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Do Bank Shocks Affect Firm Activities? A Survey*

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Abstract This paper presents an overview of the extant literature on the real impacts of financial constraints, with a particular focus on those originating from adverse shocks on bank lending. While numerous studies have been conducted to establish the causal linkage between negative fund supply shocks and various firm activities, empirical studies that successfully identify loan supply shocks are, in our view, still in the development stage. The first part of this paper reviews the large body of literature on this topic and details how recent studies have attempted to overcome an important identification challenge: disentangling fund supply and demand shocks. After discussing various approaches ranging from natural experiments to the employment of extensive panel datasets, we introduce two studies from our own research, which employ a natural disaster in Japan as a natural experiment to study the real impact of financial constraints on the capital investment and export behaviors of firms.

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1 Introduction

Following the seminal work of Bernanke (1983), numerous studies have investigated how shocks to bank loan supply, such as damage to bank capital or liquidity, affect the real economic activities of firms. Although one may easily observe an empirical association between bank loans and firm activities, especially during financial crises, one cannot directly conclude that bank loan supply affects firm activity solely from this evidence. As an extreme example, in frictionless complete financial markets, the financial system simply reflects the change in firms' fund demand (e.g., Fama 1980; King and Plosser 1984). Put differently, any changes in bank loans merely reflect the change in loan demand and not that in loan supply. This illustration implies that economists could fail to establish a causal linkage running from fund supply shocks to firm activities without properly taking care of this simultaneity problem. The central challenges empirical researchers face are therefore to isolate shocks to loan supply from shocks to loan demand, and to trace the transmission of loan supply shocks to economic activities, such as survival/exit, capital investment, research and development (R&D), exports, and foreign direct investment.

The purpose of this paper is to survey empirical studies on bank lending and firm activities through the lens of identification strategies. While theoretical studies based on asymmetric information between lenders and borrowers and incomplete contracts have been significantly developed over the last three decades (see, among others, Bernanke and Gertler 1989; Kiyotaki and Moore 1997; Holmstrom and Tirole 1997), empirical studies that successfully identify loan supply shocks are, in our view, still in the development stage. We focus on papers that are innovative in terms of identification strategies and describe them in detail. Reflecting this motivation, the papers covered in this paper are not necessarily comprehensive.

A number of theoretical models show that if banks incur damages to capital or liquidity, they reduce loan supply, which, in turn, imposes constraints on firm activities. If bank capital or liquidity is to affect economic activities, two effects have to be at play. One is the bank-lending channel, through which banks with damaged capital or liquidity reduce loans more (or increase loans less) than banks with abundant capital or liquidity. The other is the firm-borrowing channel, through which borrowers find it difficult to switch without costs from banks with damaged capital or liquidity to other undamaged lenders. In this paper, we primarily review those studies that trace the impacts of bank distresses on both bank lending and firm activities. Note that we restrict our attention to research on the effects on firm activities, although a number of papers study the effects of loan supply on households (e.g., Sawada and

Shimizutani 2008; Mian and Sufi 2011).

The rest of the paper is structured as follows. Section 2 reviews early studies on the relationship between aggregate bank loans (or bank health) and economic activities. Although a few studies have succeeded in overcoming the identification problem mentioned above, using aggregate data makes it relatively difficult to distinguish loan supply shocks from loan demand shocks. In addition, aggregate data are silent about whether shocks to banks really affect their client firms. This limitation of aggregate data naturally motivates researchers to use micro data. Section 3 reviews recent studies that are successful in overcoming the identification problem. Most of them use the firm, bank, and bank–firm match–level micro data. Then, in Section 4, we pay special attention to those studies that use the occurrence of a natural disaster in Japan as a natural experiment to identify loan supply shocks and to trace their impacts on domestic firms. Section 5 summarizes our review and concludes.

2 Early Studies on Bank Lending and Firm Activities

There are many publications that empirically examine the effects of bank lending on the real economy using aggregate data. In his seminal paper, Bernanke (1983), using aggregate data, purported to show that bank failures significantly reduced aggregate production in the US economy during the Great Depression. Specifically, using monthly data on industrial production, deposits on failing banks, and the liabilities of failing business during the interwar period, he found that the growth rate of industrial production was negatively correlated with changes in the deposits of failing banks and the liabilities of failing business after controlling for the unexpected part of the rates of growth of money supply (M1) and wholesale price index. In addition, he found that a decrease in bank loans during the banking crisis preceded a decline in output, which, according to him, suggests that changes in bank loans were not only driven by changes in loan demand associated with output. Based on these findings, Bernanke (1983) concluded that bank failures and business defaults increased the cost of credit intermediation and thus affected output.

Besides bank failures, the effects of damage to bank capital on economic activity (“capital crunch”) have been extensively studied. Using US state-level data for the 1990–1991 recession, Bernanke and Lown (1991) found no significant relationship between bank lending and employment growth when the loan growth is instrumented for by the bank capital/asset ratio, suggesting that a credit crunch was not a major cause of the 1990–1991 recession.

While damages to bank capital are found to constrain bank loan supply in many preceding studies,

whether or not firms can switch lenders without costs are mixed, possibly because the availability of alternative funding sources differ greatly across borrowers and are difficult to measure. One simple conjecture is that large and transparent firms are more likely to find alternative lenders than small and opaque firms and households. To illustrate, Hancock and Wilcox (1998), using U.S. state-level data for 1989–1992, found that in response to a decline in bank capital at their own banks, small banks shrank their loan portfolios to a greater extent than large banks. They also found that although other banks partially offset reductions in the supply of credit from banks that lost capital, reductions in bank capital at banks led to reduced bank lending overall. Finally, they found that economic activity (in terms of employment, payrolls, the number of firms, and gross state product) at small firms was affected more per dollar of bank capital loss than economic activity at large firms, although the statistical inference corresponding to this hypothesis did not necessarily produce very strong results.

3 Identification Strategies of Recent Studies

The earlier studies touched on in the previous section, have been challenged on the grounds that they do not identify loan supply shocks as distinct from shocks to loan demand. In other words, the observed relationship between bank failures (or financial distresses) and aggregate production may simply capture the fact that the recession caused bank failures (or distresses). To establish a causal linkage between loan supply shocks and firm activities, we need to identify bank failures or financial distress that have little to do with local economic activities. To validate and quantify the effects of bank loan supply on firm activities, recent studies have developed a number of identification strategies to isolate shocks to the supply of bank loans from shocks to the demand for bank loans, and have proceeded to trace the transmission of these shocks to bank lending and further to firm activities. Before detailing each study, we briefly explain and classify those strategies.

One approach is to conduct an event study that examines the stock market performance of firms that have relationships with failed banks. Using high-frequency (daily) data, one has a good chance to identify shocks to bank loans associated with bank failures and estimate their impacts on client firms' share prices. Slovin et al. (1993), Yamori (1999), Yamori and Murakami (1999), Bae et al. (2002), and Brewer et al. (2003a, 2003b) follow this strategy. However, as we discuss below, this approach has a number of serious limitations.

