Lending Channels and Financial Shocks: The Case of Small and Medium-Sized Enterprise Trade Credit and the Japanese Banking Crisis

Kenshi Taketa and Gregory F. Udell

We offer a new paradigm for understanding the impact of financial shocks on the flow of credit to small and medium-sized enterprises (SMEs). Drawing from research on the lending view of monetary policy and research on SME financial contracting, we introduce the concept of "lending channels." A lending channel is a two-dimensional conduit through which SMEs obtain financing. In particular, a lending channel consists of a specific lending technology provided by a specific type of institution. We hypothesize that during financial shocks some lending channels may close and other channels may expand to absorb the slack. We empirically test a possible implication of this hypothesis by examining whether one lending channel, trade credit, played a significant role as a substitute for other lending channels in offsetting a contraction in SME lending of other lending channels during the Japanese financial crisis. We find little evidence that trade credit played such a role. To the contrary, we find some evidence that trade credit and financial institution lending are complements, rather than substitutes, during the Japanese financial crisis periods. This does not preclude the possibility that other lending channels may have behaved in a manner consistent with this hypothesis.

Keywords: Trade credit; Credit crunch
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I. Introduction

There is mounting evidence that monetary shocks may have a disproportionate effect on the behavior of small and medium-sized enterprises (SMEs). Beginning with the early literature on the credit channel, researchers have focused on the potential effects that these shocks might have on bank-dependent borrowers who do not have access to the capital markets for their external financing (e.g., Bernanke and Blinder [1988], Kashyap and Stein [1995], Gertler and Gilchrist [1994], and Bernanke, Gertler, and Gilchrist [1996]). Non-monetary policy shocks may also have similar effects on SMEs, as may have been the case with the credit crunch in the United States between 1990–92 and the Japanese financial crises during the 1990s.

The analysis of the effect of financial shocks on SMEs can be viewed in the broader context of credit availability and financial system architecture. Some of the research in this area has focused on the importance of the overall development of a financial system and its ability to relax credit constraints to promote growth in externally dependent sectors (Levine [1997, 2005], Rajan and Zingales [1998], and Kroszner and Strahan [2005]). More recently, research in this area has turned its attention to the association between financial development and credit constraints during banking crises. This work suggests that growth in externally dependent sectors is slower during a banking crisis and that the contraction of credit during a crisis may be greater in "deeper" financial systems (Dell'Ariccia, Detragiache, and Rajan [2005] and Kroszner, Laeven, and Klingebiel [2007]). Our approach in this paper is to attempt to penetrate further into the meaning of financial development. We focus on the banking crises in a single country, Japan, and ask the following question: does the impact of a financial shock on SME credit constraints depend on how SME loans are underwritten? More specifically: does the impact of a financial shock depend on the specific linkages between the institutions that provide credit and the manner in which that credit is provided?

Our understanding of SME loan underwriting has recently been the focus of considerable research effort. This began with the literature on SME financing that emphasized relationship building as the defining characteristic of SME lending (e.g., Rajan [1992], Petersen and Rajan [1994] and Berger and Udell [1995]). Subsequent research, on balance, adopted the view that SME lending falls into two categories: relationship lending and transaction lending (e.g., Cole, Goldberg, and White [2004] and Berger *et al.* [2005]). New research, however, offers a richer view emphasizing that SME lending consists of a variety of different lending technologies. This research emphasizes that in addition to the "relationship lending technology" there are many other transaction lending technologies which are deployed globally in providing debt finance to SMEs (Berger and Udell [2002, 2006]).

While this new research emphasizes the breadth of lending technologies and how their mix might differ across countries with different institutional and legal infrastructures, it is still a static concept in the sense that it does not take into account how the mix might be affected by macroeconomic conditions and, particularly, financial shocks such as changes in monetary policy, credit crunches, and financial crises. In this paper, we build on the notion of lending technologies by introducing the concept of "lending channels." A lending channel is a two-dimensional conduit through which

SMEs obtain financing. In particular, a lending channel consists of a specific lending technology provided by a specific type of institution. For example, relationship lending delivered by small banks would be a lending channel. We adopt the view articulated in these new papers on lending technologies that there exist at least nine lending technologies globally which may be used to underwrite SME lending: relationship lending, financial statement lending, trade credit, small business credit scoring, asset-based lending, equipment lending, real estate-based lending, leasing, and factoring (see Berger and Udell [2006]). The number of financial institutions that deliver one or more of these technologies likely varies significantly across countries. In Japan, for example, we hypothesize that there are six types of institutions which deliver one or more of these technologies. Furthermore, we hypothesize that in Japan the combination of lending technologies and institution types is currently associated with 31 lending channels. More generally, we view our lending channel paradigm as a useful way for policymakers to view the impact of financial shocks on SME credit availability.

The purpose of this paper is threefold. First, we develop more fully the concept of the lending channel and what these lending channels might look like in different countries. Second, we hypothesize how these channels might be affected by financial shocks. We show how some of these channels might be shut off during certain types of financial shocks while other channels produce more credit availability. We speculate based on existing evidence in the literature connecting institutions and lending that the specific nature of the financial shock may determine which channels are most affected. And finally, we test one implication of our theory of lending channels during the Japanese crisis. Specifically, we examine the extent to which one of these lending channels, trade credit, may have played a significant role in offsetting contractions in the flow of credit to SMEs through other lending channels. While we do not view our empirical analysis as a complete test of our theory of lending channels, we do view it as suggestive of the kinds of tests that can be conducted to determine the power of our lending channel paradigm to explain the impact of financial crises on this important sector of business activity.

In the next section of the paper, we motivate and flesh out the details of our lending channel paradigm. We compare how lending channels might appear in two large developed economies, the United States and Japan. In this section, we also consider the potential impact of different types of financial shocks on lending channels. In Section III, we develop the framework for our empirical tests of how one specific lending channel, trade credit, may have behaved during the Japanese financial crises. Here we briefly review the literature on trade credit in general, and Japan in particular. We also motivate the hypothesis we test empirically that the trade credit lending channel may have increased credit availability to SMEs to offset a contraction in the flow of credit through other Japanese lending channels. We note in advance that available data do not permit an examination of each lending channel in Japan during the banking crisis. However, our data do permit an examination of the behavior of one specific lending channel (trade credit) and combinations of other lending channels. In Section IV, we present our data and model specification. Our empirical results are presented in Section V. In Section VI, we discuss some policy implications of our paradigm and offer some concluding thoughts.

II. SME Lending, Financial Shocks, and Lending Channels

In this section, we introduce a new paradigm to explain the potential impact of financial shocks on SME financing. This paradigm builds on the recent work that emphasizes that lenders provide external SME financing through a variety of different lending technologies (Berger and Udell [2006], hereafter BU [2006]). We extend BU (2006), which is essentially static with respect to macro and business cycle effects, and make it dynamic by introducing the concept of "lending channels." Our SME lending channels are two-dimensional lending conduits that may expand or contract in response to financial shocks. The manner in which these lending channels expand or contract will determine the overall impact of a financial shock on SME credit availability. We note that these lending channels may vary significantly across countries. We proceed in this section by first reviewing the BU (2006) concept of lending technologies and their relationship to a country's financial institution structure and lending infrastructure. Then we introduce our concept of lending channels. We conclude by offering hypotheses about the nature of lending channels in two developed countries, Japan and the United States, and how they might behave during financial shocks.

