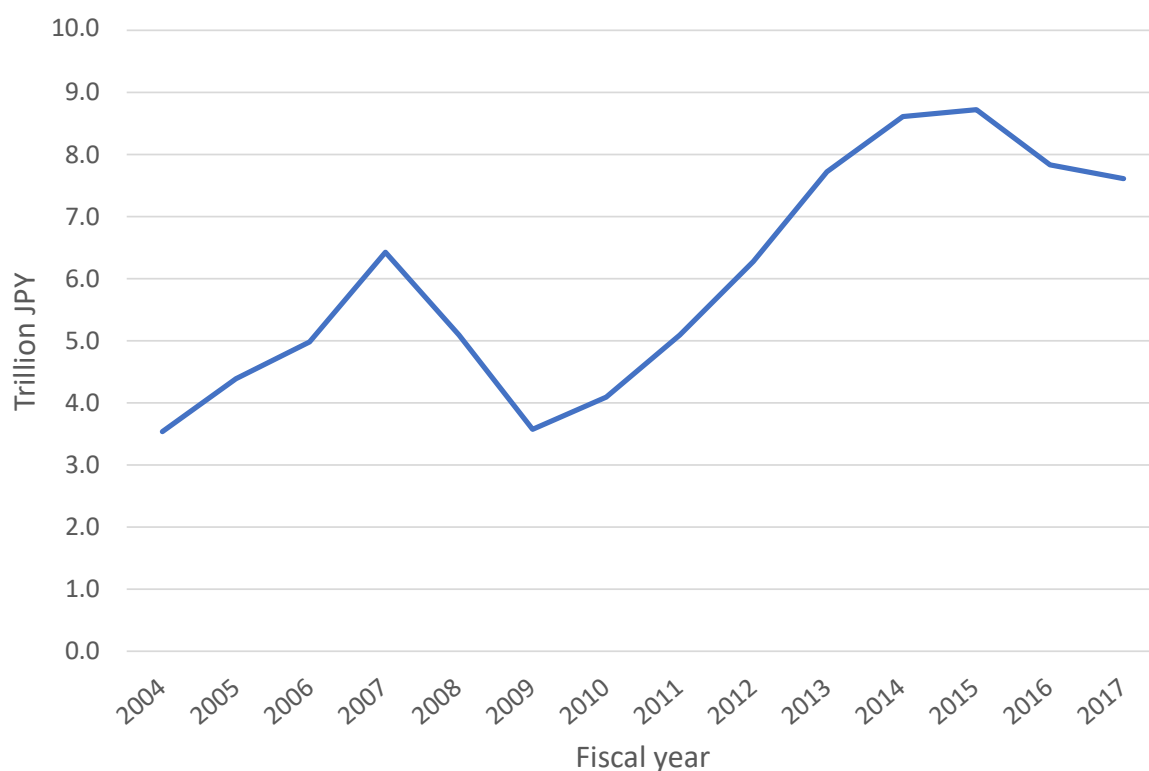


Table 1: Summary Statistics

This table reports summary statistics from 2006 to 2017. See the appendix for variable definitions.

	Mean	SD	p1	p10	p50	p90	p99	N
Cash	0.140	0.128	0.001	0.019	0.104	0.311	0.611	23448
Bank0708	0.018	0.073	-0.192	-0.037	0.000	0.099	0.281	23448
Bank0708 from the main bank	0.000	0.028	-0.112	-0.021	0.000	0.025	0.095	23448
Bank0708 from non-main banks	0.018	0.061	-0.146	-0.027	0.000	0.088	0.243	23448
Bank borrowing	0.142	0.142	0.000	0.000	0.104	0.350	0.567	23448
Cash flow	0.060	0.058	-0.116	0.009	0.055	0.125	0.241	23448
Tangibility	0.243	0.184	0.000	0.026	0.212	0.500	0.795	23448
Leverage	0.470	0.213	0.043	0.175	0.472	0.753	0.914	23448
NWC	0.050	0.169	-0.384	-0.157	0.051	0.256	0.487	23448
Size	10.573	1.653	7.009	8.625	10.414	12.803	15.178	23448
MTB	1.192	0.801	0.454	0.680	0.991	1.795	4.661	23448
Dividends	0.011	0.011	0.000	0.000	0.009	0.023	0.058	23448
Volatility	0.021	0.029	0.001	0.003	0.013	0.044	0.154	23448
Mature07	0.007	0.019	0.000	0.000	0.000	0.024	0.105	23448
Export07	0.324	1.162	0.000	0.000	0.000	0.736	5.959	23448
Capital (%)	4.670	1.272	1.716	2.927	4.818	5.923	8.233	14665
CapitalBis (%)	15.700	2.867	10.560	11.870	16.340	18.980	21.910	10806
Liquid (%)	38.960	7.385	10.560	28.594	41.132	46.079	52.943	14665
Cost of debt	0.024	0.021	0.000	0.006	0.018	0.046	0.100	19408
Bond outstanding dummy	0.246	0.431	0.000	0.000	0.000	1.000	1.000	23448
Bond outstanding dummy in 2007	0.268	0.443	0.000	0.000	0.000	1.000	1.000	23448
Bond issuance in 2008	0.007	0.025	0.000	0.000	0.000	0.022	0.138	23448
Equity issuance dummy	0.084	0.277	0.000	0.000	0.000	0.000	1.000	23448
Equity issuance dummy in 2008	0.002	0.014	0.000	0.000	0.000	0.000	0.081	23448
Board independence (%)	14.886	14.837	0.000	0.000	14.286	33.333	60.000	23448
Audit-and-supervisory committee dummy	0.183	0.386	0.000	0.000	0.000	1.000	1.000	7816
Three-committee system dummy	0.016	0.124	0.000	0.000	0.000	0.000	1.000	23448
Ownership shares by financial institutions (%)	18.708	12.854	0.000	2.725	16.764	37.291	49.655	23448
Ownership shares by the main bank (%)	1.333	1.832	0.000	0.000	0.000	4.540	4.960	23448
Ownership shares by non-main bank (%)	1.672	1.782	0.000	0.000	1.450	4.400	4.980	23448
Ownership shares by corporations (%)	26.858	18.313	0.000	5.369	24.038	54.091	73.249	23448
Ownership shares by foreign investors (%)	9.817	11.455	0.000	0.057	5.227	26.791	45.795	23448
Business group dummy	0.081	0.272	0.000	0.000	0.000	0.000	1.000	23448
# of subsidiaries	20.494	49.926	0.000	0.000	7.000	45.000	268.000	23448
Capital expenditures	0.025	0.039	-0.082	0.000	0.017	0.064	0.167	23448
R&D expenses	0.015	0.027	0.000	0.000	0.005	0.043	0.122	23448
Equity investment in affiliates	0.176	0.167	0.000	0.022	0.125	0.393	0.798	23448

Table 2: OLS Estimation

This table presents the OLS estimation results to examine whether an increase in bank borrowing during the crisis affected post-crisis cash holdings. The regressand is the change in cash holdings from 2006 to n ($n=2008, 2009, \dots, 2017$) divided by 2006 assets. The main regressor is the change in borrowing from 2007 to 2008 divided by 2006 assets. Δ in regressors indicates the difference from the value in 2006. We include both the level and difference of control variables. For example, when the regressand is the change in cash holdings from 2006 to 2009 divided by 2006 assets, we include the level of the cash flow-to-assets ratio in 2006 and the change in cash flow from 2006 to 2009 divided by 2006 assets as control variables. We do not include variables for the audit-and-supervisory committee system until 2013 because the system was introduced in 2014. The full list of estimated coefficients of control variables is reported in the online appendix. Standard errors are clustered at the industry level and reported in parenthesis. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided t test), respectively.