Another promising strategy is to feature geographical or economic borders. Suppose that banks in economy A incur damage to capital or liquidity because of shocks inside A such as a collapse of bubbles

in domestic asset markets, a natural disaster, or new regulation. Under such circumstances, firms in economy B, where no specific shocks are observed, are unlikely to have caused financial difficulties for banks in A. In other words, changes in loans made by banks in A can be considered purely exogenous shocks to firms in B. Suppose further that while banks in A make loans to firms in B (a financial linkage), firms in A do not transact with firms in B (i.e., there is no real linkage through trade or a supply–customer relationship). Then, one is in a good position to trace the transmission of shocks to bank loan supply in A to firm activities in B. Peek and Rosengren (2000) was the first paper to analyze the international transmission of a country’s financial crisis on economic activities in a foreign country using aggregate data. Van Rijckeghem and Weder (2001) and Chor and Manova (2012) follow a similar strategy using aggregate data.

The identification strategies employed in Peek and Rosengren (2000) and subsequent studies did address the identification problem; however, the use of aggregate data still makes it difficult to determine whether the firms borrowing from the damaged banks were really the ones affected. To be more rigorous at this point, one needs to utilize information on the relationship between firms and banks. Chava and Purnanandam (2011), Paravisini et al. (2011), Schnabl (2012) investigated the international transmission of a financial crisis using matched bank–firm data. In contrast to these studies on the international transmission of loan supply shocks, there are few on domestic transmission with the exceptions of Hosono et al. (2012) and Miyakawa et al. (2013).

An important identification strategy employed in some recent studies relies on information on loans from individual banks to firms that borrow from multiple banks. To illustrate, suppose that a firm increases its total amount of borrowing but decreases borrowing from one particular bank. In this case, one can reasonably regard the decrease in loans from the bank as a decrease in loan supply rather than a decrease in loan demand. This intuition leads to the empirical strategy that attempts to identify (bank-specific) loan supply shocks based on a change in loans from a bank to a firm. Most studies employing this strategy control for firm-level fixed effect in the regression of changes in individual loans to account for changes in firm-specific loan demand (as well as the overall loan supply shocks). Khwaja and Mian (2008) first employed this approach using loan-level data to identify loan supply shocks. Jiménez et al. (2012) and Amiti and Weinstein (2013) have further elaborated this approach.

Another identification strategy is to utilize a survey that contains information on whether or not a firm applies for a loan and whether or not it is accepted by the bank. Suppose that the proportion of rejections among applications increases in the wake of a shock to the banking sector, such as a financial crisis. One can safely regard this increase in rejection as a negative shock to loan supply. Popov and Udell (2010), Puri et al. (2011), Berg and Schrader (2012), and Minetti and Zhu (2011) used survey data to identify loan supply shocks.

Other identification strategies have also been developed. As an example, Driscoll (2004) regarded the inflow of deposits induced by local demand for liquidity as a source of shocks to loan supply. Ashcraft (2005) studied the effects of failures of healthy banks that are subsidiaries of a failed multi-bank holding company, and Amiti and Weinstein (2011) used variations in bank health variables that are uncorrelated with a firm's share price changes as an exogenous shock to a bank loan. We describe each of these identification strategies and results in more detail below.

3.1 Event Study

One strand of studies follows the event-study approach to see how the stock prices of firms change when their lending banks fall into financial trouble. Slovin et al. (1993) were the first to analyze the stock prices of firms that had lending relationships with the Continental Illinois Bank during the period of its de facto failure. They found that the client firms of Continental Illinois incurred average excess returns of -4.2% during the bank's impending insolvency, and that in response to the government rescue announcement, client firms gained 2.0% on average. They concluded that bank financial distress harms client firms as a result of their loss of relationship-based cost advantages intrinsic to bank lending. Slovin et al. (1993) were followed by Yamori (1999), Yamori and Murakami (1999), Bae et al. (2002), and Brewer et al. (2003a, 2003b); all found that bank failures had a significant effect on the market values of firms that borrowed from those banks.¹

The advantage of these event studies is that they are able to clearly identify bank failure shocks using high-frequency (daily) data. Given that loan demand is unlikely to change within a few days subsequent to bank failures, high-frequency data should contain information on the effects of loan supply shocks that originate from bank financial distress on borrowers' performance. Nonetheless, they have limitations as well. First, event studies rely on the assumptions of market efficiency and rational investor behavior, which have been challenged in various studies. Second, event studies cannot be applied to non-listed firms, for which bank lending is more likely to matter compared with listed firms. In the research detailed below, including two new studies of our own, the papers focus on the real activities of firms and hence do not require any assumptions of market efficiency or rationality. In addition, some of these papers analyze unlisted firms, most of which are small and medium-sized and are therefore likely to be severely affected by shocks from lending banks.

To overcome these limitations, several studies use information on the relationship between firms

¹ Note, however, that Brewer et al. (2003a) also found that the magnitude of these negative effects on the values of borrower firms was not significantly different from that on all other firms in their sample.

and banks to investigate the effects of bank failures or weak bank health on client firm performance in terms of profitability, investment, exports, or survival. For instance, Hori (2005) examined the profitability of firms that borrowed from a large failed Japanese bank, and found adverse effects on firms with low credit ratings. Similarly, Minamihashi (2011) analyzed the failures of two long-term credit banks in Japan, and found that the failures significantly decreased the investment of their client firms (see also Fukuda and Koibuchi, 2007). In addition to bank failures, the effects of damages to bank capital on borrowing firms' investment behavior have also been explored in several studies. For example, Gibson (1995, 1997) found that client firms that borrowed from Japanese banks with low credit ratings significantly reduced their investment during 1994–1995.² However, these studies could still encounter the endogeneity problem raised against the early studies summarized in the previous section, because poor firm performance may have caused bank failures or financial distresses.

3.2 Use of Geographical or Economic Borders

3.2.1 Evidence of International Transmission using Aggregate Data

To overcome the identification problem, Peek and Rosengren (2000) used the Japanese banking crisis as a natural experiment and investigated whether loan supply shocks can affect real economic activities. Notably, Japanese banks, which were severely hit by declines in Japanese equity and commercial real estate prices in Japan in the early 1990s, suffered losses at their capital positions, and reduced their lending in the U.S. Because the shock was external to U.S. credit markets yet connected through the substantial penetration of U.S. commercial real estate loan markets by Japanese banks, this event could be utilized by the authors to identify an exogenous loan supply shock and to link that shock to construction activity in major U.S. commercial real estate markets. More precisely, as a first step, they regressed the change in bank-level commercial real estate loans in certain U.S. states to the variables representing the connection of each sample bank to Japanese parent banks and the healthiness of the parent banks, and controlled for other covariates potentially affecting bank lending.³ The regression results clearly show the international transmission of the poor financial condition of Japanese parent banks to local entities. As a second step, they further examined whether the construction activities

² Using a matched bank-firm data for Japan from 1987 to 1994, Kline et al. (2002) found that financial difficulties of banks significantly reduced the number of foreign direct investment projects by Japanese firms into the U.S. Using data of listed Japanese firms for 1993–1999, Peek and Rosengren (2005) found that banks expanded loans to unprofitable firms during this period. See also Caballero et al. (2008) for such “zombie” lending practices by Japanese banks in the 1990s.