BU (2006) offers a paradigm of SME financing which emphasizes that an SME loan is not a homogeneous product where "one size fits all." Instead, it emphasizes that SME lending comes in a variety of different forms, which it calls "lending technologies." While this observation at first blush may seem intuitive, it is strikingly at variance with most of the relatively new literature on bank lending. The innovation in BU (2006) can be best viewed in the context of the evolution of the strand of the literature on bank lending that began with the papers on bank uniqueness. These papers on bank uniqueness showed that markets responded positively to the announcement of bank lending facilities (James [1987], Lummer and McConnell [1989], and Billett, Flannery, and Garfinkel [1995]). The explicit point in these papers is that bank loans differ from capital market products (e.g., corporate bonds) because banks have a unique ability to produce information about their borrowers. This theme was echoed in subsequent theoretical and empirical literature that focused on ferreting out the unique nature of the bank loan underwriting process (e.g., Rajan [1992], Petersen and Rajan [1994, 1995], and Berger and Udell [1995]). These papers emphasize that bank lending is different because it involves (1) the generation of private information by lenders that is proprietary in nature; (2) information that tends to be soft in the sense that it is not easily communicated internally or externally;[1] and (3) information production that is associated with relationship building. Also implicit in this literature is the notion that the commercial bank loan is a relatively homogeneous product distinct from the debt products generated in the capital markets.

However, a number of subsequent papers began to emphasize that SME lending appears to come in two forms rather than just one. These two forms consist of relationship lending and transaction-based lending (e.g., Berger and Udell [1995],

1. See Stein (2002) for a subsequent model that focuses on difficulties in disseminating soft-loan information internally.

Cole, Goldberg, and White [2004], Scott [2004], and Berger *et al.* [2005]). Relationship lending that is based on soft information is targeted to relatively more opaque SMEs, while transaction-based lending is targeted to relatively more transparent SMEs. BU (2006), however, takes exception to this dichotomous view of SME lending. It emphasizes that instead of just two types of SME lending there are many types—a relationship technology that utilizes soft information and many different kinds of transaction-based technologies, all of which utilize hard information. In addition, it notes that most of these transaction-based technologies are targeted to relatively informationally opaque borrowers. This contrasts with the extant literature, which had viewed transaction lending as virtually entirely focused on relatively transparent borrowers.

The technologies identified by BU (2006) had been analyzed individually in both the practitioner and academic literature (e.g., Carey, Post, and Sharpe [1998], Hendel and Lizzeri [2002], Bakker, Klapper, and Udell [2004], Burkart and Ellingsen [2004], Udell [2004], and Berger, Frame, and Miller [2005]). However, these papers had not been connected, in effect, to the literature on "relationship lending" in the sense that the literature had continued to evolve under the assumption that SME lending was essentially dichotomous.

The technologies identified by BU (2006) are shown in Table 1. They consist of relationship lending, financial statement lending, asset-based lending, factoring, leasing, small business credit scoring, equipment lending, real estate-based lending, and trade credit. Relationship lending is a lending technology targeted to opaque SMEs that relies primarily on soft information gathered through contact over time with the SME, its owner, and the local community to address the opacity problem. This information is acquired in large part by the loan officer through direct contact with the borrower and by observing the SME's performance across all dimensions of its banking relationship. Financial statement lending is a lending technology targeted to transparent SMEs under which the lender depends on hard information in the form of informative financial statements (i.e., audited financial statements). Asset-based lending is a transaction-based lending technology that provides working capital financing to high-risk, opaque SMEs. This technology, which involves intensive daily monitoring and collateral advances against accounts receivable and inventory, exists

Table 1 Lending Technologies

Technology	Type	Borrower	Information
Relationship lending	Relationship	Opaque	Soft
Financial statement lending	Transaction	Transparent	Hard
Asset-based lending	Transaction	Opaque	Hard
Factoring	Transaction	Opaque	Hard
Leasing	Transaction	Opaque and transparent	Hard
Small business credit scoring	Transaction	Opaque	Hard
Equipment lending	Transaction	Opaque and transparent	Hard
Real estate-based lending	Transaction	Opaque and transparent	Hard
Trade credit	Transaction	Opaque and transparent	Soft and hard

in its pure form in only four countries: Australia, Canada, the United Kingdom, and the United States. Factoring and leasing are both transaction technologies that can be used to finance opaque SMEs and are based on hard information about the underlying assets purchased by the "lender" (accounts receivable and equipment, respectively). Small business credit scoring is a relatively new lending technology based on statistical default models. It is being adopted in many developed economies and is targeted to some of the most opaque SMEs, micro businesses. Equipment lending and real estate-based lending are technologies that can be used to finance opaque SMEs because underwriting is principally based on the appraised value of the underlying assets that are pledged as collateral.[2] The final lending technology is trade credit.[3]

BU (2006) emphasizes that the feasibility and power of each of these technologies likely varies significantly across countries depending on each nation's financial institution structure and lending infrastructure. Financial institution structure refers to the mix of financial institutions and competition among them. Lending infrastructure refers to the laws, regulations, and conditions that affect the ability of these institutions to deploy different lending technologies.[4] Some examples illustrate the importance of these two dimensions. Both theoretical and empirical research indicates that relationship lending is best delivered by smaller banks (e.g., Stein [2002], Cole, Goldberg, and White [2004], and Kano *et al.* [2006]). Thus, BU (2006) argues that a country's ability to mitigate SME financing constraints by deploying relationship lending may depend crucially on the mix of large and small banks. The feasibility of other lending technologies is influenced similarly by the national business environment. The feasibility of asset-based lending, for instance, appears to depend crucially on one particular element of the lending infrastructure: commercial law on security interests. The strength of these laws in the four common-law countries may explain why asset-based lending against accounts receivable and inventory—at least in its pure form—is limited to these countries. Likewise, the existence of small business credit scoring depends crucially on the existence of comprehensive formal third-party information sharing organizations, either in the form of public credit registries or private business credit bureaus (e.g., Dun and Bradstreet).