Panel A: OLS – Base Analysis

	Change in cash holdings									
	2006-08	2006-09	2006-10	2006-11	2006-12	2006-13	2006-14	2006-15	2006-16	2006-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0708	0.069*	0.003	-0.050*	-0.098*	-0.079***	-0.086**	-0.144***	-0.146***	-0.213**	-0.186***
	(0.032)	(0.025)	(0.025)	(0.043)	(0.017)	(0.037)	(0.035)	(0.036)	(0.078)	(0.051)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Observations	1954	1954	1954	1954	1954	1954	1954	1954	1954	1954

Panel B: OLS – Level Controls

	Change in cash holdings									
	2006-08	2006-09	2006-10	2006-11	2006-12	2006-13	2006-14	2006-15	2006-16	2006-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0708	0.045 (0.035)	-0.028 (0.025)	-0.054* (0.027)	-0.084** (0.029)	-0.070*** (0.017)	-0.104** (0.032)	-0.137*** (0.029)	-0.111** (0.037)	-0.200** (0.073)	-0.172*** (0.046)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Observations	1954	1954	1954	1954	1954	1954	1954	1954	1954	1954

Panel C: OLS – Lagged Level Controls

	Change in cash holdings									
	2006-08	2006-09	2006-10	2006-11	2006-12	2006-13	2006-14	2006-15	2006-16	2006-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0708	0.090** (0.027)	-0.005 (0.029)	-0.006 (0.023)	-0.098*** (0.027)	-0.084*** (0.017)	-0.062*** (0.018)	-0.127*** (0.017)	-0.077* (0.040)	-0.212** (0.073)	-0.164*** (0.044)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Observations	1954	1954	1954	1954	1954	1954	1954	1954	1954	1954

Table 3: First-Stage Estimation

This table presents the first-stage estimation results to examine whether the instruments *Mature07* and *Export07* increased bank borrowing during the crisis. The regressand is the change in bank borrowing from 2007 to 2008 divided by 2006 assets. Δ in regressors indicates the difference from the value in 2006. Standard errors are clustered at the industry level and reported in parenthesis. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided t test), respectively.

	Bank0708	
	(1)	(2)
Mature07	0.622*** (0.103)	0.622*** (0.105)
Export07		0.003* (0.001)
Other controls	Yes	Yes
Industry dummies	Yes	Yes
Estimation	OLS	OLS
First stage F-value	31.65	25.47
Observations	1954	1954

Table 4: Second-Stage Estimation

This table presents the second-stage estimation results to examine whether an increase in bank borrowing during the crisis affected post-crisis cash holdings. The regressand is the change in cash holdings from 2006 to n ($n=2008, 2009, \dots, 2017$) divided by 2006 assets. Δ in regressors indicates the difference from the value in 2006. The audit-and-supervisory committee system dummy is available after 2015. Standard errors are clustered at the industry level. The main regressor is the imputed value of the change in borrowing from 2007 to 2008 divided by 2006 assets, obtained from the first stage regression. “First stage F-value” refers to the F-value of the excluded instrument(s). ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided t test), respectively.

Panel A: Instrumental Variable Estimation – One Instrument

	Change in cash holdings									
	2006-08	2006-09	2006-10	2006-11	2006-12	2006-13	2006-14	2006-15	2006-16	2006-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0708	-0.502** (0.242)	-0.516** (0.242)	-0.734*** (0.248)	-0.791*** (0.256)	-0.761*** (0.234)	-0.815** (0.336)	-0.817*** (0.221)	-0.796*** (0.117)	-0.646*** (0.169)	-0.400 (0.309)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
Instrument	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07
First stage F-value	31.65	34.18	45.22	33.90	39.37	41.50	37.84	34.41	39.09	31.61
Observations	1954	1954	1954	1954	1954	1954	1954	1954	1954	1954

Table 4 – Continued

Panel B: Instrumental Variable Estimation – Two Instruments

	Change in cash holdings									
	2006-08	2006-09	2006-10	2006-11	2006-12	2006-13	2006-14	2006-15	2006-16	2006-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0708	-0.435*	-0.426*	-0.657***	-0.757***	-0.595***	-0.715***	-0.739***	-0.680***	-0.645***	-0.349
	(0.227)	(0.229)	(0.242)	(0.202)	(0.162)	(0.240)	(0.193)	(0.121)	(0.201)	(0.370)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
Instruments	Mature07 & Export07	Mature07 & Export07	Mature07 & Export07	Mature07 & Export07	Mature07 & Export07	Mature07 & Export07	Mature07 & Export07	Mature07 & Export07	Mature07 & Export07	Mature07 & Export07
P-value of overidentification test	0.20	0.22	0.45	0.79	0.31	0.51	0.44	0.36	0.99	0.74
First stage F-value	25.47	24.72	36.92	29.32	31.31	23.62	20.89	18.90	21.07	16.57
Observations	1954	1954	1954	1954	1954	1954	1954	1954	1954	1954

Panel C: Instrumental Variable Estimation – One Instrument with Level Controls

	Change in cash holdings									
	2006-08	2006-09	2006-10	2006-11	2006-12	2006-13	2006-14	2006-15	2006-16	2006-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0708	-0.470**	-0.540**	-0.774***	-0.799***	-0.766**	-0.858**	-0.793***	-0.775***	-0.642***	-0.383
	(0.195)	(0.232)	(0.241)	(0.282)	(0.303)	(0.437)	(0.255)	(0.199)	(0.146)	(0.246)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
Instrument	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07
First stage F-value	18.40	27.22	24.83	20.34	20.98	21.97	24.15	22.24	20.97	20.18
Observations	1954	1954	1954	1954	1954	1954	1954	1954	1954	1954

Table 4 – Continued

Panel D: Instrumental Variable Estimation – One Instrument with Lagged Level Controls

	Change in cash holdings									
	2006-08	2006-09	2006-10	2006-11	2006-12	2006-13	2006-14	2006-15	2006-16	2006-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0708	-0.762*** (0.213)	-0.295 (0.216)	-0.820*** (0.269)	-0.920*** (0.297)	-0.896*** (0.333)	-0.769* (0.428)	-0.754*** (0.187)	-0.964*** (0.274)	-0.693*** (0.216)	-0.425 (0.282)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
Instrument	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07
First stage F-value	78.95	18.43	27.22	24.83	20.34	20.98	21.97	24.29	22.31	21.81
Observations	1954	1954	1954	1954	1954	1954	1954	1954	1954	1954

Panel E: Instrumental Variable Estimation – Pre-crisis Year of 2005

	Change in cash holdings									
	2005-08	2005-09	2005-10	2005-11	2005-12	2005-13	2005-14	2005-15	2005-16	2005-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0708	-0.547** (0.276)	-0.461* (0.253)	-0.769*** (0.247)	-0.801*** (0.248)	-0.828*** (0.263)	-0.784** (0.382)	-0.831*** (0.257)	-1.047*** (0.289)	-0.841*** (0.255)	-0.812*** (0.231)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
Instrument	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07
First stage F-value	44.18	40.38	50.85	37.16	37.66	26.36	23.96	26.96	26.94	20.90
Observations	1875	1875	1875	1875	1875	1875	1875	1875	1875	1875

Table 5: Replacing Negative Borrowing Changes with Zero

This table examines how an incremental change in borrowing affected cash holdings. The estimation procedure is the same as that in Table 4 except that negative values of *Bank0708* are replaced by zero. In other words, we treat unchanged borrowing and a reduction in borrowing the same way and focus on incremental changes in borrowing. Standard errors are clustered at the industry level. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided t test), respectively.

	Change in cash holdings									
	2006-08	2006-09	2006-10	2006-11	2006-12	2006-13	2006-14	2006-15	2006-16	2006-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0708	-0.683*	-0.713*	-0.999**	-1.053***	-1.011***	-1.086**	-1.073***	-1.031***	-0.849***	-0.523
	(0.361)	(0.370)	(0.395)	(0.404)	(0.328)	(0.496)	(0.353)	(0.151)	(0.223)	(0.412)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
Instrument	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07
First stage F-value	45.42	41.51	41.50	40.86	60.21	55.77	35.26	41.79	48.88	39.21
Observations	1954	1954	1954	1954	1954	1954	1954	1954	1954	1954

Table 6: Main Banks versus Non-Main Banks: Hold-up Hypothesis

This table examines borrowing from main banks in Panel A and from non-main banks in Panel B. Panel C considers how emergency borrowing affected borrowing costs. Panel D scrutinizes the cost of debt with respect to borrowing from non-main banks. The estimation procedure in Panels A and B is the same as that in Table 4, except that *Bank0708* is defined by the change in main-bank loans in Panel A and non-main-bank loans in Panel B. The dependent variable in Panels C and D is the borrowing cost. The included regressors in Panels C and D are the same as those in Panels A and B, respectively. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided t test), respectively.