³ For this part of their analysis, they used bank-level (i.e., micro) data.

aggregated at a state-level experienced an adverse impact from the international transmission of Japanese banking crisis. Such an impact was confirmed. Their findings imply that the retrenchment of Japanese lending had a substantial adverse impact on U.S. construction activity, indicating that alternative financing was not easily obtained, at least for some borrowers.

A number of empirical studies following Peek and Rosengren (2000) used the same identification strategy as theirs. First, Van Rijckeghem and Weder (2001) examined the potential contagion of the Mexican, Thai, and Russian crises to other countries. They constructed several measures accounting for the similarity between the “ground-zero” countries (i.e., Mexico, Thailand, and Russia) and other countries in terms of the patterns of international trade and finance. Their conjecture is that countries are more likely to face an adverse impact through a financial channel if they borrow from lender countries that happen to be the lenders to the ground-zero countries. By using country-level international trade and finance data, they confirmed the existence of such a common lender effect (i.e., financial channel) while controlling for the real linkage (i.e., trade channel). Second, Chor and Manova (2012) studied the impact of the global financial crisis of 2008–2009 to international trade flows. Their empirical methodology involved the regression of U.S. imports from each country–sector pair in each year on various independent variables including (i) country–year specific interbank rate, (ii) sector specific dependence on external finance, (iii) a dummy variable taking a value of 1 after a financial crisis, and (iv) a triple interaction term among these three variables. Using monthly international trade data, they found that countries with tighter financial conditions (i.e., proxied for by higher interbank rates), exported less to the U.S. during the 2008–2009 global financial crisis. They also confirmed that this pattern became more apparent in those sectors showing higher dependence on external finance, which exemplifies the mechanism generating the real impact of financial constraint.

3.2.2 Evidence of International Transmission using Matched Bank–Firm Data

As stated previously, although the identification strategies employed in Peek and Rosengren (2000) and other studies were successful in overcoming the identification problem, the use of aggregate data makes it difficult to determine whether the firms borrowing from the damaged banks were really the ones affected. Moreover, two further concerns have emerged in this strand of literature. First, aggregate data do not take into account individual-level heterogeneity. To illustrate, firms with weaker balance sheets might encounter more stringent adverse shock originating from loan supply shocks. In this regard, the employment of individual-level (e.g., firm-level and bank–firm match-level) data could be a natural

response, directly taking care of the concern. Second, the loan supply shock itself could be measured at an individual bank level. More precisely, in the same spirit of the state-level regression in Peek and Rosengren (2000), some lender banks might be exposed to a financial crisis to a larger extent through, for example, investment in mortgage-backed securities originating in the U.S. Such a discussion naturally motivates the usage of a more detailed measure of fund supply shocks.

Chava and Purnanandam (2011), Paravisini et al. (2011), and Schnabl (2012) addressed these issues using matched bank–firm data. First, Chava and Purnanandam (2011) measured firm heterogeneity in terms of firms’ bank dependence and examined whether bank-dependent firms were more adversely affected by the shock to the U.S. banking system originating from the Russian crisis in 1998. They established that bank-dependent firms faced larger valuation loss compared to firms with records in the public bond market. To further account for the heterogeneity of loan supply shocks, Chava and Purnanandam (2011) constructed bank–firm match-level data using a Dealscan dataset to identify each firm’s main bank and measure the extent of which these main banks’ were exposed to the Russian crisis. To measure the exposure, they used the information in quarterly call reports filed by commercial banks. By using bank–firm match-level data augmented by each main bank’s heterogeneous exposure to the crisis, the authors confirmed that crisis-affected banks, compared with the unaffected banks, reduced the quantity of lending and increased interest rates to their client firms in the post-crisis period.

Second, as another example of succeeding both in taking into account firm-level heterogeneity and employing individually measured financial shocks, Paravisini et al. (2011) employed Peruvian bank–firm match-level data with custom information about the exported products of each firm, and examined whether the capital flow reversal during the 2008 crisis had greater adverse impacts on both extensive (i.e., the number of firms continuing exports) and intensive margins (i.e., volume of exports) in the case where a firm borrows largely from banks exposed to the financial crisis. To ensure the exogeneity of the fund supply shock, they instrumented for the supply of credit to a firm using a shock to the balance sheet of the banks lending to the firm. Their results suggest that a negative credit supply shock significantly reduces both the extensive and intensive margins of exports.

Third, Schnabl (2012) also employed firm-, bank-, and bank–firm match-level data in Peru to examine the liquidity shock originating from the 1998 Russian sovereign default. One of the key features of his study was an investigation into the impacts of the Russian default on (i) the lending from international banks to Peruvian banks, (ii) the lending from Peruvian banks to Peruvian firms, and (iii) its impact on the real outcome measures of Peruvian firms (e.g., loan default and firm survival). As in Khwaja and Mian (2008), which we discuss in detail later, they controlled for the bank- or firm-level

individual effect on the change in fund demand when they estimated the items (i) and (ii). By including the fixed effects corresponding to these components, they were able to identify the causal impact running from Russian default to items (i) and (ii). However, they did not control for firm fixed effects when they estimated (iii), because the unit of observation in that estimation is a firm rather than a loan relationship. Their results showed a significant effect for each of (i) and (ii). As for (iii), they did not find a monotonic relationship between the banks' liquidity shock and firms' real outcome. However, firms borrowing from intermediate and low exposure banks experienced better real outcomes relative to borrowers from high exposure banks. This result is stronger for intermediate relative to low exposure banks. They conjecture that this finding may be due to lack of firm fixed effects in the regression of (iii).