Our theory of lending channels borrows from the causal link in BU (2006) that runs from financial institution structure and lending infrastructure to lending technologies to SME credit availability. We define a lending channel as a two-dimensional conduit that consists of a lending institution on one dimension and a lending technology on the other. Thus, each lending channel reflects a unique combination of a lending institution and lending technology. The specific number of lending channels in a financial system will depend on, among other things, a country's

2. Here we slightly deviate from BU (2006) in our classification of lending technologies. BU (2006) combines equipment lending and real estate-based lending into a single category, fixed-asset lending. In considering the Japanese banking crisis, we feel it is useful to make a distinction between these two given links between the banking crisis and the Japanese real estate bubble.
3. For a summary of the literature on the idiosyncratic nature of trade credit, see BU (2006).
4. The financial institution structure has four dimensions: large versus small banks; foreign-owned versus domestically owned banks; privately owned versus state-owned banks; and the competitive structure of the banking industry. The lending infrastructure consists of the information environment, the legal, judicial, and bankruptcy environments, the social environment, and the tax and regulatory environments.

financial institution structure and its lending infrastructure. The United States today may provide the best benchmark example, in part, because all feasible SME lending technologies exist in economically significant amounts.

Table 2 illustrates our hypothesized existence of lending channels in the U.S. context. The rows consist of the same nine lending technologies that are listed in Table 1. The columns consist of the different types of institutions that deliver one or more SME lending technologies: large banks, small banks, commercial finance companies, and corporations. The boxes designated "○" indicate an open lending channel. We hypothesize the existence today of 19 distinct lending channels in the United States. For example, as we noted above, theory and empirical evidence suggest that relationship lending may be exclusively delivered by only one type of institution, small banks. As a result, the only "open" box in the row for relationship lending is in the column for small banks.

We use our model of lending channels to assess the effects of financial shocks on credit availability to SMEs. We hypothesize that different types of financial shocks may contract one or more of a country's lending channels. We can use the U.S. credit crunch during 1990–92 to illustrate how credit availability might have been affected. A number of different hypotheses about the U.S. credit crunch have been tested with some evidence supporting each (see, e.g., Berger and Udell [1994]). These include the introduction of the Basel risk-based capital requirements, the regulatory scrutiny hypothesis, and the bank capital shock hypothesis. The effects on SME lending channels associated with these different hypotheses are illustrated respectively in Tables 3 to 5. Under the risk-based capital hypothesis, large banks in the U.S. contracted lending (which disproportionately affected bank-dependent SMEs) to meet new Basel I capital adequacy requirements. This is reflected in Table 3 in a contraction in the six large bank lending channels ("○" becomes "×"). Under the regulatory scrutiny hypothesis, bank examiners over-reacted to problems in the banking industry to avoid a meltdown similar to the savings and loan crises in the 1980s. This resulted in a contraction of all bank channels as shown in Table 4. Under the bank capital shock hypothesis, banks that suffered significant loan losses which depleted their capital contracted their lending to meet targeted (or regulatory) capital requirements.

Table 2 U.S. Lending Channels: Normal Times

	Large banks	Small banks	Commercial finance companies	Corporations
Relationship lending		○		
Financial statement lending	○	○		
Asset-based lending	○	○	○	
Factoring	○	○	○	
Leasing	○	○	○	
Small business credit scoring	○	○		
Equipment lending	○	○		
Real estate-based lending	○	○		
Trade credit				○

This likely affected large banks more than small banks, as indicated in Table 5 with "×" in the large bank lending channels and "○/×" (i.e., mixed) in the small bank lending channels. It is interesting to note that under any, or all, of these three hypotheses the commercial finance and trade credit lending channels do not contract. While this has not been empirically tested, anecdotal evidence is consistent with this. In particular, industry participants indicate that commercial finance companies

Table 3 U.S. Lending Channels: Credit Crunch (1990–92)—Risk-Based Capital Hypothesis

	Large banks	Small banks	Commercial finance companies	Corporations
Relationship lending		○		
Financial statement lending	×	○		
Asset-based lending	×	○	○	
Factoring	×	○	○	
Leasing	×	○	○	
Equipment lending	×	○		
Real estate-based lending	×	○		
Trade credit				○

Table 4 U.S. Lending Channels: Credit Crunch (1990–92)—Regulatory Scrutiny Hypothesis

	Large banks	Small banks	Commercial finance companies	Corporations
Relationship lending		×		
Financial statement lending	×	×		
Asset-based lending	×	×	○	
Factoring	×	×	○	
Leasing	×	×	○	
Equipment lending	×	×		
Real estate-based lending	×	×		
Trade credit				○

Table 5 U.S. Lending Channels: Credit Crunch (1990–92)—Capital Shock Hypothesis

	Large banks	Small banks	Commercial finance companies	Corporations
Relationship lending		○/×		
Financial statement lending	×	○/×		
Asset-based lending	×	○/×	○	
Factoring	×	○/×	○	
Leasing	×	○/×	○	
Equipment lending	×	○/×		
Real estate-based lending	×	○/×		
Trade credit				○

enjoyed windfall profits during this period.[5] Attempts to verify this, however, are severely hampered by data limitations.

Turning to the empirical focus of this paper, we are interested in lending channels in Japan and how they may have behaved during the Japanese banking crisis. We begin with a profile of what lending channels likely look like today in Japan, which can be viewed in some sense as our "normal period" (Table 6). There are substantial similarities and some interesting differences between lending channels in Japan and the United States. Most of the lending technologies available in the United States are also available in Japan with one exception, asset-based lending.[6] There are also two lending technologies uniquely characteristic of Japan: *sogo shosha* lending, which is associated with specialized wholesale companies, and *keiretsu*/subcontracting lending, which is associated with the *keiretsu*. *Sogo shosha*, which are Japan's large wholesale firms, not only extend and receive trade credit but also provide a variety of financial commitments to their customers in the form of loans, loan guarantees, and other investments.[7] The former is included in trade credit issued by corporations, while the latter is categorized as *sogo shosha* lending in Table 6. A *keiretsu* is a vertical group of firms (a supply chain with one dominant firm, called a parent firm).[8] For instance, Toyota Motor Corp., as a parent firm, extends and receives trade credit and provides loans to SMEs that are subcontractors in the *keiretsu* relationship with it. The former is included in trade credit issued by corporations, while the latter is categorized as *keiretsu*/subcontracting lending in Table 6. The biggest differences are in the institutions that deliver lending. Particularly different here is the importance

Table 6 Japanese Lending Channels: Normal Times

	City banks	Regional banks	*Shinkin* banks	Government-affiliated banks[1]	Nonbank *shoko*	Corporations
Relationship lending		○	○	○	○	
Financial statement lending	○	○	○	○		
Factoring	○	○	○	○		
Leasing	○	○	○	○	○	
Small business credit scoring	○					
Equipment lending	○	○	○	○	○	
Real estate-based lending	○	○	○	○	○	
Trade credit						○
Sogo shosha lending						○
Keiretsu/subcontracting lending						○

Note: 1. In Tables 6 to 11, government-affiliated banks comprise Development Bank of Japan, Shoko Chukin Bank, Japan Finance Corporation for Small Business, National Life Finance Corporation, Okinawa Development Finance Corporation, Housing Loan Corporation and Agriculture, and Forestry and Fisheries Finance Corporation.