Panel A: Borrowing from Main Banks										
Change in cash holdings										
	2006-08	2006-09	2006-10	2006-11	2006-12	2006-13	2006-14	2006-15	2006-16	2006-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0708 (Main bank)	-2.702	-3.070	-4.272	-4.259	-4.247	-4.359	-4.523	-4.406	-3.609*	-2.185**
	(2.012)	(2.511)	(3.297)	(3.547)	(3.943)	(4.534)	(3.698)	(3.066)	(2.104)	(0.983)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
Instrument	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07
First stage F-value	2.75	1.69	2.00	1.73	1.75	1.60	1.62	1.67	1.65	1.61
Observations	1954	1954	1954	1954	1954	1954	1954	1954	1954	1954

Panel B: Borrowing from Non-Main Banks										
Change in cash holdings										
	2006-08	2006-09	2006-10	2006-11	2006-12	2006-13	2006-14	2006-15	2006-16	2006-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0708 (Non-main banks)	-0.610**	-0.614**	-0.872***	-0.946***	-0.907***	-0.982***	-0.980***	-0.944***	-0.771***	-0.481
	(0.302)	(0.299)	(0.294)	(0.282)	(0.175)	(0.301)	(0.246)	(0.161)	(0.276)	(0.442)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
Instrument	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07
First stage F-value	44.52	59.76	38.84	48.38	40.40	58.92	64.23	63.52	76.80	59.09
Observations	1954	1954	1954	1954	1954	1954	1954	1954	1954	1954

Table 6 – Continued

Panel C: Borrowing Costs										
	Change in the cost of debt									
	2006-08	2006-09	2006-10	2006-11	2006-12	2006-13	2006-14	2006-15	2006-16	2006-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0708	-0.024 (0.049)	-0.122*** (0.047)	-0.130** (0.062)	-0.156** (0.069)	-0.222*** (0.076)	-0.239*** (0.084)	-0.230*** (0.079)	-0.227*** (0.073)	-0.222*** (0.037)	-0.210*** (0.045)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
Instrument	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07
First stage F-value	73.33	91.46	59.43	49.87	57.49	57.18	49.01	52.66	45.38	34.10
Observations	1574	1553	1539	1524	1520	1512	1511	1502	1491	1485

Panel D: Borrowing Costs from Non-Main Banks										
	Change in the cost of debt									
	2006-08	2006-09	2006-10	2006-11	2006-12	2006-13	2006-14	2006-15	2006-16	2006-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0708 (Non-main banks)	-0.029 (0.060)	-0.143** (0.061)	-0.151** (0.076)	-0.181** (0.082)	-0.259*** (0.086)	-0.280*** (0.096)	-0.267*** (0.081)	-0.262*** (0.076)	-0.257*** (0.046)	-0.240*** (0.058)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
Instrument	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07
First stage F-value	71.21	76.55	39.53	49.24	43.28	42.42	55.07	57.35	59.78	65.81
Observations	1574	1553	1539	1524	1520	1512	1511	1502	1491	1485

Table 7: Main Bank Merger

This table examines whether firms facing great uncertainty about bank credit availability due to main bank mergers reduced their cash holdings in response to successful borrowing. The estimation procedure is the same as that in Table 4. Panel A's estimation is for firms whose main bank experienced a merger up to 2002. Panel B's estimation is for other firms. Main bank is defined as the bank that provided the largest loans to the firm in 2007. We exclude firms if their top lender was not a bank, such as an insurance company, or they did not borrow. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided t test), respectively.

Panel A: Main Bank Experienced a Merger										
	Change in cash holdings									
	2006-08	2006-09	2006-10	2006-11	2006-12	2006-13	2006-14	2006-15	2006-16	2006-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0708	-0.452** (0.205)	-0.398* (0.211)	-0.707*** (0.245)	-0.731** (0.327)	-0.559** (0.274)	-0.549** (0.235)	-0.517** (0.237)	-0.526** (0.224)	-0.551*** (0.149)	-0.193 (0.530)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
Instrument	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07
First stage F-value	30.70	25.20	41.49	27.25	31.29	30.80	30.88	22.62	26.34	27.68
Observations	1010	1010	1010	1010	1010	1010	1010	1010	1010	1010

Panel B: Main Bank did not Experience a Merger

	Change in cash holdings									
	2006-08	2006-09	2006-10	2006-11	2006-12	2006-13	2006-14	2006-15	2006-16	2006-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0708	-0.161	0.055	-0.480	-0.976	-2.195	-0.277	-0.865	-0.479	-1.152	-9.143
	(0.285)	(0.314)	(0.316)	(0.680)	(1.723)	(1.163)	(2.052)	(0.751)	(3.356)	(30.762)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
Instrument	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07
First stage F-value	4.23	2.45	2.68	1.71	1.09	0.81	0.29	1.51	0.31	0.07
Observations	331	331	331	331	331	331	331	331	331	331

Table 8: Personal Experiences

This table divides the firm-year observations into three groups: those with a crisis-period CEO as an executive in Panels A and D, those with a crisis-period financial officer as an executive in Panels B and E, and those with both in Panels C and F. Panels A – C examine borrowing from all banks, Panels D – F from non-main banks. The estimation procedure is the same as that in Table 4.

Panel A: Crisis-Period CEO									
	2006-09	2006-10	2006-11	2006-12	2006-13	2006-14	2006-15	2006-16	2006-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bank0708	-0.532** (0.268)	-0.611** (0.249)	-0.708** (0.351)	-0.627** (0.249)	-0.659* (0.380)	-0.762*** (0.220)	-1.072*** (0.277)	-0.711*** (0.247)	-0.670** (0.282)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	IV	IV	IV	IV	IV	IV	IV	IV	IV
Instrument	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07
First stage F-value	40.18	35.49	34.56	78.09	62.31	42.52	27.71	26.57	19.31
Observations	1844	1737	1605	1468	1347	1223	1132	1034	937

Panel B: Crisis-Period Financial Officer									
	2006-09	2006-10	2006-11	2006-12	2006-13	2006-14	2006-15	2006-16	2006-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bank0708	-0.494** (0.239)	-0.606*** (0.183)	-0.810*** (0.187)	-0.443*** (0.162)	-0.651** (0.263)	-0.929*** (0.214)	-0.853** (0.432)	-0.251 (0.370)	-0.814** (0.386)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	IV	IV	IV	IV	IV	IV	IV	IV	IV
Instrument	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07
First stage F-value	26.27	21.51	27.40	50.60	66.11	23.09	6.55	11.03	9.63
Observations	781	720	661	597	551	486	420	357	306

Table 9: Main Bank's Capital Constraint

This table extends our main analysis in Tables 3 and 4 to examine the supply side. We include bank capital or the liquidity ratio as an additional instrument: either *Capital*, *CapitalBis*, or *Liquidity*. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided t test), respectively.