Although matched bank–firm data is useful in identifying loan supply shocks, it may cause another issue: an endogenous matching of firms and banks. Suppose that banks specialize in a certain class of firms and that such a class of firms happens to be hit by a decline in demand for a certain product or a in a country that the firms export to. Then, banks are hit by the product- or country-level demand shock, which may shrink the supply of loans. At the same time, firms may decrease the demand for loans due to the same shock. To overcome the bias originating from this endogenous matching, controlling for product- and country-level fixed effect is useful. Paravisini et al. (2011) controlled for such a fixed effect defined as firm–product–destination level to exclude this type of matching mechanism when they estimated the effects of credit supply on firm export.⁴

3.2.3 Evidence of Domestic Transmission using Matched Bank–Firm Data

Contrary to numerous studies employing the international transmission of shocks as an important identification tool, only a few studies have succeeded in examining the domestic transmission of shocks. This is simply because it is generically difficult to find appropriate proxies for fund supply shocks independent from fund demand shocks in domestic cases. Given the difficulty of this identification issue, a strand of literature has focused on natural disasters (Hosono et al. 2012; Miyakawa et al. 2013) or man-made events (Khawaja and Mian 2008) as natural experiments. To illustrate, a large earthquake might cause severe damage to nearby enterprises and banks without affecting those located far away from the seismic center. Such an environment allows us to compare earthquake unaffected firms transacting with unaffected banks and unaffected firms transacting with affected banks through a natural experimental environment, which resembles that studied in the international transmission literature. In Section 4, we will detail two studies that follow this identification strategy: Hosono et al. (2012) and Miyakawa et al. (2013).

⁴ Amiti and Weinstein (2011), which we describe in Section 3.4, deal with the endogenous matching problem by adding a dummy variable indicating whether or not the firm is the bank's client in that year.

3.3. Use of Loan-level Information for Firms with Multiple Bank Relationships

Khawaja and Mian (2008) first employed the strategy of identifying (bank-specific) loan supply shocks as a change in loans after controlling for firm-level fixed effects, which reflects firm-specific loan demand shocks (as well as the aggregate loan supply shocks). They used as a natural experiment a large-scale withdrawal of foreign currency (dollar) deposits inside Pakistan immediately after the suspension of liquidity support provided by the IMF. This IMF's action followed the testing of a nuclear device in India and Pakistan. Owing to the partial freeze of dollar deposit accounts declared by the prime minister of Pakistan in response to the intervention of the IMF, Pakistan's banking sector encountered a serious negative shock. Khawaja and Mian (2008) used the matched bank–firm loan data and the characteristics of each bank including the change in deposits to test whether a larger withdrawal of a main bank's deposits led to a greater decline in lending to their client firms. The key result in their study is that banks actually passed the negative shock originating from the reduction in their deposits to their client firms. They controlled for the firm-level fixed effect, which potentially accounts for the change in fund demand, to overcome the identification problem. Through an additional exercise (a regression of the change in firms' exit rates on the change in the average change in lender banks' deposits), they also found that the transmission of the shock had a real impact on firms' defaults. Interestingly, it was also found that such an adverse impact can be effectively compensated by larger firms with stronger political ties as they could more easily switch lenders to other unaffected banks.

Jiménez et al. (2012) employed data covering granted loan applications in Spain to study how a change in aggregate variables, including interest rates and GDP, as well as the interaction between these variables and lender bank characteristics affect the likelihood of loan applications being granted. Extending the empirical strategy used in Khwaja and Mian (2008), they controlled for the time-variant quality of potential borrowers by considering either firm-month or loan-level fixed effects.⁵ They found that higher short-term interest rates and lower GDP growth reduced the probability that a loan application is granted and that this tendency is stronger for banks with low capital (in periods of higher short-term interest rates and lower GDP growth) or low liquidity (in periods of higher short-term interest rates). They also found that firms that get rejected in their initial loan application were unable to reverse the resultant reduction in credit availability by applying to other banks, especially in periods of tighter monetary and economic conditions.

⁵ They utilized information on a firm's successive loan applications to different banks when they controlled for loan-level fixed effects.

3.4. Use of Information on Loan Applications and Acceptance/Rejection

3.4.1. Survey Evidence of International Transmission

To examine the international transmission of financial crises, Popov and Udell (2010) and Puri et al. (2011) used survey data that contained information on whether or not a firm applied for a bank loan and whether or not it was accepted by the bank.

Using data on local small and medium-sized enterprise financing in 14 central and eastern European countries, Popov and Udell (2010) examined the effect of the financial distress of foreign parent banks during the early stage of the 2007–2008 financial crisis on small firms. Combining unique survey data on the results of firms' loan application and information about those firms discouraged to apply with city-level foreign bank penetration measures, they illustrated that foreign-owned banks transmitted the shock originating from the financial crisis to local borrowers.

Puri et al. (2011) used retail banking data in Germany, including information regarding the acceptance and rejection of loan applications, to test whether or not local saving banks exposed to the 2007 U.S. financial crisis transmitted the shock to their customers. In addition to seeing the post-crisis impact spreading from crisis-affected banks, they were also interested in how pre-crisis loan relations between customers and banks mitigated the adverse impact of the crisis. Their findings confirmed that the negative shock to fund supply significantly reduced the probability for customers' loan application to be accepted; however, this effect was mitigated where banks had fewer liquidity constraints and pre-crisis customer–bank relationships existed.

3.4.2. Survey Evidence of Domestic Transmission

Berg and Schrader (2012) and Minetti and Zhu (2011) also used information on loan applications from firm surveys, but they examined the domestic transmission of loan supply shocks. Berg and Schrader (2012) examined what happened to firms' loan demand after a volcanic eruption in Ecuador. Although they did not explicitly control for fund supply shocks, they found that loan applications were more likely to be rejected while loan demand per se increased after the eruption. They also found that the adverse impact associated with the volcanic eruption was reduced for clients with pre-eruption relations with banks.

Minetti and Zhu (2011) used an Italian firm-level survey regarding subjectively measured degrees of credit constraint to identify financially constrained firms and its impact on firm exports. They also took

care of two potential endogeneity issues. First, whether or not a firm is rationed may correlate with unobservable firm attributes, such as the productivity that only lenders can observe. Second, firms with severe agency problems may be more exposed to rationing and at the same time, more likely to export (for the purpose of, say, “empire building”). To control for these endogeneity issues, they instrumented the answered status of firms’ credit constraints using previously implemented banking regulations in Italy. Minetti and Zhu (2011) confirmed the robustness of the results based on the idea that exogenous bank regulations implemented in the past affect bank location choice and competitiveness, and thus the degree of financial frictions faced by firms located in each region. As the implementation of past bank regulations is completely exogenous to firms, there is a good chance to identify the causal impact running from financial frictions to firm activities. Their results showed that both the extensive margin of exports (i.e., the probability of exporting) and their intensive margin (i.e., foreign sales) are significantly lower for rationed firms.

3.5. Other Identification Strategies

Existing literature employs a number of alternative identification strategies. First, Driscoll (2004) exploited the fact that U.S. states can be viewed as a group of small open economies. This suggests that state-specific shocks to money demand are automatically accommodated, leading to changes in lending if banks rely on deposits as a source of lending. For example, an increase in demand for deposits in one state results in a flow of funds from other states and an increase in deposits in that state. Thus, the supply of loans is increased in that state. Based on this idea, Driscoll used state-specific money demand shocks as instruments for loan supply in the regression of output on loans. Using a panel of annual data on U.S. states, he found that although shocks to money demand have a significant effect on loans, upon instrumentation, shocks to the supply of loans do not have a significant effect on state personal income.