5. See Udell (2004) for a discussion of the potential role of asset-based lending during the 1990–92 U.S. credit crunch.
6. New Japanese legislation was passed in 2005 on commercial law related to security interests (i.e., collateralization) on movable assets (i.e., accounts receivable and inventory). This could potentially lead to the introduction of asset-based lending into the Japanese SME market.
7. See Uesugi and Yamashiro (2004) for a discussion of *sogo shosha* lending in Japan.
8. There is another definition of *keiretsu*: a horizontal group of large firms with major financial institutions at the core. See Hoshi and Kashap (2001) and Yafeh (2003). Because our focus is SME financing, we adopt the definition of *keiretsu* that covers a vertical group of large firms and SMEs connected through a supply chain.

of government-affiliated banks and nonbanks including *shoko* lenders. (Nonbanks provide loans but do not take deposits.) *Shoko* lenders are somewhat analogous to U.S. independent commercial finance companies, except that they specialize in lending to small companies.[9]

A number of hypotheses have been formulated to explain the impact of the Japanese banking crisis on SME lending. Like the United States, Japan implemented Basel I risk-based capital requirements during the period 1990–92. This hypothesis is reflected in Table 7 with the impact likely confined to the city banks and some regional banks.[10] (Note that small business credit scoring did not exist in Japan during the banking crisis, so it does not appear as a lending technology.) There is also evidence that, just as in the United States, shocks to the banking system in Japan (the capital crunch version of the credit crunch) may have led to a contraction in bank loan supply during at least some of the bank crisis period (e.g., Woo [1999], Kang and Stulz [2000], and Hayashi and Prescott [2002]). This possibility is reflected in Table 8. Central to our empirical tests is the behavior of the trade credit lending channel. This channel may have expanded to offset a contraction in the private bank-delivered lending channels. However, the capacity for this channel to fill this gap will depend in part on whether the corporations that extend trade credit can find additional financing to support their increased receivables. This may have been problematic for firms that were bank dependent during this period. Evidence from the United States suggests that large firms are able to increase their extension of trade credit (i.e., their accounts receivable) in response to monetary shocks by financing this expansion in the commercial paper market (Calomiris, Himmelberg, and Wachtel [1995]). The ability of large Japanese corporations to access the commercial paper market or other alternative sources of finance such as loans from foreign banks may have been limited, particularly early in the banking crisis.

Table 7 Japanese Lending Channels: Credit Crunch (1990–92)—Risk-Based Capital Hypothesis

	City banks	Regional banks	*Shinkin* banks	Government-affiliated banks	Nonbank *shoko*	Corporations
Relationship lending		○/×	○	○	○	
Financial statement lending	×	○/×	○	○		
Factoring	×	○/×	○	○		
Leasing	×	○/×	○	○	○	
Equipment lending	×	○/×	○	○	○	
Real estate-based lending	×	○/×	○	○	○	
Trade credit						○
Sogo shosha lending						○
Keiretsu/subcontracting lending						○

9. In 2003, the BOJ announced its intention to purchase asset-based securities (ABSs) whose underlying assets are closely related to SME activity. See Hirata and Shimizu (2004). This could effectively create a new lending channel that could be added to Table 6.
10. Several regional banks operated internationally during the period 1990–92. They had to meet the Basel I risk-based capital requirements if they planned to continue their international operations. That is why we put "○/×" (i.e., mixed) in the column of regional banks.

Table 8 Japanese Lending Channels: Credit Crunch (1990–2000)—Capital Shock Hypothesis

	City banks	Regional banks	*Shinkin* banks	Government-affiliated banks	Nonbank *shoko*	Corporations
Relationship lending		×	×	○	○	
Financial statement lending	×	×	×	○		
Factoring	×	×	×	○		
Leasing	×	×	×	○	○	
Equipment lending	×	×	×	○	○	
Real estate-based lending	×	×	×	○	○	
Trade credit						○/×
Sogo shosha lending						○/×
Keiretsu/subcontracting lending						○/×

While these hypotheses are reflected in Tables 7 and 8, it is important to note that the regulatory response in Japan appears to have been much different from the regulatory response during the credit crunch in the United States. While excessive regulatory scrutiny of banks may have been a contributing (or at least exacerbating) factor in the United States, Japanese bank regulation has been moving in the opposite direction for at least part of the banking crisis—possibly to avoid exacerbating a bank credit crunch. Specifically, it has been argued that Japanese bank regulators under the "convoy system" chose instead to supervise banks in a manner that treated them more as "providers of public financial services [rather] than competitive private sector intermediaries where 'survival of the fittest' was the underlying principle" (Nakaso [2001]). This appears to have been associated with a process of encouraging banks to roll over nonperforming loans (an "evergreen" policy) and even *increase* their lending to SMEs, especially after 1998 (Peek and Rosengren [2005] and Caballero, Hoshi, and Kashyap [2006]).[11] This suggests that the net effect on SMEs may then vary over the period of the banking crisis and may also vary by bank size and bank condition. Some researchers have found that instead of provoking a capital crunch, large banks increased their supply of credit, at least during some periods of the crisis, consistent with a moral hazard incentive (Horiuchi and Shimizu [1998] and Watanabe [2006]).

Another potential hypothesis that may apply to SME lending during this period is more directly related to one of the key underlying causes of the banking crisis in Japan, the bursting of the real estate bubble in 1990. This hypothesis, which could be called the real estate lending hypothesis, argues that there may have been a dampening effect on the lending channels associated with the real estate-based lending technology as shown in Table 9. Under this lending technology, commercial loans are primarily based on recourse against real estate collateral. In SME lending, this can often include personal real estate hypothecated by the entrepreneur as collateral for commercial loans

11. Evidence of evergreening has also been found in South Korea during the Asian financial crisis (Park, Shin, and Udell [2006]).

Table 9 Japanese Lending Channels: Credit Crunch (1990–2000)—Real Estate Lending Channel

	City banks	Regional banks	*Shinkin* banks	Government-affiliated banks	Nonbank *shoko*	Corporations
Relationship lending		○	○	○	○	
Financial statement lending	○	○	○	○		
Factoring	○	○	○	○		
Leasing	○	○	○	○	○	
Equipment lending	○	○	○	○	○	
Real estate-based lending	×	×	×	×	×	
Trade credit						○
Sogo shosha lending						○
Keiretsu/subcontracting lending						○

for his/her business. If banks became averse to real estate-based lending because of falling real estate prices, then this lending channel would have contracted. Interestingly, however, the evidence suggests the opposite effect. That is, the stock of real estate loans actually increased both in absolute terms and as a fraction of the total loan portfolio. This may have been driven by the moral hazard problem as weaker banks sought to increase their portfolio risk (Iwatsubo [2007]). This finding, though consistent with an expansion of the bank-delivered real estate-based lending channels, is not sufficient to prove that these SME lending channels expanded.