Panel A: First-Stage Estimation			
	Bank0708		
	(1)	(2)	(3)
Mature07	0.622*** (0.103)	0.722*** (0.148)	0.745*** (0.118)
Capital		0.258*** (0.081)	0.162** (0.074)
CapitalBis			0.377 (0.277)
Liquid			-0.021 (0.025)
Other controls	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
Estimation	OLS	OLS	OLS
F-value of the instruments	31.65	18.02	21.91
Observations	1954	1276	992

Table 9 – Continued

Panel B: Second-Stage Estimation (*Capital* as an additional instrument)

	Change in cash holdings									
	2006-08	2006-09	2006-10	2006-11	2006-12	2006-13	2006-14	2006-15	2006-16	2006-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0708	-0.388*	-0.329	-0.690***	-0.724**	-0.655***	-0.584***	-0.547***	-0.714***	-0.737***	-0.548
	(0.204)	(0.207)	(0.221)	(0.304)	(0.214)	(0.206)	(0.195)	(0.176)	(0.188)	(0.334)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
Instruments	Mature07 & Capital	Mature07 & Capital	Mature07 & Capital	Mature07 & Capital	Mature07 & Capital	Mature07 & Capital	Mature07 & Capital	Mature07 & Capital	Mature07 & Capital	Mature07 & Capital
First stage F-value	18.02	15.50	20.81	17.63	14.56	16.94	16.03	10.18	10.62	10.37
Observations	1276	1276	1276	1276	1276	1276	1276	1276	1276	1276

Table 9 – Continued

Panel C: Main Bank's Capital Constraint and Borrowing from Main or Non-Main Bank

	Bank0708 (Main bank)		Bank0708 (Non-main banks)	
	(1)	(2)	(3)	(4)
Mature07	0.176*	0.193**	0.552***	0.558***
	(0.090)	(0.059)	(0.087)	(0.083)
Capital	0.100**	0.190***	0.182*	0.065
	(0.030)	(0.049)	(0.084)	(0.129)
CapitalBis		-0.099		0.398*
		(0.102)		(0.206)
Liquid		0.025		-0.050
		(0.017)		(0.028)
Other controls	Yes	Yes	Yes	Yes
Industry dumm	Yes	Yes	Yes	Yes
Estimation	OLS	OLS	OLS	OLS
Observations	1276	992	1276	992

Table 10: Exclusion Restrictions

This table examines whether an instrument evaluated prior to the crisis affected cash holdings afterwards. Panels A-B evaluate the instrument in 2005 and 2004, respectively. Standard errors are clustered at the industry level. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided t test), respectively.

Panel A: Instrument in 2005										
	Change in cash holdings									
	2004-06	2004-07	2004-08	2004-09	2004-10	2004-11	2004-12	2004-13	2004-14	2004-15
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Mature05	-0.017	-0.131	-0.294	-0.175	-0.108	-0.234	0.070	-0.116	0.039	-0.111
	(0.121)	(0.180)	(0.226)	(0.216)	(0.212)	(0.200)	(0.185)	(0.181)	(0.157)	(0.156)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Observations	1814	1814	1814	1814	1814	1814	1814	1814	1814	1814

Panel B: Instrument in 2004										
	Change in cash holdings									
	2003-05	2003-06	2003-07	2003-08	2003-09	2003-10	2003-11	2003-12	2003-13	2003-14
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Mature04	-0.139	-0.152	-0.076	-0.103	-0.084	-0.034	-0.077	-0.186	0.096	0.019
	(0.109)	(0.102)	(0.099)	(0.104)	(0.129)	(0.133)	(0.169)	(0.156)	(0.183)	(0.180)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Observations	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750

Table 11: Placebo Test

This table shows the results of a placebo test. The estimation procedure is the same as that in Table 4. The hypothetical year of a financial crisis in Panels A-B is 2005 and 2004, respectively. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided t test), respectively.

Panel A: Hypothetical Crisis Year of 2005

	Change in cash holdings									
	2004-06	2004-07	2004-08	2004-09	2004-10	2004-11	2004-12	2004-13	2004-14	2004-15
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0506	-0.042	-0.399	-1.038	-0.750	-0.586	-1.425	0.295	-0.487	0.182	-0.515
	(0.301)	(0.615)	(1.190)	(1.231)	(1.502)	(2.447)	(0.758)	(0.957)	(0.743)	(0.907)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
Instrument	Mature05	Mature05	Mature05	Mature05	Mature05	Mature05	Mature05	Mature05	Mature05	Mature05
First stage F-value	15.36	6.92	2.59	1.89	0.96	0.65	2.15	1.71	1.52	1.61
Observations	1814	1814	1814	1814	1814	1814	1814	1814	1814	1814

Panel B: Hypothetical Crisis Year of 2004

	Change in cash holdings									
	2003-05	2003-06	2003-07	2003-08	2003-09	2003-10	2003-11	2003-12	2003-13	2003-14
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0405	-0.345	-0.419	-0.238	-0.383	-0.356	-0.144	-0.337	-0.872	0.472	0.089
	(0.230)	(0.262)	(0.310)	(0.408)	(0.515)	(0.541)	(0.686)	(0.811)	(1.004)	(0.845)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
Instrument	Mature04	Mature04	Mature04	Mature04	Mature04	Mature04	Mature04	Mature04	Mature04	Mature04
First stage F-value	7.36	6.54	7.32	4.26	3.09	3.11	2.3	2.15	2.56	2.75
Observations	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750

Table 12: Borrowing and Equity Investments in Affiliates

This table examines whether an increase in bank borrowing in the crisis affected investment. The estimation procedure is the same as that in Panel A of Table 4. The regressand is the change in capital expenditures, R&D expenses, or equity investments in affiliates from 2006 to n ($n=2008, 2009, \dots, 2017$) divided by 2006 assets. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided t test), respectively.

Panel A: Capital Expenditures

	Capital expenditures									
	2006-08	2006-09	2006-10	2006-11	2006-12	2006-13	2006-14	2006-15	2006-16	2006-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0708	-0.104	0.099	0.256	0.057	0.006	-0.118	-0.173	-0.109	-0.105	0.039
	(0.114)	(0.095)	(0.165)	(0.179)	(0.181)	(0.125)	(0.113)	(0.091)	(0.125)	(0.137)
Cash flow	0.074***	0.032	0.111**	0.074	0.104**	0.070	0.091***	0.085**	0.114*	0.121**
	(0.025)	(0.029)	(0.050)	(0.072)	(0.046)	(0.049)	(0.032)	(0.041)	(0.063)	(0.055)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
Instrument	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07
Observations	1954	1954	1954	1954	1954	1954	1954	1954	1954	1954

Panel B: R&D Expenses

	R&D expenses									
	2006-08	2006-09	2006-10	2006-11	2006-12	2006-13	2006-14	2006-15	2006-16	2006-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0708	-0.032	-0.045*	-0.060	-0.046	-0.043	0.066	0.079	0.135*	0.083	0.069
	(0.021)	(0.027)	(0.038)	(0.041)	(0.041)	(0.046)	(0.059)	(0.080)	(0.075)	(0.065)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
Instrument	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07
Observations	1954	1954	1954	1954	1954	1954	1954	1954	1954	1954

Table 12 – Continued

Panel C: Equity Investments in Affiliates

	Equity investment in affiliates									
	2006-08	2006-09	2006-10	2006-11	2006-12	2006-13	2006-14	2006-15	2006-16	2006-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0708	0.537** (0.258)	0.400* (0.220)	0.475* (0.251)	0.888*** (0.175)	0.715*** (0.241)	0.729*** (0.206)	0.506* (0.287)	0.735*** (0.166)	0.450* (0.253)	0.775* (0.400)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
Instrument	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07
Observations	1954	1954	1954	1954	1954	1954	1954	1954	1954	1954

Panel D: Intensive Margin of R&D Expenses

	R&D expenses									
	2006-08	2006-09	2006-10	2006-11	2006-12	2006-13	2006-14	2006-15	2006-16	2006-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0708	-0.052** (0.026)	-0.063 (0.043)	-0.095* (0.054)	-0.075 (0.055)	-0.063 (0.061)	0.105** (0.052)	0.121** (0.056)	0.187*** (0.058)	0.115* (0.069)	0.088 (0.082)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
Instrument	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07
First stage F-value	223.19	56.53	45.42	74.80	45.11	57.53	102.30	52.19	82.95	92.27
Observations	1327	1327	1327	1327	1327	1327	1327	1327	1327	1327

Panel E: Intensive Margin of R&D Expenses among Small Firms

	R&D expenses									
	2006-08	2006-09	2006-10	2006-11	2006-12	2006-13	2006-14	2006-15	2006-16	2006-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0708	0.033 (0.021)	0.040 (0.034)	0.019 (0.033)	0.034 (0.065)	0.064** (0.030)	0.089*** (0.024)	0.110*** (0.031)	0.078* (0.040)	-0.034 (0.044)	0.021 (0.030)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
Instrument	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07
First stage F-value	13.77	6.92	18.47	16.68	36.93	50.18	27.79	39.76	37.02	35.28
Observations	664	664	664	664	664	664	664	664	664	664