Second, using a U.S. county-level panel dataset, Ashcraft (2005) studied two incidents where healthy subsidiaries of a multi-bank holding company failed following the failure of unhealthy lead banks in Texas in 1988 and 1992. Given that a substantial part of a bank’s portfolio is made up of loans to local area firms, it is unlikely that bank failure is exogenous to the *counterfactual* path of income that would be realized if the bank did not actually fail. If this is the case, OLS estimates from regressing local income on bank failure variables (e.g., the ratio of deposits at failed banks to local income) and lagged local income do not accurately measure the effect of bank failure on local income. To solve this problem, Ashcraft (2005) controlled for county characteristics prior to bank failures, and found that healthy bank failures

have significant and persistent effects on real economic activities.

Finally, using matched bank-firm data on Japanese firms and banks providing them with trade finance from 1990 to 2010, Amiti and Weinstein (2011) regressed a firm's export growth rate on a bank's health variable. To see the robustness of their results, they addressed the endogeneity problem that may arise from the OLS by using the residuals from a regression of changes in the bank's health variable (i.e., market-to-book value) on firm share price changes as an instrument. They concluded that deteriorations in bank health result in a significant decrease in client firms' exports relative to output, suggesting that trade finance does have an impact as a determinant of exports.

4 Two Empirical Exercises: Earthquake as a Natural Experiment

In this section, we detail two exercises featuring a domestic transmission mechanism and employing a natural experiment approach taken from our own studies (Hosono et al. 2012; Miyakawa et al. 2013). Both studies use the Great Hanshin-Awaji (Kobe) Earthquake (which hit areas around Kobe City and Awaji Island in western Japan in January 1995) as an exogenous shock to Japanese banks. We examined whether damage to banks had an adverse impact on the capital investment and exports of client firms that did not themselves suffer any damage. To do so, we constructed and used a unique firm-level dataset compiled from various sources. The dataset contains firms' investment and export activities, and information on whether these banks and firms were located inside or outside the earthquake-affected area. By comparing the investment and export behaviors of undamaged firms borrowing from damaged banks with that of undamaged firms borrowing from undamaged banks, we were able to identify the effect of damage to banks on the two important firm activities.

4.1. Capital Investment

In order to see the causal impacts running from the natural disaster to firms' capital investment, we estimated the following Tobin's Q-type investment equation, which is augmented by a dummy variable indicating whether or not the firm is located in the earthquake-affected area, a proxy for bank damage, proxies for the firm's financial constraints, and the bank's lending capacity.

$$\begin{aligned}
\frac{I_{it}}{K_{it-1}} = & \beta_0 + \beta_1 F_SALESGROWTH_{it-1} + \beta_2 F_DAMAGED_i + \beta_3 B_DAMAGED_i \\
& + \beta_4 F_DAMAGED_i * B_DAMAGED_i + \beta_5 F_CONSTRAINTS_{i,t-1} \\
& + \beta_6 B_CAPACITY_{it-1} + \beta_7 Industry_i + \varepsilon_{it}, \quad \text{for } t = 1995, 1996, 1997.
\end{aligned} \tag{1}$$

The dependent variable is the capital investment ratio, which is defined as the ratio of investment during period t to the capital stock at the end of period $t-1$. Taking into account the possibility that the effects of the earthquake on investment change over time, we ran a separate cross-sectional regression for each fiscal year.⁶

Among the regressors, we included the firm's sales growth as a proxy for Tobin's Q . We controlled for a variety of additional variables that may affect investment. Specifically, we included $F_DAMAGED$, which takes a value of 1 if the firm is located in the earthquake-affected area. Our main interest lay in the effects of bank damage on borrowing firms' investment; $B_DAMAGED$ indicates the damage to a firm's main bank. Because we have no precise information concerning whether and to what extent banks suffered from the earthquake, we used two alternative variables for $B_DAMAGED$. The first alternative is $B_HQDAMAGED$, a dummy variable that takes a value of 1 if the headquarters of the bank is located in the earthquake-affected area. This variable captures whether or not the managerial capacity to process loans is impaired; this managerial capacity includes back-office operations, such as the ability to process applications for large loans or to manage the total risk of the bank's loan portfolio.

The second alternative is $B_BRDAMAGED$, which is the share of the main bank's branches located in the earthquake-affected area as a fraction of the total number of branches. Compared with $B_HQDAMAGED$, this variable measures the extent of damage to the main bank's branch network. It represents the impairment of the main bank's ability to process applications for relatively small loans under the authority of branch managers. It also captures the extent of the main banks' exposure to damaged and possibly non-performing borrowers, which is likely to negatively affect their risk-taking capacity. We hypothesized that either of these measures of bank damage imposed borrowing constraints on client firms, and thus would take a negative coefficient in the regression.

Note that we used the status of each main bank at the time the earthquake occurred (i.e., in FY 1994). This was done to properly identify an exogenous shock to the firm, i.e., whether or not the firm's main bank at the time of the earthquake sustained damage. If firms can easily switch their main banks, they might be able to escape collateral damage from the adverse effects suffered by their

⁶ Fiscal year t begins in April of year t and ends in March of year $t + 1$.

earthquake-affected main banks; this would reduce the size of the coefficients on $B_HQDAMAGED$ and $B_BRDAMAGED$.⁷

In addition to $F_DAMAGED$ and $B_DAMAGED$, we also added an interaction term for these two variables. This was done to differentiate the impact of bank damage on damaged firms from that on undamaged firms. As mentioned earlier, what we were most interested in was the effect of bank damage on undamaged borrowers, which is captured by the coefficient on $B_DAMAGED$.

We also included a vector of variables representing the firm's financial constraints, $F_CONSTRAINTS$. Specifically, we used the firm's size, which is represented by the natural logarithm of total assets ($F_LNASSETS$); its leverage, which is computed as the ratio of total liabilities to total assets (F_LEV); its profitability, which is represented by the ratio of current income to total assets (F_ROA); and its liquidity, which is proxied for by the ratio of liquid assets to total assets (F_CASH).

We further included a vector of variables representing the main bank's lending capacity, $B_CAPACITY$. More specifically, we controlled for the size, financial health, and profitability of each firm's main bank. For size, we used the natural logarithm of the bank's total assets ($B_LNASSETS$). As proxies for the financial health and profitability of the main bank, we used the bank's risk-unadjusted capital/asset ratio (B_CAP) and the ratio of operating profit to total assets (B_ROA).

Finally, to control for industry-level shocks that affect firm investment, we classified the firms into five industries (mining and construction; manufacturing; wholesale, retail and restaurant; finance, insurance, real estate, transportation, and communications; and others) and added four industry dummies accordingly.