In great part, the extent to which these hypotheses explain bank commercial lending during the banking crisis in Japan is still an open question. Viewed through the prism of our lending channel paradigm, the answer in part will depend on the extent to which one or more lending channels contracted and the extent to which other lending channels were able to offset any negative effect by expanding. Data availability problems likely preclude a comprehensive test of the behavior of each individual lending channel during the crisis. However, data do permit a partial examination that focuses on one potentially important channel, trade credit. In the next section, we discuss the importance of trade credit in Japan and elsewhere and outline how we conduct our analysis.

Before turning to our analysis of trade credit and its potential behavior during the banking crisis, we note how our lending channel paradigm can be used to assess the impact of another type financial "shock": shifts in monetary policy. Table 10 illustrates how a tightening of monetary policy might affect lending channels in Japan today. As with the case of the banking crisis credit crunch hypotheses, the net effect of a monetary policy shock will depend on the extent to which expansion of the unaffected channels (the nonbank channels here) can offset the affected channels (the bank channels here).

Table 10 Japanese Lending Channels: Monetary Policy—Today (Tight Money)

	City banks	Regional banks	*Shinkin* banks	Government-affiliated banks	Nonbank *shoko*	Corporations
Relationship lending		×	×	○	○	
Financial statement lending	×	×	×	○		
Factoring	×	×	×	○		
Leasing	×	×	×	○	○	
Small business credit scoring	×					
Equipment lending	×	×	×	○	○	
Real estate-based lending	×	×	×	○	○	
Trade credit						○
Sogo shosha lending						○
Keiretsu/subcontracting lending						○

III. Lending Channels during the Japanese Banking Crisis: The Case of Trade Credit

If a credit crunch occurred during at least part of the Japanese banking crisis, our lending channel paradigm suggests that its net effect on credit availability would be determined by the extent to which the contraction of some lending channels was offset by the expansion of others. The existence of a credit crunch, however, is still an open research question. There are several related issues. Did some financial institutions contract their supply of lending during a fraction of the crisis period, contracting or shutting down some of the lending channels? Did the "convoy system" of bank prudential supervision and any associated "evergreen" policy work in the opposite direction of a credit crunch? Did moral hazard-driven behavior mitigate an SME credit crunch, with some banks increasing their supply of SME lending, and expanding some lending channels, consistent with empirical and theoretical work on bank risk-taking and capital shocks?[12] While our empirical analysis is related to all of these questions, our objective is much more focused. We simply ask the following question: if a contraction of some of the lending channels occurred during any fraction of the banking crisis, was this offset by an expansion of other lending channels?

Testing the behavior of lending channels during any financial shock is quite problematic because of data limitations. For example, the literature on SME lending has identified relationship lending as a very important source of SME financing in developed and developing economies. This literature has also associated relationship lending with smaller financial intermediaries. However, due to data limitations it is very difficult to isolate the relationship lending channel during the Japanese banking crisis. For example, without data that can distinguish between lending by smaller banks using

12. The theoretical and empirical literature on this issue offers mixed results. See Iwatsubo (2007) for a discussion of this literature.

the relationship lending technology and lending by smaller banks using other lending technologies (i.e., financial statement lending, leasing, factoring, equipment lending, real estate-based lending), it may be quite difficult to assess the impact of a contraction of the relationship lending channel on SME credit availability during either the Japanese banking crisis or the U.S. credit crunch.[13] However, data on one lending channel during the Japanese banking crisis offer a window for analysis and a partial test of the lending channel paradigm—data on trade credit. In this section, we outline our hypothesis on the behavior of the trade credit lending channel during the banking crisis, preceded by a review of the literature on trade credit.

Table 11 illustrates our basic empirical strategy. As we will discuss in our next section, our primary data consist of aggregate firm balance sheets. As a result, we can only identify broad categories of lending channels, with one important exception. The key exception is trade credit, the focus of our analysis. Specifically, our data enable us to isolate the Japanese trade credit lending channel: trade credit provided by corporations designated as the "t" channel in Table 11.

Our data do not enable us to distinguish among all of the different bank lending channels. We only know the aggregate amount that firms borrow from banks and nonbank financial institutions. Thus, we group the bank lending channels (channel "b") and the nonbank lending channels (channel "n") together, and we will refer to them as the financial institution lending channels. *Sogo shosha* lending is excluded from our analysis due to data limitations. Our empirical tests then examine whether the allocation of credit changed between the financial institution channels and the trade credit channel. If, for example, a bank credit crunch occurred during some or all

Table 11 Japanese Lending Channels: Our Analysis

	City banks	Regional banks	*Shinkin* banks	Government-affiliated banks	Nonbank *shoko*	Corporations
Relationship lending		b	b	b		
Financial statement lending	b	b	b	b	n	
Factoring	b	b	b	b		
Leasing	b	b	b	b	n	
Real estate-based lending	b	b	b	b	n	
Trade credit						t
Sogo shosha lending						s
Keiretsu/subcontracting lending						k
Our analysis:	b (bank loans)	vs.	n (nonbank *shoko*)	vs.	t (trade credit)	

Note: The *sogo shosha* lending channel, s, and the *keiretsu*/subcontracting lending channel, k, are excluded from the analysis.

13. A recent study of four countries during the Asian financial crisis found evidence that relationship lending in general mitigated credit access problems in South Korea and Thailand, but not in Indonesia and the Philippines. Specifically, in the former two countries it found that stronger banking relationships were associated with credit availability. See Jiangli, Unal, and Yom (2005).

of the crisis, we might expect to see a relative contraction of the financial institution lending channels and relative expansion of the trade credit channel. This would be consistent with the behavior of trade credit in response to financial shocks identified in the literature on trade in the United States (Calomiris, Himmelberg, and Wachtel [1995]). Our analysis, however, will not be able to detect a change in the mix between the individual lending channels within the group of financial institution lending channels. For example, we would not be able to detect a contraction of the city bank channel relative to the regional bank channel.

Before turning to our empirical analysis, we offer a brief review of the literature on trade credit, given its prominence in our analysis and its importance in Japanese financial system architecture. Trade credit in Japan today represents 22.67 percent of all debt extended to nonfarm, nonfinancial, non-real estate, for-profit firms and 23.67 percent of all debt extended to nonfarm, nonfinancial, non-real estate, for-profit SMEs. This compares to 33.56 percent and 38.81 percent, respectively, of debt provided by banks. By way of comparison, trade credit in the United States is about one-third of all debt extended to nonfarm, nonfinancial, non-real estate, for-profit U.S. SMEs, which is only slightly less than the fraction extended by commercial banks (Robb [2002]). More generally, the level of trade credit in Japan is among the highest in developed economies (Kneeshaw [1995]). Trade credit may be even more important in economies with weak financial systems, where industries with higher dependence on trade credit exhibit higher growth rates (Demirgüç-Kunt and Maksimovic [2002] and Fisman and Love [2003]).

In Table 1, we classified trade credit as primarily a transaction technology. This would be justified to the extent that trade credit decisions are made on hard information culled by suppliers about payment performance, customer financial conditions, and buyer industry performance. However, we note that vendor-customer relationships may play an important role and thus soft information may also be important—also indicated in Table 1. The literature on trade credit, however, offers many different theories and evidence on trade credit.