Appendix: Variable Definitions

	Definition
Cash	Cash divided by total assets.
Bank0708	Borrowing from 2007 to 2008 divided by 2006 total assets.
Bank0708 from the main bank	Borrowing from the main bank from 2007 to 2008 divided by 2006 total assets.
Bank0708 from non-main banks	Borrowing from non-main banks from 2007 to 2008 divided by 2006 total assets.
Bank borrowing	Borrowing divided by total assets.
Cash flow	Operating profit plus depreciation divided by total assets.
Tangibility	Tangible assets divided by total assets.
Leverage	Total liabilities divided by total assets.
NWC	Current assets minus current liabilities minus cash divided by total assets.
Size	Natural logarithm of total assets in million JPY.
MTB	Market capitalization plus total liabilities divided by total assets.
Dividends	Dividends divided by total assets.
Volatility	Standard deviation of the cash flow across the previous three years.
Mature07	The amount of bonds maturing within one year divided by total assets in 2007.
Export07	Exports divided by sales in 2007.
Capital	The percentage of book value of net assets to total assets of the main bank in 2007 (%).
CapitalBis	Risk-adjusted capital adequacy ratio (in percentage) based on the BIS requirement of the main bank in 2007 (%).
Liquid	The percentage of book value of liquid assets to total assets of the main bank in 2007 (%).
Cost of debt	The ratio of interest payments to total borrowing.
Bond outstanding dummy (i.e., stock variable)	Dummy takes one if the firm have outstanding bonds.
Bond outstanding dummy in 2007	Dummy takes one if the firm had outstanding bonds in 2007.
Bond issuance in 2008 (i.e., flow variable)	Dummy takes one if the firm issued bonds in 2008.
Equity issuance dummy	Dummy takes one if the firm issue equity.
Equity issuance dummy in 2008	Dummy takes one if the firm issued equity in 2008.
Board independence	The percentage of outside directors to total directors.
Audit-and-supervisory committee dummy	Dummy takes one if the firm adopts the audit-and-supervisory committee system. Available since 2014.
Three-committee system dummy	Dummy takes one if the firm adopts the three-committee system.
Ownership shares by financial institutions	Ownership shares by financial institutions (%).
ownership shares by the main bank	ownership shares by the main bank (%).
Ownership shares by non-main banks	Ownership shares by non-main bank (%).
Ownership shares by corporations	Ownership shares by corporations (%).
Ownership shares by foreign investors	Ownership shares by foreign investors (%).
Business group dummy	Dummy takes one if the firm has a listed parent company.
# of subsidiaries	The number of subsidiaries.
Capital expenditures	Capital expenditures divided by total assets.
R&D expenses	R&D expenses divided by total assets.
Equity investment in affiliates	Equity investment in affiliates divided by total assets.

Online Appendix for:
“Borrowing in Unsettled Times and Cash Holdings Afterwards”

This online appendix reports the full list of estimated coefficients of control variables in Tables 2-4 in the main text. The online appendix tables A2-A4 correspond to Tables 2-4 in the main text.

Table A2: OLS Estimation

This table presents the OLS estimation results to examine whether an increase in bank borrowing during the crisis affected post-crisis cash holdings. The regressand is the change in cash holdings from 2006 to n ($n=2008, 2009, \dots, 2017$) divided by 2006 assets. The main regressor is the change in borrowing from 2007 to 2008 divided by 2006 assets. Δ in regressors indicates the difference from the value in 2006. We include both the level and difference of control variables. For example, when the regressand is the change in cash holdings from 2006 to 2009 divided by 2006 assets, we include the level of the cash flow-to-assets ratio in 2006 and the change in cash flow from 2006 to 2009 divided by 2006 assets as control variables. We do not include variables for the audit-and-supervisory committee system until 2013 because the system was introduced in 2014. Standard errors are clustered at the industry level and reported in parenthesis. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided t test), respectively.

Panel A: OLS – Base Analysis

	Change in cash holdings									
	2006-08	2006-09	2006-10	2006-11	2006-12	2006-13	2006-14	2006-15	2006-16	2006-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0708	0.069*	0.003	-0.050*	-0.098*	-0.079***	-0.086**	-0.144***	-0.146***	-0.213**	-0.186***
	(0.032)	(0.025)	(0.025)	(0.043)	(0.017)	(0.037)	(0.035)	(0.036)	(0.078)	(0.051)
Δ cash flow	0.371***	0.383***	0.463***	0.574***	0.629***	0.451**	0.544**	0.601***	0.570***	0.860***
	(0.054)	(0.109)	(0.067)	(0.107)	(0.159)	(0.172)	(0.163)	(0.066)	(0.055)	(0.060)
Δ tangibility	-0.338***	-0.305***	-0.288***	-0.275***	-0.306***	-0.285***	-0.305***	-0.279***	-0.264***	-0.337***
	(0.049)	(0.044)	(0.037)	(0.022)	(0.042)	(0.057)	(0.042)	(0.045)	(0.051)	(0.068)
Δ leverage	-0.132***	-0.139***	-0.104***	-0.106***	-0.118***	-0.160***	-0.123***	-0.049***	-0.089***	-0.057**
	(0.027)	(0.025)	(0.018)	(0.023)	(0.022)	(0.021)	(0.028)	(0.012)	(0.013)	(0.022)
Δ NWC	-0.358***	-0.321***	-0.322***	-0.277***	-0.309***	-0.274***	-0.317***	-0.266***	-0.258***	-0.259***
	(0.039)	(0.056)	(0.034)	(0.046)	(0.042)	(0.043)	(0.023)	(0.023)	(0.028)	(0.027)
Δ size	0.204***	0.206***	0.185***	0.193***	0.220***	0.254***	0.264***	0.216***	0.244***	0.255***
	(0.030)	(0.032)	(0.026)	(0.021)	(0.024)	(0.042)	(0.028)	(0.029)	(0.034)	(0.051)
Δ MTB	0.005	0.009*	0.022***	0.015*	0.008	0.040***	0.024***	0.015***	0.018**	0.019***
	(0.003)	(0.005)	(0.004)	(0.007)	(0.008)	(0.003)	(0.007)	(0.003)	(0.006)	(0.005)
Δ dividends	-0.306	-0.569	-0.012	-0.210	-0.437	-0.777	-0.703	0.061	-0.518	-1.274***
	(0.347)	(0.498)	(0.327)	(0.309)	(0.522)	(0.663)	(0.620)	(0.331)	(0.289)	(0.240)
Δ volatility	0.261	0.210	0.084	0.368*	0.466**	0.710	0.526**	-0.006	-0.057	0.190
	(0.151)	(0.147)	(0.187)	(0.192)	(0.139)	(0.466)	(0.164)	(0.188)	(0.249)	(0.360)