4.2 Export Behavior

To see the causal impacts running from the natural disaster to firms' export behavior, we followed a methodology that is similar to the one adopted by Minetti and Zhu (2011) and Koenig et al. (2010). Specifically, let $Start_{it}$ denote a dummy that takes 1 if the firm starts exports in year t , and 0 otherwise, and $Export_{t-1}$ denotes the value of exports in year $t-1$. Then, assuming that the error term is normally distributed with zero mean and unit variance, we expressed the probability that firm i starts exporting conditional on the firm's not exporting in year $t-1$ as follows:

⁷ Note that firms in our sample rarely changed their main banks, which justifies our empirical strategy.

$$\begin{aligned}
\Pr(Start_t = 1 | Export_{t-1} = 0) = & \Phi (\beta_0 + \beta_1 F_TFP_{it-1} + \beta_2 F_DAMAGED_t + \beta_3 B_DAMAGED_t \\
& + \beta_4 F_DAMAGED_t * B_DAMAGED_t + \beta_5 F_CONSTRAINTS_{it-1} \\
& + \beta_6 B_CAPACITY_{it-1} + \beta_7 Industry_t) \quad (2)
\end{aligned}$$

for t = 1995, 1996, 1997.

In this model, Φ denotes the standard normal cumulative distribution function (cdf). We estimated (2) applying a linear probability model (i.e., OLS) to a sample of firms that did not export in year $t-1$.⁸ Our main interest lies in the effect of bank damages on the export decision of firms located outside the earthquake-hit area, which is captured by $B_DAMAGED$, because bank damages are purely exogenous to these firms.

The dependent variable represents the probability of starting exports conditional on the firm's not exporting in the previous period, as we discussed above. Among the regressors, we included the firm's total factor productivity (TFP), following the pioneering theoretical work by Melitz (2003) and subsequent empirical works (e.g., Bernard and Jensen 2004). The other explanatory variables are the same as in the investment equation (1) except for $F_SALESGROWTH$, which we omitted from equation (2).

4.3 Results

4.3.1 Capital Investment

The results for the baseline estimation for the investment ratio are shown in Table 1. For each year, we report the results for two specifications: one using (1) $B_HQDAMAGED$ and the other using (2) $B_BRDAMAGED$ as the bank damage variable (referred to as $B_DAMAGED$). Note that we report only the variables of our interests, $F_SALESGROWTH$ and $B_DAMAGED$, and drop all other control variables in Table 1. We found that $F_SALESGROWTH$, the proxy for Q , takes a positive coefficient in all years for both specifications, and is statistically significant in FY 1995 and FY 1997. Focusing on our variables of primary interest, we found that $B_DAMAGED$ has a negative and significant coefficient in either FY 1995 (for specification (1)) or FY 1996 (for specification (2)), implying that the investment ratio of firms that were not hit by the earthquake was adversely affected if their main bank was hit. As damage to banks is an exogenous financial shock for firms located outside the earthquake-hit area, this result strongly suggests that exogenous shocks to bank lending capacity generally affect client firm investment.

⁸ We do not estimate (2) by probit or logit, because ordinary reported marginal effects and standard errors of interacted variables (e.g., the interaction term of $F_DAMAGED$ and $B_DAMAGED$) in these nonlinear models require corrections (e.g., Norton et al. 2004). Angrist and Pischke (2008) demonstrated that the coefficients estimated by OLS are virtually the same as the marginal effects estimated by probit.

The impact of bank damage on undamaged firms is economically significant as well. For specification (1), where bank damage is defined as headquarter damage, the investment ratio of undamaged firms associated with damaged main banks is smaller by 8.1 percentage points than that of undamaged firms associated with undamaged main banks. This impact is economically significant, given that the average investment ratio for undamaged firms in FY 1995 was 13.1%. For specification (2), where bank damage is represented by branch damage, the investment ratio of undamaged firms associated with damaged main banks whose value of *B_BRDAMAGED* equal to its sample mean of the undamaged firms (i.e., 7 percentage points) in FY 1996, had investment ratios that were lower by 1.0 percentage points compared with firms with undamaged main banks. The quantitative impact is again economically significant.

An interesting finding is that the timing of the impact of bank damage on firm investment differs between the two specifications. While the negative and significant impact of *B_HQDAMAGED* on client firms' investment manifested itself immediately after the earthquake, i.e., in FY 1995, the significant impact of *B_BRDAMAGED* did so only 1 year later in FY 1996. This difference might stem from what these variables represent. *B_HQDAMAGED* captures the impairment to a bank's back-office operations at the headquarters, such as making decisions on whether to accept or reject applications for large loans, while *B_BRDAMAGED* reflects the damage to a bank's ability to process applications for small loans, and/or loan portfolio losses caused by the deterioration in local borrowers' financial conditions due to the earthquake. Note that the effects of bank damage, either to headquarters or to branch networks, are short-lived. The coefficient of *B_HQDAMAGED* turns *positive* and significant in FY 1997, possibly reflecting a recovery from the low investment caused by bank damage in FY 1995, while *B_BRDAMAGED* is not significant in FY 1997.

4.3.2 Exports

The results for the probability of starting exports conditional on firms not exporting in the previous period are shown in Table 2. For each year, we report the results for two specifications: one using (1) *B_HQDAMAGED* and the other using (2) *B_BRDAMAGED* as the bank damage variable (referred to as *B_DAMAGED*). We report only *F_TFP* and *B_DAMAGED* and drop all the other control variables.

We found that *B_HQDAMAGED* has negative and significant coefficients for all 3 years following the earthquake. In contrast, *B_BRDAMAGED* does not take significant coefficients except for FY 1996, for which it takes a negative and marginally significant coefficient. These results imply that the

probability of starting exports for firms that were not hit by the earthquake were adversely affected if their main bank was hit. As damage to banks is an exogenous financial shock for firms located outside the earthquake-hit area, this result strongly suggests that exogenous shocks to bank lending capacity generally affect the client firm's starting exports.

The impact of bank damage on undamaged firms is economically significant as well. For specification (1), where bank damage is defined as headquarter damage, the probability of starting exports for undamaged firms associated with damaged main banks is smaller by 4.4 percentage points than that of undamaged firms associated with undamaged main banks. This impact is economically significant, given that the average probability of starting exports for undamaged firms in FY 1995 was 4.4%. The negative impact increases to 5.1% in FY 1996 and decreases to 2.4% in FY 1997. For specification (2), where bank damage is represented by branch damage, the probability of starting exports for undamaged firms associated with damaged main banks whose value of *B_BRDAMAGED* is equal to its sample mean of undamaged firms (i.e., 6.8 %) in FY 1996, had a lower probability of exporting (by 0.33 percentage points) than firms with undamaged main banks. Thus, the quantitative impact of damage to bank branch network is not negligible, although it seems to be much smaller than the impact of damage to bank headquarters. It should also be noted that the impact of branch damage only appeared with a 1-year lag.