This literature has suggested that trade creditors may have a comparative advantage over other types of lenders. Typically, these advantages are either related to market structure or product characteristics. More specifically, these theories of trade credit have identified potential advantages in funding, production/inventory management, price discrimination, and product quality guarantees. Some studies find that product sellers may have an informational advantage over other types of lenders in assessing the customer's ability to pay, solving incentive problems, repossessing and reselling goods in the event of default, or withholding future supplies (see Petersen and Rajan [1997], Burkart, Ellingsen, and Giannetti [2004], and Uchida, Udell, and Watanabe [2006] for summaries of these theories and related empirical evidence). Other recent work has suggested that trade creditors may have a comparative advantage, because firms may be less inclined to strategically default on trade credit than bank credit (Cunat [2007] and Burkart and Ellingsen [2004]). It has been argued theoretically and empirically that if vendors have an informational advantage over banks and other types of lenders, and if they have an automatic collateral priority under local commercial law, then a greater amount of trade credit will be used by less creditworthy companies than more

creditworthy firms (Frank and Maksimovic [2005] and Chan *et al.* [2001]). Here it should be noted, however, that countries vary in terms of whether (and the extent to which) trade creditors have any automatic collateral priority. In addition, there is some evidence that the amount of trade credit is related to the type of product sold: specifically, more trade credit is extended when a product is not standardized and thus less divertible (Burkart, Ellingsen, and Giannetti [2004]).

Some papers have argued that trade creditors may be relationship lenders that produce private soft information about their borrower to make credit decisions (e.g., Mian and Smith [1992], Biais and Gollier [1997], Jain [2001], Cunat [2007], Miwa and Ramseyer [2005], Fabri and Menichini [2006], and Uchida, Udell, and Watanabe [2006]). It is possible that this soft information may differ from the soft information generated by banking relationships (Biais and Gollier [1997]).[14]

A number of papers have examined whether trade credit and commercial loans are substitutes or complements of one another. Most empirical literature finds that they are substitutes (Meltzer [1960], Brechling and Lipsey [1963], Jaffee [1968], Ramey [1992], Marotta [1996], Tsuruta [2003], and Uesugi and Yamashiro [2004]). However, some of the empirical literature has found that they are complements in developing economies (Cook [1999]) and Japan (Ono [2001]).

Many papers have assumed that trade credit is more expensive than bank loans, with many arguing that it is considerably more expensive (e.g., Elliehausen and Wolken [1993], Petersen and Rajan [1994, 1995, 1997], Hernández de Cos and Hernando [1998], and Danielson and Scott [2000]). This assumption has been quite useful in the literature on evaluating credit constraints in SMEs, because it allows researchers to use dependence on trade credit as a proxy for the degree of financial constraints. This view of trade credit as the most expensive source of credit (or one of the most expensive), however, is not without its critics. Typically, the cost of trade credit is estimated in a mechanical way that assumes a standard pricing which has a discount for early payment and a final maturity. If these terms are a 2 percent discount in 10 days and net (i.e., maturity) of 30 days, then this implies an annual rate of nearly 40 percent. Critics argue, however, that the stated terms vary considerably. More importantly, the stated terms such as maturity are likely very different from the actual terms. Equally important, one additional element in the pricing menu is generally unknown to the researcher—the price of the underlying product. Thus, critics argue that if these factors were known it is likely that the estimates of the cost of trade credit would not indicate it is more expensive than bank loans (Miwa and Ramseyer [2005]).

The closest papers to our empirical analysis are Ono (2001), Ogawa (2003), Uesugi (2005), and Fukuda, Kasuya, and Akashi (2006). They all investigate empirically whether trade credit and financial institution lending are complements or substitutes in Japan, while the results are mixed. Important differences between these papers and our empirical analysis are as follows. Ono (2001) and Ogawa (2003) do not include the non-manufacturing sector in their empirical analysis or pay special attention to

14. One paper specifically tests the link between the strength of the trade credit relationship and the quantity of trade credit. It finds evidence for Japanese SMEs that stronger trade credit relationships lead to more trade credit consistent with the hypothesis that trade creditors are relationship lenders. See Uchida, Udell, and Watanabe (2006).

the credit crunch periods, while we do both. Besides investigating the credit crunch periods, it turns out that it is important to include the non-manufacturing sector in the empirical analysis, because there is an important difference between it and the manufacturing sector in terms of trade credit and financial institution lending, as will be discussed below. Uesugi (2005) and Fukuda, Kasuya, and Akashi (2006) concentrate their empirical analysis on relatively short periods: the former covers 1997–2002 and the latter covers 2001–03. In contrast, our empirical analysis covers much longer periods than those two papers, as will be explained in the next section. It is important for our purpose to cover longer periods, because we investigate whether or not and how the relation between the trade credit channel and the financial institution lending channel during the credit crunch period differs from that during other periods.

IV. The Specification and the Data

As we noted in the previous section, our empirical approach in this paper is to investigate the impact of the Japanese banking crises on the trade credit lending channel. More specifically, we investigate whether the trade credit channel expanded during the crises—or during sub-periods in the crisis—when we suspect that the financial institution lending channel may have contracted. We do this by analyzing both the lending and borrowing sides of trade credit. The lending side of trade credit is reflected in the accounts receivable on firm balance sheets,[15] and the borrowing side is reflected in the accounts payable on firm balance sheets.

This section introduces the data that we use and specifies the linear regressions. The Japanese Ministry of Finance compiles *Financial Statements Statistics of Corporations by Industry* (FSSC) to survey the balance sheets and income statements of nonfinancial private corporations. We use these data for balance-sheet information including accounts receivable and accounts payable. The Bank of Japan compiles *Short-Term Economic Survey of Enterprises in Japan* (called the *Tankan*) to assess the current conditions at the industry level of the domestic economy on a quarterly basis. The FSSC and the *Tankan* are our main data sources. The FSSC and the *Tankan* divide sample firms by size of capital stock and industry. Here we explain in detail how sample firms are divided.

A. Division of Firms by Size of Capital Stock

In terms of size of capital stock, both the FSSC and the *Tankan* divide firms into three categories: "large" firms (¥1 billion or more), "medium-sized" firms (¥100 million up to ¥1 billion), and "small" firms (¥10 million up to ¥100 million).[16] We will exploit these size categories to isolate SMEs and explore potential differential effects on the lending and borrowing size.

15. See the Appendix, Section A.2, for further details.
16. Actually the FSSC divides firms into more refined categories (five categories) as well as three categories in terms of firm size. However, the *Tankan* divides firms into just three categories. To match the data in the FSSC and the *Tankan*, we use the three-category division in the FSSC.