Table A2, Panel A – Continued

Δbond outstanding dummy	0.013**	0.001	-0.004	-0.000	-0.004	-0.012	-0.008	-0.015	-0.006	0.002
	(0.006)	(0.006)	(0.008)	(0.005)	(0.005)	(0.007)	(0.009)	(0.009)	(0.005)	(0.010)
Δequity issuance dummy	0.005	0.011	0.044**	0.005	0.003	-0.011	0.009	-0.010	0.007	0.005
	(0.010)	(0.008)	(0.014)	(0.021)	(0.018)	(0.016)	(0.018)	(0.014)	(0.023)	(0.018)
Δboard independence	-0.000**	0.000	0.000	0.000	0.000	-0.000	0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Δaudit-and-supervisory committee dummy							-0.018**	-0.006	-0.005	-0.003
							(0.007)	(0.007)	(0.007)	(0.006)
Δthree-committee system dummy	-0.152**	-0.138**	-0.057*	-0.067**	-0.122**	-0.132**	-0.176**	-0.064	-0.052	-0.001
	(0.049)	(0.055)	(0.028)	(0.026)	(0.051)	(0.056)	(0.075)	(0.051)	(0.039)	(0.043)
Δownership shares by financial institutions	-0.001*	-0.001**	-0.001	-0.001	-0.002*	-0.003*	-0.003**	-0.002**	-0.002*	-0.003*
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Δownership shares by the main bank	-0.000	-0.001	0.000	0.000	-0.002	-0.004	-0.004*	-0.004	-0.001	-0.000
	(0.004)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Δownership shares by non-main banks	0.001	0.002	0.002***	-0.002	0.000	0.001	0.001	0.002	0.004	0.002
	(0.001)	(0.002)	(0.001)	(0.003)	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)	(0.002)
Δownership shares by corporations	-0.000	-0.000	-0.000	-0.000	-0.000*	-0.001***	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Δownership shares by foreign investors	-0.000**	-0.001	-0.000	-0.001*	-0.000	-0.000	-0.001	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Δbusiness group dummy	0.021	-0.019	-0.008	-0.014	-0.026*	-0.035	-0.011	-0.014	-0.031	-0.035
	(0.017)	(0.012)	(0.020)	(0.012)	(0.012)	(0.020)	(0.027)	(0.025)	(0.021)	(0.020)
Δnumber of subsidiaries	-0.003**	-0.003**	-0.002**	-0.002**	-0.002***	-0.001**	-0.002***	-0.001**	-0.002***	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Δsquared number of subsidiaries	0.000*	0.000*	0.000**	0.000**	0.000**	0.000*	0.000***	0.000**	0.000**	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Cash flow in 2006	0.331***	0.394***	0.489***	0.579***	0.641***	0.433***	0.523***	0.632***	0.634***	0.824***
	(0.051)	(0.056)	(0.048)	(0.105)	(0.100)	(0.103)	(0.099)	(0.074)	(0.075)	(0.126)
Tangibility in 2006	-0.016	-0.032	-0.042**	-0.050***	-0.071***	-0.028*	-0.051***	-0.031**	-0.067***	-0.092***
	(0.011)	(0.017)	(0.013)	(0.015)	(0.017)	(0.015)	(0.009)	(0.013)	(0.015)	(0.010)

Table A2, Panel A – Continued

Leverage in 2006	0.005 (0.016)	-0.001 (0.013)	0.027*** (0.006)	0.011 (0.010)	0.023 (0.018)	0.029 (0.030)	0.031 (0.033)	0.053* (0.026)	0.028 (0.039)	0.007 (0.027)
NWC in 2006	0.012 (0.023)	0.020 (0.026)	0.014 (0.023)	0.003 (0.024)	-0.004 (0.030)	0.041 (0.036)	-0.017 (0.022)	0.022 (0.027)	0.009 (0.028)	-0.031 (0.022)
Size in 2006	-0.003 (0.002)	-0.003 (0.002)	-0.003 (0.002)	0.000 (0.004)	0.002 (0.004)	0.005 (0.006)	0.002 (0.004)	0.002 (0.003)	-0.000 (0.003)	-0.001 (0.004)
MTB in 2006	-0.005* (0.002)	-0.001 (0.004)	0.005 (0.004)	0.005 (0.007)	0.003 (0.005)	0.019*** (0.005)	0.005 (0.007)	-0.001 (0.004)	0.005 (0.005)	0.014*** (0.004)
Dividends in 2006	-0.268 (0.317)	-0.419 (0.331)	-0.141 (0.180)	-0.713*** (0.197)	-0.954** (0.321)	-0.976** (0.310)	-0.848** (0.283)	-0.648 (0.467)	-1.184** (0.489)	-1.922** (0.797)
Volatility in 2006	0.056 (0.075)	0.058 (0.101)	-0.075 (0.125)	0.195 (0.151)	0.360** (0.126)	0.682 (0.410)	0.320* (0.162)	-0.153 (0.189)	-0.179 (0.207)	0.055 (0.425)
Bond outstanding dummy in 2006	0.005 (0.009)	-0.002 (0.009)	-0.014 (0.015)	-0.009 (0.015)	-0.012 (0.013)	-0.022 (0.017)	-0.019 (0.023)	-0.025 (0.024)	-0.012 (0.017)	-0.000 (0.010)
Equity issuance dummy in 2006	-0.003 (0.011)	0.005 (0.006)	0.038** (0.012)	-0.001 (0.023)	0.000 (0.017)	-0.004 (0.012)	0.006 (0.019)	-0.008 (0.017)	0.012 (0.021)	0.014 (0.026)
Board independence in 2006	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.001)	0.000 (0.001)	-0.000 (0.000)	-0.000 (0.000)
Three-committee system dummy in 2006	0.009 (0.014)	0.001 (0.012)	0.004 (0.013)	-0.003 (0.018)	0.005 (0.018)	-0.033 (0.024)	-0.060 (0.048)	-0.038 (0.052)	-0.020 (0.057)	-0.010 (0.036)
Ownership shares by financial institutions in 2006	0.000* (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.001 (0.001)	-0.001** (0.000)	-0.001* (0.001)	-0.001* (0.001)	-0.001** (0.001)
Ownership shares by the main bank in 2006	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.001 (0.001)	0.001 (0.001)	0.000 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.002)	-0.001 (0.002)
Ownership shares by non-main banks in 2006	-0.002* (0.001)	0.000 (0.001)	0.001 (0.001)	-0.002 (0.001)	0.000 (0.001)	0.001 (0.001)	0.000 (0.001)	0.002 (0.001)	0.000 (0.002)	0.002 (0.003)
Ownership shares by corporations in 2006	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000** (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Ownership shares by foreign investors in 2006	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.001 (0.001)	-0.000 (0.001)	0.000 (0.000)	0.000 (0.001)	0.000 (0.001)

Table A2, Panel A – Continued

Business group dummy in 2006	0.006 (0.008)	0.004 (0.013)	-0.002 (0.010)	-0.000 (0.011)	-0.006 (0.011)	-0.004 (0.005)	-0.012 (0.007)	-0.040*** (0.009)	-0.045*** (0.006)	-0.044*** (0.008)
# of subsidiaries in 2006	0.000* (0.000)	0.000 (0.000)	0.000 (0.000)	0.000** (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000* (0.000)	-0.000 (0.000)	-0.000 (0.000)
Squared # of subsidiaries in 2006	-0.000** (0.000)	-0.000 (0.000)	0.000 (0.000)	-0.000*** (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000* (0.000)	-0.000 (0.000)	0.000 (0.000)
Bond outstanding dummy in 2007	0.004 (0.006)	0.008 (0.006)	0.013 (0.011)	0.009 (0.009)	0.009 (0.009)	0.013 (0.011)	0.015 (0.014)	0.008 (0.016)	-0.001 (0.009)	-0.004 (0.011)
Bond issuance in 2008	-0.016 (0.071)	-0.002 (0.067)	-0.046 (0.047)	-0.068 (0.058)	-0.008 (0.046)	-0.020 (0.072)	-0.114* (0.061)	-0.031 (0.070)	0.016 (0.071)	-0.070 (0.053)
Equity issuance in 2008	0.292 (0.323)	0.336 (0.275)	0.193 (0.352)	0.084 (0.423)	0.175 (0.411)	0.022 (0.424)	0.327 (0.488)	0.474 (0.537)	0.169 (0.349)	-0.001 (0.390)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Observations	1954	1954	1954	1954	1954	1954	1954	1954	1954	1954

Table A3: First-Stage Estimation

This table presents the first-stage estimation results to examine whether the instruments *Mature07* and *Export07* increased bank borrowing during the crisis. The regressand is the change in bank borrowing from 2007 to 2008 divided by 2006 assets. Δ in regressors indicates the difference from the value in 2006. Standard errors are clustered at the industry level and reported in parenthesis. ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided t test), respectively.