5 Conclusion

In this paper, we presented an overview of extant literature examining the causal linkage running from fund supply shocks to various firm activities. To establish such a bank-lending channel, researchers need to isolate fund supply shocks from fund demand shocks. Recent research, including our two studies detailed in this paper, has attempted to overcome this important identification challenge by employing various identification strategies and datasets. Several studies have confirmed that shocks to loan supply have both statistically and economically significant impacts on firm activities such as investment and export.

However, evidence based on successful identification strategies is still scarce and limited to a small number of economies and specific events such as financial crises or natural disasters. Bank lending affects firm activities when of the following two financial frictions exist: 1) a bank's inability to raise equity or obtain liquidity without significant costs when it is hit by damages to its equity or liquidity, and 2) a firm's inability to switch lenders to more sound ones without significant costs from damaged lenders. To the extent that such financial frictions differ across economies and time with different degrees of

financial development and stability, further evidence from various economies and events will help us to understand under what conditions bank lending affects real economic activities. A closely related issue is what types of policies or institutions can mitigate the negative impacts of bank loans on firm activities. Finally, examining broader aspects of firm activities, including firm entry and exit, relocation, networking, and employment, will provide further guides for better understanding of the connection between bank lending and firm activities.

References

- Amiti, M. and D. Weinstein, "Exports and Financial Shocks," *Quarterly Journal of Economics* 126 (November 2011), 1841-1877.
- Amiti, M. and D. Weinstein, "How Much Do Bank Shocks Affect Investment? Evidence from Matched Bank-Firm Loan Data," *NBER Working Paper* 18890 (March 2013).
- Angrist, J. D. and J-S. Pischke, *Mostly Harmless Econometrics: An Empiricist's Companion*, Princeton University Press, 2008.
- Ashcraft, A.B., "Are Banks Really Special? New Evidence from the FDIC-Induced Failure of Healthy Banks," *American Economic Review* 95 (December 2005), 1712-1730.
- Bae, K-H., J-K. Kang and C-W. Lim, "The Value of Durable Bank Relationships: Evidence from Korean Banking Shocks," *Journal of Financial Economics* 64 (May 2002), 181-214.
- Berg, G. and J. Schrader, "Access to Credit, Natural Disasters, and Relationship Lending," *Journal of Financial Intermediation* 21 (October 2012), 549-568.
- Bernanke, B.S., "Nonmonetary Effects of the Financial Crisis in the Propagation of the Great Depression," *American Economic Review* 73 (June 1983), 257-276.
- Bernanke, B. and M. Gertler, "Agency Costs, Net Worth, and Business Fluctuations" *American Economic Review* 79 (1) (March 1989), 14-31.
- Bernanke, B.S. and C.S. Lown, "The Credit Crunch," *Brookings Papers on Economic Activity* 2 (1991), 205-48.
- Bernard, A.B. and J.B. Jensen, "Why Some Firms Export," *Review of Economics and Statistics* 86 (May 2004), 561-569.
- Brewer III, E., H. Genay, W.C. Hunter and G.G. Kaufman, "The Value of Banking Relationships During a Financial Crisis: Evidence from Failures of Japanese Banks," *Journal of the Japanese and International Economies* 17 (September 2003a), 233-262.
- Brewer III, E., H. Genay, W.C. Hunter and G.G. Kaufman, "Does the Japanese Stock Market Price Bank-Risk? Evidence from Financial Firm Failures," *Journal of Money, Credit, and Banking* 35 (August 2003b), 507-543.
- Caballero, R.J., T. Hoshi, and A.K. Kashyap, "Zombie Lending and Depressed Restructuring in Japan," *American Economic Review* 98 (December 2008), 1943-1977.
- Chava, S. and A. Purnanandam, "The Effect of Banking Crisis on Bank-Dependent Borrowers," *Journal of Financial Economics* 99 (January 2011), 116-135.

- Chor, D. and K. Manova, "Off the Cliff and Back: Credit Conditions and International Trade during the Global Financial Crisis," *Journal of International Economics* 87 (May 2012), 117-133.
- Driscoll, J. C., "Does Bank Lending Affect Output? Evidence from the U.S. States," *Journal of Monetary Economics* 51 (April 2004), 451-471.
- Fama, E., "Banking in the Theory of Finance," *Journal of Monetary Economics* 6 (January 1980), 39-57.
- Fukuda, S. and S. Koibuchi, "The Impacts of "Shock Therapy" on Large and Small Clients: Experiences from Two Large Bank Failures in Japan," *Pacific-Basin Finance Journal* 15 (November 2007), 434-451.
- Gibson, M.S., "Can Bank Health Affect Investment? Evidence from Japan," *Journal of Business* 68 (July 1995), 281-308.
- Gibson, M.S., "More Evidence on the Link Between Bank Health and Investment in Japan," *Journal of the Japanese and International Economies* 11 (September 1997), 296-310.
- Hancock, D. and J. A. Wilcox, "The "Credit Crunch" and the Availability of Credit to Small Firms," *Journal of Banking and Finance* 22 (6-8) (August, 1998), 983-1014.
- Holmstrom, B. and J. Tirole, "Financial Intermediation, Loanable Funds, and the Real Sector," *Quarterly Journal of Economics* 112 (3) (August 1997), 663-691.
- Hori, M., "Does Bank Liquidation Affect Client Firm Performance? Evidence from a Bank Failure in Japan," *Economics Letters* 88 (September 2005), 415-420.
- Hosono, K., D. Miyakawa, T. Uchino, M. Hazama, A. Ono, H. Uchida, and I. Uesugi, "Natural Disasters, Damage to Banks, and Firm Investment," *RIETI Discussion Paper Series* 12-E-062, 2012.
- Ito, T. and Y. N. Sasaki, "Impacts of the Basel Capital Standards on Japanese Banks' Behavior," *Journal of the Japanese International Economies* 16 (September 2002), 372-397.
- Jiménez, G., S. Ongena, J. Peydro, and J. Saurina, "Credit Supply and Monetary Policy: Identifying the Bank Balance-Sheet Channel with Loan Applications," *American Economic Review* 102 (August 2012), 2301-2326.
- Khwaja, A.I. and A. Mian, "Tracing the Impact of Bank Liquidity Shocks: Evidence from an Emerging Market," *American Economic Review* 98 (September 2008), 1413-1412.
- King, R. and C., Plosser, "Money, Credit, and Prices in a Real Business Cycle," *American Economic Review* 74 (1984), 363-380.
- Kiyotaki, N. and J. Moore, "Credit Cycles," *Journal of Political Economy* 105 (2) (April 1997), 211-248.
- Kline, M. W., J. Peek, and E. S. Rosengren, "Troubled Banks, Impaired Foreign Direct Investment: The