B. Division of Firms by Industry

Both the *Tankan* and the FSSC divide firms into refined industries in each of the manufacturing sector and the non-manufacturing sector (e.g., food & beverages, textiles, construction, wholesaling, and so on). Using the *Tankan* and the FSSC, we construct our dataset as follows. First, we match industries in the FSSC to those in the *Tankan*. If we cannot match an industry because the industry is missing in either of the *Tankan* or the FSSC, we drop the industry from our dataset. Furthermore, we drop any industry if the number of observations in the industry is fewer than 10. Second, we adjust the data discontinuity of medium-sized firms and small firms in the FSSC.[17] As a result, our dataset consists of 22 industries that are listed in Table 12. The minimum number of observations in an industry is 49, while the maximum is 150. The average number of observations per industry is 112.62.

C. Specification

The following is the basic specification for h-size firms (h = large, medium, small) to determine trade receivables per sales, trade payables per short-term financial institution

Table 12 Industries and Sample Period

Industry	Firm size		
	Large	Medium	Small
Food & beverages	1974/Q2–2005/Q4	1974/Q2–2005/Q1	1967/Q3–2004/Q4
Textiles	1974/Q2–2005/Q4	1974/Q2–2005/Q1	1967/Q3–2004/Q4
Lumber & wood products	1975/Q3–2005/Q4	1975/Q3–2005/Q1	1975/Q3–2004/Q4
Pulp & paper	1974/Q2–2005/Q4	1974/Q2–2005/Q1	1967/Q3–2004/Q4
Chemicals	1974/Q2–2005/Q4	1974/Q2–2005/Q1	1967/Q3–2004/Q4
Petroleum & coal products	1975/Q3–2005/Q4	1975/Q3–2005/Q1	1975/Q3–2004/Q4
Ceramics, stone & clay	1975/Q3–2005/Q4	1975/Q3–2005/Q1	1975/Q3–2004/Q4
Iron & steel	1974/Q2–2005/Q4	1974/Q2–2005/Q1	1967/Q3–2004/Q4
Nonferrous metals	1974/Q2–2005/Q4	1974/Q2–2005/Q1	1974/Q3–2004/Q4
Processed metals	1974/Q2–2005/Q4	1974/Q2–2005/Q1	1967/Q3–2004/Q4
Industrial machinery	1974/Q2–2005/Q4	1974/Q2–2005/Q1	1967/Q3–2004/Q4
Electrical machinery	1974/Q2–2005/Q4	1974/Q2–2005/Q1	1967/Q3–2004/Q4
Motor vehicles	1992/Q4–2005/Q4	1992/Q4–2005/Q1	1992/Q4–2004/Q4
Precision machinery	1975/Q3–2005/Q4	1975/Q3–2005/Q1	1975/Q3–2004/Q4
Other manufacturing	1974/Q2–2005/Q4	1974/Q2–2005/Q1	1967/Q3–2004/Q4
Mining	1983/Q2–2005/Q4	1983/Q2–2005/Q1	1983/Q2–2004/Q4
Construction	1983/Q2–2005/Q4	1983/Q2–2005/Q1	1983/Q2–2004/Q4
Transportation	1983/Q2–2005/Q4	1983/Q2–2005/Q1	1983/Q2–2004/Q4
Wholesaling	1983/Q2–2005/Q4	1983/Q2–2005/Q1	1983/Q2–2004/Q4
Retailing	1983/Q2–2005/Q4	1983/Q2–2005/Q1	1983/Q2–2004/Q4
Real estate	1983/Q2–2005/Q4	1983/Q2–2005/Q1	1983/Q2–2004/Q4
Services	1983/Q2–2005/Q4	1983/Q2–2005/Q1	1983/Q2–2004/Q4

17. The way to adjust the discontinuity is slightly different across medium-sized firms and small firms. That is why the end of sample period is different across medium-sized firms and small firms in the same industry after the adjustment. See the Appendix for details of the discontinuity adjustment. Furthermore, the start of sample period is sometimes different across large, medium-sized, and small firms even in the same industry in the FSSC.

borrowing, trade payables, or short-term financial institution borrowing in industry i during time period t.

$$
\begin{aligned}
& Dep_{h,i,t} \\
& = \beta X_{h,i,t} + \alpha_i + \epsilon_{h,i,t} \\
& = \beta_0 + \beta_1 Tankan_{large,i,t} + \beta_2 Tankan_{medium,i,t} + \beta_3 Tankan_{small,i,t} + \beta_4 Bubble\_Dummy \\
& \quad + \beta_5 CP\_Dummy + \beta_6 Crunch\_Dummy_1 + \beta_7 Crunch\_Dummy_2 \\
& \quad + \beta_8 Crunch\_Dummy_3 + \beta_9 (Inv_{large,i,t-1}/Sales_{large,i,t}) + \beta_{10} (Inv_{medium,i,t-1}/Sales_{medium,i,t}) \\
& \quad + \beta_{11} (Inv_{small,i,t-1}/Sales_{small,i,t}) + \beta_{12} Leverage_{large,i,t-1} + \beta_{13} Leverage_{medium,i,t-1} \\
& \quad + \beta_{14} Leverage_{small,i,t-1} + \beta_{15} (Cash\_Flow_{large,i,t}/Sales_{large,i,t}) \\
& \quad + \beta_{16} (Cash\_Flow_{medium,i,t}/Sales_{medium,i,t}) + \beta_{17} (Cash\_Flow_{small,i,t}/Sales_{small,i,t}) \\
& \quad + \beta_{18} Trend_t + \beta_{19} ST\_Rate_t + \beta_{20} LT\_Rate_t + \beta_{21} Unemployment\_Rate_t \\
& \quad + \beta_{22} Growth\_Rate_t + \beta_{23} Q2\_Dummy + \beta_{24} Q3\_Dummy \\
& \quad + \beta_{25} Q4\_Dummy + \alpha_i + \epsilon_{h,i,t}.
\end{aligned}
$$

The description of variables is in Table 13. $Dep_{h,i,t}$ is the dependent variable: $TR_{h,i,t}/Sales_{h,i,t}$, $TP_{h,i,t}/ST\_Borrowing_{h,i,t}$, $TP_{h,i,t}$, or $ST\_Borrowing_{h,i,t}$. β is a coefficient matrix, $X_{h,i,t}$ is a matrix of explanatory variables, α_i is the industry-specific residual, and $\epsilon_{h,i,t}$ is the residual with the usual properties (mean zero, serially uncorrelated, uncorrelated with $X_{h,i,t}$, uncorrelated with α_i, and homoskedastic). Our first two dependent variables, respectively, are measures of the quantity of trade credit supplied expressed as a turnover ratio and the quantity of trade credit demanded expressed as fraction of short-term financial institution borrowing. We also use trade payables and the short-term borrowing, respectively, for the dependent variables to see how each of these behaves in the sample period. We assume α_i to be random effects.[18] Since the cash flow may be endogenous, we use the lagged cash flow ($Cash\_Flow_{h,i,t-1}/Sales_{h,i,t-1}$) as instrument variables.