	Bank0708	
	(1)	(2)
Mature07	0.622*** (0.103)	0.622*** (0.105)
Export07		0.003* (0.001)
Δ cash flow	-0.146* (0.079)	-0.142* (0.078)
Δ tangibility	0.169*** (0.048)	0.171*** (0.048)
Δ leverage	0.257*** (0.024)	0.258*** (0.024)
Δ NWC	0.037** (0.018)	0.038** (0.018)
Δ size	-0.027** (0.013)	-0.029** (0.013)
Δ MTB	-0.004 (0.007)	-0.004 (0.007)
Δ dividends	0.149 (0.630)	0.155 (0.626)
Δ volatility	0.052 (0.047)	0.049 (0.050)
Δ bond outstanding dummy	-0.013* (0.007)	-0.013* (0.007)
Δ equity issuance dummy	-0.007 (0.007)	-0.007 (0.006)
Δ board independence	0.000* (0.000)	0.000* (0.000)
Δ three-committee system dummy	-0.022* (0.012)	-0.025** (0.013)
Δ ownership shares by financial institutions	0.000 (0.001)	0.000 (0.001)
Δ ownership shares by the main bank	0.005 (0.004)	0.005 (0.004)
Δ ownership shares by non-main banks	0.002 (0.002)	0.002 (0.002)
Δ ownership shares by corporations	-0.000* (0.000)	-0.000* (0.000)

Table A3 – Continued

Δownership shares by foreign investors	-0.000*	-0.000**
	(0.000)	(0.000)
Δbusiness group dummy	0.003	0.003
	(0.012)	(0.011)
Δ# of subsidiaries	0.000	0.000
	(0.001)	(0.001)
Δsquared number of subsidiaries	-0.000	-0.000
	(0.000)	(0.000)
Cash flow in 2006	0.002	0.010
	(0.027)	(0.026)
Tangibility in 2006	-0.015	-0.013
	(0.013)	(0.013)
Leverage in 2006	0.018	0.019
	(0.017)	(0.017)
NWC in 2006	-0.026	-0.023
	(0.018)	(0.017)
Size in 2006	0.002	0.002
	(0.002)	(0.002)
MTB in 2006	-0.001	-0.001
	(0.004)	(0.004)
Dividends in 2006	-0.160	-0.194
	(0.306)	(0.309)
Volatility in 2006	-0.076	-0.086
	(0.060)	(0.064)
Bond outstanding dummy in 2006	0.000	0.000
	(0.006)	(0.006)
Equity issuance dummy in 2006	-0.001	-0.001
	(0.006)	(0.006)
Board independence in 2006	0.000	0.000
	(0.000)	(0.000)
Three-committee system dummy in 2006	-0.051***	-0.053***
	(0.018)	(0.019)
Ownership shares by financial institutions in 2006	0.000**	0.000**
	(0.000)	(0.000)
Ownership shares by the main bank in 2006	-0.000	-0.000
	(0.001)	(0.001)
Ownership shares by non-main banks in 2006	-0.001	-0.001
	(0.001)	(0.001)
Ownership shares by corporations in 2006	0.000	0.000
	(0.000)	(0.000)
Ownership shares by foreign investors in 2006	-0.000	-0.000
	(0.000)	(0.000)

Table A3 – Continued

Business group dummy in 2006	0.008 (0.006)	0.008 (0.006)
# of subsidiaries in 2006	0.000* (0.000)	0.000 (0.000)
Squared # of subsidiaries in 2006	-0.000 (0.000)	-0.000 (0.000)
Bond outstanding dummy in 2007	-0.003 (0.006)	-0.003 (0.006)
Bond issuance in 2008	-0.361*** (0.062)	-0.368*** (0.067)
Equity issuance in 2008	-0.299* (0.160)	-0.291* (0.158)
Industry dummies	Yes	Yes
Estimation	OLS	OLS
First stage F-value	31.65	25.47
Observations	1954	1954

Table A4: Second-Stage Estimation

This table presents the second-stage estimation results to examine whether an increase in bank borrowing during the crisis affected post-crisis cash holdings. The regressand is the change in cash holdings from 2006 to n ($n=2008, 2009, \dots, 2017$) divided by 2006 assets. Δ in regressors indicates the difference from the value in 2006. The audit-and-supervisory committee system dummy is available after 2015. Standard errors are clustered at the industry level. The main regressor is the imputed value of the change in borrowing from 2007 to 2008 divided by 2006 assets, obtained from the first stage regression. “First stage F-value” refers to the F-value of the excluded instrument(s). ***, **, and * denote significance at the 1%, 5%, and 10% levels (two-sided t test), respectively.

Panel A: Instrumental Variable Estimation – One Instrument

	Change in cash holdings									
	2006-08	2006-09	2006-10	2006-11	2006-12	2006-13	2006-14	2006-15	2006-16	2006-17
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank0708	-0.502** (0.242)	-0.516** (0.242)	-0.734*** (0.248)	-0.791*** (0.256)	-0.761*** (0.234)	-0.815** (0.336)	-0.817*** (0.221)	-0.796*** (0.117)	-0.646*** (0.169)	-0.400 (0.309)
Δ cash flow	0.294*** (0.060)	0.338*** (0.112)	0.380*** (0.058)	0.515*** (0.067)	0.595*** (0.123)	0.446*** (0.167)	0.534*** (0.149)	0.625*** (0.062)	0.588*** (0.055)	0.866*** (0.061)
Δ tangibility	-0.244*** (0.072)	-0.252*** (0.061)	-0.251*** (0.042)	-0.245*** (0.020)	-0.281*** (0.031)	-0.278*** (0.047)	-0.292*** (0.036)	-0.278*** (0.037)	-0.258*** (0.046)	-0.334*** (0.064)
Δ leverage	0.016 (0.070)	-0.023 (0.055)	0.001 (0.033)	-0.011 (0.041)	-0.039 (0.032)	-0.095*** (0.033)	-0.078*** (0.026)	-0.018 (0.011)	-0.074*** (0.011)	-0.051** (0.021)
Δ NWC	-0.342*** (0.038)	-0.317*** (0.047)	-0.351*** (0.028)	-0.310*** (0.055)	-0.342*** (0.044)	-0.312*** (0.040)	-0.342*** (0.027)	-0.302*** (0.024)	-0.280*** (0.023)	-0.268*** (0.027)
Δ size	0.184*** (0.031)	0.189*** (0.032)	0.176*** (0.020)	0.183*** (0.018)	0.210*** (0.018)	0.252*** (0.034)	0.263*** (0.023)	0.222*** (0.024)	0.246*** (0.028)	0.256*** (0.045)
Δ MTB	0.003 (0.004)	0.008 (0.007)	0.025*** (0.006)	0.013*** (0.005)	0.007 (0.005)	0.039*** (0.003)	0.025*** (0.006)	0.014*** (0.003)	0.017*** (0.005)	0.019*** (0.004)
Δ dividends	-0.285 (0.276)	-0.750** (0.368)	-0.218 (0.364)	-0.380 (0.489)	-0.642 (0.418)	-1.221* (0.624)	-1.104** (0.545)	-0.269 (0.365)	-0.658** (0.264)	-1.360*** (0.198)
Δ volatility	0.285** (0.145)	0.287* (0.150)	0.217 (0.221)	0.451** (0.192)	0.455*** (0.125)	0.831* (0.504)	0.594*** (0.176)	0.023 (0.152)	-0.052 (0.222)	0.220 (0.333)