- Role of Relative Access to Credit," *American Economic Review* 92 (3) (June, 2002), 664-682.
- Koenig, P., F., Mayneris, and S. Poncet, "Local Export Spillovers in France," *European Economic Review* 54 (2010), 622-641.
- Mian, A. and A. Sufi, "House Prices, Home Equity-Based Borrowing, and the U.S. Household Leverage Crisis," *American Economic Review* 101 (August 2011), 2108-2131.
- Minamihashi, N., "Credit Crunch Caused by Bank Failures and Self-Selection Behavior in Lending Markets," *Journal of Money, Credit and Banking* 43 (February 2011), 133-161.
- Minetti, R. and S. C. Zhu, "Credit Constraints and Firm Export: Microeconomic Evidence from Italy," *Journal of International Economics* 83 (March 2011), 109-125.
- Miyakawa, D., K. Hosono, T. Uchino, A. Ono, H. Uchida, and I. Uesugi, "Natural Disasters, Financial Shocks, and Firm Export," *Mimeographed*, 2013.
- Norton, Edward C., Hua Wang, and Chunrong Ai. 2004. ng Ai. unrong Ai. i. , affects and Standard Errors in Logit and Probit Models.od *Stata Journal* 4 (2): 154nal
- Paravisini, D., V. Rappoport, P. Schnabl and D. Wolfenzon, "Dissecting the Effect of Credit Supply on Trade: Evidence from Matched Credit-Export Data," *NBER Working Paper* 16975, 2011.
- Peek, J. and E.S. Rosengren, "Collateral Damage: Effects of the Japanese Bank Crisis on Real Activity in the United States," *American Economic Review* 90 (March 2000), 30-45.
- Peek, J. and E.S. Rosengren, "Unnatural Selection: Perverse Incentives and the Misallocation of Credit in Japan," *American Economic Review* 95 (September 2005), 1144-1166.
- Popov, A. and G.F. Udell, "Cross-Border Banking and the International Transmission of Financial Distress during the Crisis of 2007-2008," *European Central Bank Working Papers* No. 1203, 2010.
- Puri, M., J. Rocholl, and S. Steffen, "Global Retail Lending in the Aftermath of the US Financial Crisis: Distinguishing between Supply and Demand Effects," *Journal of Financial Economics* 100 (Jun 2011), 556-578.
- Sawada, Y. and S. Shimizutani, "How Do People Cope With Natural Disasters? Evidence from the Great Hanshin-Awaji (Kobe) Earthquake," *Journal of Money, Credit, and Banking* 40 (March/April 2008), 463-488.
- Schnabl, P., "The International Transmission of Bank Liquidity Shocks: Evidence from an Emerging Market," *Journal of Finance* 67 (June 2012), 897-932.
- Slovin, M.B., M.E. Sushka, and J.A. Polonchek, "The Value of Bank Durability: Borrowers as Bank Stakeholders," *Journal of Finance* 48 (March 1993), 247-266.
- Yamori, N., "Stock Market Reaction to the Bank Liquidation in Japan: A Case for the Information Effect

Hypothesis,” *Journal of Financial Service Research* 15 (February 1999), 57-68.

Yamori, N. and A. Murakami, “Does Bank Relationship Have an Economic Value? The Effect of Main Bank Failure on Client Firms,” *Economics Letters* 65 (October 1999), 115-120.

Van Rijckeghem, C., Weder, B., “Sources of Contagion: Is It Finance or Trade?” *Journal of International Economics* 54 (August 2001), 293– 308.

Table 14.1 Year-by-year Cross-sectional Regressions for Investment Ratios

Dependent variable: <i>F_INVESTMENTRATIO</i> (t)	(1) <i>B_DAMAGED</i> = <i>B_HQDAMAGED</i> <i>D</i>	(2) <i>B_DAMAGED</i> = <i>B_BRDAMAGED</i>	(1) <i>B_DAMAGED</i> = <i>B_HQDAMAGED</i> <i>D</i>	(2) <i>B_DAMAGED</i> = <i>B_BRDAMAGED</i>	(1) <i>B_DAMAGED</i> = <i>B_HQDAMAGED</i> <i>D</i>	(2) <i>B_DAMAGED</i> = <i>B_BRDAMAGED</i>
	FY1995		FY1996		FY1997	
<i>F_SALESGROWTH</i> (t-1)	0.0960 * (0.0529)	0.1006 * (0.0528)	0.0452 (0.0479)	0.0437 (0.0480)	0.1712 *** (0.0490)	0.1741 *** (0.0490)
<i>B_DAMAGED</i> †	-0.0815 *** (0.0230)	-0.0396 (0.0558)	-0.0290 (0.0297)	-0.1273 ** (0.0593)	0.1713 *** (0.0666)	0.0061 (0.0611)
Obs	1,955	1,955	1,990	1,990	1,997	1,997
F-value	9.46	8.62	7.05	7.21	8.97	8.47
p-value	**	**			**	
R-squared	0.0811	0.0792	0.0462	0.0472	0.0581	0.0567
Root MSE	0.2223	0.2225	0.2239	0.2238	0.1996	0.1998
Industry dummies	yes	yes	yes	yes	yes	yes

Notes: Heteroskedasticity-robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

† The *B_DAMAGED* variable is either *B_HQDAMAGED* or *B_BRDAMAGED* as indicated in the column heading.

Table 14.2 Year-by-year Cross-sectional Regressions for Extensive Margins

Dependent variable: <i>Prob(Start(t)=1 Export(t-1)=0)</i> (t)	(1) <i>B_DAMAGED</i> = <i>B_HQDAMAGED</i>	(2) <i>B_DAMAGED</i> = <i>B_BRDAMAGED</i>	(1) <i>B_DAMAGED</i> = <i>B_HQDAMAGED</i>	(2) <i>B_DAMAGED</i> = <i>B_BRDAMAGED</i>	(1) <i>B_DAMAGED</i> = <i>B_HQDAMAGED</i>	(2) <i>B_DAMAGED</i> = <i>B_BRDAMAGED</i>
	FY1995		FY1996		FY1997	
<i>F_TFP</i> (t-1)	-0.0328 (0.0312)	-0.0324 (0.0313)	0.0030 (0.0247)	0.0044 (0.0246)	0.0191 (0.0202)	0.0190 (0.0200)
<i>B_DAMAGED</i> [†]	-0.0436 *** (0.0139)	-0.0480 (0.0522)	-0.0510 *** (0.0143)	-0.0844 * (0.0484)	-0.0237 *** (0.0075)	0.0297 (0.0401)
Obs	1,993	1,993	1,917	1,917	1,953	1,953
F-value	6.29	4.79	4.60	3.95	3.02	3.01
p-value	***	***	***	***	***	***
R-squared	0.0089	0.0094	0.008	0.0088	0.0036	0.0037
Root MSE	0.2097	0.2096	0.1836	0.1836	0.1470	0.1470
Industry dummies	yes	yes	yes	yes	yes	yes

Notes: Heteroskedasticity-robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

[†] The *B_DAMAGED* variable is either *B_HQDAMAGED* or *B_BRDAMAGED* as indicated in the column heading.