Table A4, Panel A – Continued

Δbond outstanding dummy	0.005 (0.008)	-0.003 (0.006)	-0.005 (0.009)	-0.003 (0.008)	-0.007 (0.008)	-0.016* (0.008)	-0.012 (0.010)	-0.018* (0.010)	-0.008 (0.006)	0.001 (0.010)
Δequity issuance dummy	0.000 (0.010)	0.017* (0.009)	0.035** (0.014)	-0.010 (0.021)	0.005 (0.019)	-0.007 (0.018)	0.010 (0.017)	-0.015 (0.017)	0.008 (0.024)	0.008 (0.016)
Δboard independence	-0.000* (0.000)	0.000 (0.000)	0.000 (0.000)	0.001 (0.001)	0.001 (0.001)	0.000 (0.000)	0.001 (0.001)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)
Δaudit-and-supervisory committee dummy							-0.025*** (0.008)	-0.011 (0.007)	-0.007 (0.006)	-0.004 (0.005)
Δthree-committee system dummy	-0.166*** (0.053)	-0.156*** (0.052)	-0.076*** (0.029)	-0.086*** (0.024)	-0.113*** (0.029)	-0.112*** (0.028)	-0.161*** (0.052)	-0.053 (0.036)	-0.047 (0.032)	0.003 (0.041)
Δownership shares by financial institutions	-0.000 (0.000)	-0.001* (0.000)	-0.000 (0.000)	-0.001 (0.001)	-0.002** (0.001)	-0.002*** (0.001)	-0.002** (0.001)	-0.002*** (0.001)	-0.002** (0.001)	-0.003** (0.001)
Δownership shares by the main bank	0.003 (0.003)	0.000 (0.002)	0.002 (0.004)	0.003 (0.003)	0.000 (0.003)	-0.004** (0.002)	-0.005** (0.002)	-0.004 (0.003)	-0.001 (0.003)	-0.000 (0.003)
Δownership shares by non-main banks	0.001 (0.002)	0.004 (0.003)	0.003*** (0.000)	-0.001 (0.003)	0.001 (0.002)	0.002 (0.002)	0.002 (0.002)	0.003 (0.003)	0.005 (0.003)	0.002 (0.002)
Δownership shares by corporations	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.001 (0.000)	-0.001* (0.000)	-0.001*** (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Δownership shares by foreign investors	-0.001*** (0.000)	-0.001** (0.000)	-0.001 (0.000)	-0.001** (0.000)	-0.000 (0.000)	-0.001* (0.000)	-0.001* (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.001)
Δbusiness group dummy	0.023 (0.020)	-0.011 (0.015)	-0.011 (0.022)	-0.020 (0.012)	-0.025** (0.011)	-0.037* (0.020)	-0.009 (0.025)	-0.010 (0.023)	-0.026 (0.018)	-0.032 (0.020)
Δ# of subsidiaries	-0.002** (0.001)	-0.003** (0.001)	-0.002*** (0.001)	-0.002*** (0.001)	-0.002*** (0.000)	-0.001*** (0.000)	-0.002*** (0.000)	-0.001*** (0.000)	-0.002*** (0.000)	-0.002*** (0.001)
Δsquared number of subsidiaries	0.000* (0.000)	0.000 (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Cash flow in 2006	0.334*** (0.055)	0.393*** (0.066)	0.473*** (0.053)	0.582*** (0.090)	0.669*** (0.101)	0.479*** (0.115)	0.567*** (0.087)	0.692*** (0.056)	0.679*** (0.067)	0.842*** (0.136)
Tangibility in 2006	-0.024* (0.014)	-0.041** (0.017)	-0.050*** (0.014)	-0.057*** (0.018)	-0.078*** (0.018)	-0.036** (0.017)	-0.055*** (0.007)	-0.038*** (0.010)	-0.069*** (0.013)	-0.093*** (0.008)

Table A4, Panel A – Continued

Leverage in 2006	0.018 (0.024)	0.016 (0.018)	0.043*** (0.008)	0.027*** (0.008)	0.042** (0.019)	0.045 (0.030)	0.044 (0.029)	0.064*** (0.019)	0.034 (0.032)	0.009 (0.021)
NWC in 2006	-0.002 (0.026)	0.006 (0.020)	-0.012 (0.019)	-0.024 (0.030)	-0.027 (0.032)	0.015 (0.036)	-0.038** (0.015)	-0.003 (0.021)	-0.008 (0.021)	-0.039** (0.015)
Size in 2006	-0.002 (0.002)	-0.001 (0.002)	-0.002 (0.003)	0.002 (0.004)	0.003 (0.004)	0.006 (0.005)	0.003 (0.004)	0.003 (0.003)	0.000 (0.003)	-0.001 (0.004)
MTB in 2006	-0.005 (0.003)	-0.000 (0.004)	0.008 (0.006)	0.006 (0.006)	0.004 (0.005)	0.022*** (0.005)	0.009 (0.007)	0.002 (0.005)	0.006 (0.005)	0.015*** (0.004)
Dividends in 2006	-0.345 (0.280)	-0.575* (0.302)	-0.334 (0.241)	-0.897*** (0.238)	-1.062*** (0.370)	-1.152*** (0.362)	-1.009*** (0.356)	-0.774* (0.438)	-1.263*** (0.453)	-1.941*** (0.744)
Volatility in 2006	0.001 (0.078)	0.039 (0.087)	-0.035 (0.128)	0.165 (0.124)	0.246** (0.120)	0.670* (0.396)	0.264** (0.134)	-0.233 (0.152)	-0.239 (0.164)	0.048 (0.418)
Bond outstanding dummy in 2006	0.013 (0.013)	0.006 (0.009)	-0.001 (0.014)	0.002 (0.014)	-0.003 (0.012)	-0.013 (0.014)	-0.011 (0.021)	-0.016 (0.023)	-0.006 (0.018)	0.003 (0.012)
Equity issuance dummy in 2006	-0.003 (0.011)	0.013 (0.009)	0.034** (0.013)	-0.009 (0.024)	0.007 (0.018)	0.006 (0.014)	0.013 (0.017)	-0.007 (0.021)	0.016 (0.023)	0.019 (0.025)
Board independence in 2006	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.001)	0.000 (0.001)	-0.000 (0.000)	-0.000 (0.000)
Three-committee system dummy in 2006	-0.020 (0.022)	-0.024 (0.024)	-0.023 (0.024)	-0.035 (0.030)	-0.023 (0.027)	-0.063 (0.039)	-0.090 (0.057)	-0.064 (0.054)	-0.038 (0.051)	-0.019 (0.031)
Ownership shares by financial institutions in 2006	0.001*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.001 (0.000)	-0.001** (0.000)	-0.001** (0.000)	-0.001** (0.001)	-0.001** (0.001)
Ownership shares by main bank in 2006	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.001 (0.001)	0.000 (0.001)	0.000 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.002)	-0.001 (0.001)
Ownership shares by non-main banks in 2006	-0.002** (0.001)	0.000 (0.001)	0.000 (0.001)	-0.002* (0.001)	-0.000 (0.001)	0.001 (0.001)	-0.000 (0.001)	0.001 (0.001)	0.000 (0.002)	0.002 (0.003)

Table A4, Panel A – Continued

Ownership shares	0.000	0.000	0.000	-0.000	-0.000	-0.001**	-0.000	-0.000	0.000	0.000
by corporations in 2006	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ownership shares	-0.000	-0.000	0.000	-0.000	-0.000	-0.001	-0.000	0.000	0.001	0.000
by foreign investors in 2006	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Business group dummy in 2006	0.011	0.010	0.005	0.003	-0.005	-0.005	-0.013	-0.038***	-0.043***	-0.043***
	(0.008)	(0.011)	(0.011)	(0.011)	(0.009)	(0.008)	(0.010)	(0.011)	(0.007)	(0.009)
# of subsidiaries in 2006	0.000***	0.000**	0.000	0.000***	0.000	0.000	0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Squared # of subsidiaries in 2006	-0.000***	-0.000**	-0.000	-0.000***	-0.000*	-0.000	-0.000**	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Bond outstanding dummy in 2007	-0.001	0.002	0.005	0.003	0.004	0.008	0.010	0.003	-0.004	-0.006
	(0.008)	(0.006)	(0.011)	(0.010)	(0.010)	(0.010)	(0.014)	(0.016)	(0.010)	(0.012)
Bond issuance in 2008	-0.173	-0.157	-0.245***	-0.279***	-0.224***	-0.245*	-0.313***	-0.213**	-0.101	-0.130**
	(0.110)	(0.104)	(0.088)	(0.097)	(0.078)	(0.145)	(0.109)	(0.092)	(0.095)	(0.058)
Equity issuance in 2008	0.138	0.139	-0.078	-0.225	-0.162	-0.364	-0.042	0.135	-0.081	-0.126
	(0.227)	(0.243)	(0.280)	(0.309)	(0.232)	(0.225)	(0.291)	(0.359)	(0.302)	(0.408)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estimation	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
Instrument	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07	Mature07
First stage F-value	31.65	34.18	45.22	33.90	39.37	41.50	37.84	34.41	39.09	31.61
Observations	1954	1954	1954	1954	1954	1954	1954	1954	1954	1954