We will also try the "parsimonious" specification for trade payables per short-term financial institution borrowing, trade payables, and short-term financial institution borrowing as follows.

18. We have conducted fixed effects regression as well as random effects regression. By running a Hausman test, we have chosen random effects regression.

$$
\begin{aligned}
& Dep_{h,i,t} \\
& = \beta_0 + \beta_1 Tankan_{h,i,t} + \beta_2 Bubble\_Dummy + \beta_3 CP\_Dummy \\
& \quad + \beta_4 Crunch\_Dummy_1 + \beta_5 Crunch\_Dummy_2 + \beta_6 Crunch\_Dummy_3 \\
& \quad + \beta_7 (Inv_{h,i,t-1}/Sales_{h,i,t}) + \beta_8 Leverage_{h,i,t-1} + \beta_9 (Cash\_Flow_{h,i,t}/Sales_{h,i,t}) \\
& \quad + \beta_{10} Trend_t + \beta_{11} ST\_Rate_t + \beta_{12} LT\_Rate_t + \beta_{13} Unemployment\_Rate_t \\
& \quad + \beta_{14} Growth\_Rate_t + \beta_{15} Q2\_Dummy + \beta_{16} Q3\_Dummy \\
& \quad + \beta_{17} Q4\_Dummy + \alpha_i + \epsilon_{h,i,t}.
\end{aligned}
$$

The variables in X include a number of variables that control for economic conditions, including GDP growth and unemployment. We explain some of the variables in more detail.

Our key explanatory variables are our "crunch" dummies and our *Tankan* variables. We test the hypothesis that some lending channels may have expanded during the Japanese banking crisis in response to the contraction of other lending channels.

Table 13 Variables for *h*-Size Firms in Industry *i* (*h* = Large; Medium; Small)

Variable	Description
$TR_{h,i,t}$	Trade receivables of *h*-size firms in industry *i* at the end of time *t*
$Sales_{h,i,t}$	Sales of *h*-size firms in industry *i* during time *t*
$TP_{h,i,t}$	Trade payables of *h*-size firms in industry *i* at the end of time *t*
$ST\_Borrowing_{h,i,t}$	Short-term financial institution borrowing of *h*-size firms in industry *i* at the end of time *t*
$Tankan_{h,i,t}$	Diffusion index for lending attitude of financial institutions for *h*-size firms in industry *i* at time *t*
Bubble_Dummy	1 in 1987/Q1–1990/Q4, 0 otherwise
CP_Dummy	1 from 1987/Q4 onward, 0 otherwise
$Crunch\_Dummy_1$	1 in 1990/Q1–1992/Q4, 0 otherwise
$Crunch\_Dummy_2$	1 in 1994/Q3–1996/Q4, 0 otherwise
$Crunch\_Dummy_3$	1 in 1997/Q3–1999/Q1, 0 otherwise
$Inv_{h,i,t-1}$	Inventories of *h*-size firms in industry *i* at the end of time *t*–1
$Leverage_{h,i,t-1}$	Ratio of total liabilities to total assets of *h*-size firms in industry *i* at the end of time *t*–1
$Trend_{h,i,t}$	Trend
ST_Rate_t	Short-term interest rate at time *t*
LT_Rate_t	Long-term interest rate at time *t*
$Unemployment\_Rate_t$	Unemployment rate at time *t*
$Growth\_Rate_t$	GDP growth rate at time *t* (percent change from the previous year)
Q2_Dummy	1 in Q2, 0 otherwise
Q3_Dummy	1 in Q3, 0 otherwise
Q4_Dummy	1 in Q4, 0 otherwise

Specifically, we investigate whether SMEs used more trade credit during periods where financial institutions may have contracted their supply of credit, thus contracting their lending channels. We also investigate whether other companies lent more trade credit during this period. Our crunch dummies identify periods where, if there was any contraction of financial institution lending, it likely occurred. We use $Crunch\_Dummy_1$ to capture the implementation period of the Basel I risk-based capital requirements (1990/Q1–1992/Q4). There is evidence that in some countries this may have been associated with a contraction in the supply of bank credit (e.g., Haubrich and Wachtel [1993], Berger and Udell [1994], Hancock and Wilcox [1994a, b], and Wagster [1999]).[19] $Crunch\_Dummy_2$ is used to capture the period when many financial institutions were in deepest trouble (1994/Q3–1996/Q4). Five deposit-taking institutions failed during this period (Tokyo Kyowa Credit Cooperative, Anzen Credit Cooperative, Cosmo Credit Cooperative, Kizu Credit Cooperative, and Hyogo Bank). Daiwa Bank was ordered by the U.S. regulators to close all operations in the U.S. markets, since it had incurred a loss of approximately US$1.1 billion as a result of the fraudulent conduct of an employee at its New York branch. In addition, the aggregate loss of seven non-banks (the so-called *jusen* housing loan companies) was found to be ¥6,410 billion. $Crunch\_Dummy_3$ is used to capture the period (1997/Q3–1999/Q1) when even larger financial institutions failed (Nippon Credit Bank, Sanyo Securities, Hokkaido Takushoku Bank, Yamaichi Securities, and Tokuyo City Bank).

Our *Tankan* variables are also used to identify a contraction in the supply of financial institution credit. Specifically, $Tankan_{h,i,t}$ is the diffusion index for the lending attitude of financial institutions for h-size firms in industry i at time t.[20] The larger $Tankan_{h,i,t}$ is, the more willing financial institutions are to lend to h-size firms in industry i at time t.

Bubble_Dummy is used to capture the period when Japan experienced the so-called bubble economy (1987/Q1–1990/Q4).[21] During the bubble period, financial institution lending increased substantially. If trade credit and financial institution lending are substitutes (complements), trade credit may decrease (increase) during the bubble period. *CP_Dummy* captures the fact that the commercial paper market was created in 1987/Q4 in Japan, which might affect the behavior of trade credit issuers or borrowers thereafter. In particular, this may capture any effect driven by larger firms issuing commercial paper to finance more trade credit, in other words, funding more accounts receivable (Calomiris, Himmelberg, and Wachtel [1995]).

$Inv_{h,i,t-1}/Sales_{h,i,t}$ captures a possible role of inventories as collateral for trade credit and short-term borrowing. Trade receivables, trade payables, and short-term borrowing may increase if the inventories serve as collateral for them. $Leverage_{h,i,t-1}$, the

19. Some researchers have found that Basel may have had a more complicated effect in Japan, where international banks appear to be sensitive to capital constraints under Basel while domestic banks appear not to have been affected by the accord. Consistent with the moral hazard finding, this same research also suggests the possibility that in addition to a general sensitivity to capital constraints, international Japanese banks may have had an incentive to switch from low risk to high risk *within* their portfolios (Montgomery [2005]). This is also consistent with other research that poorly capitalized banks in Japan tended to misallocate their loan portfolios to troubled borrowers (Peek and Rosengren [2005]). The implication here for viable SMEs may be negative.
20. See the Appendix, Section B, for the construction of the diffusion index.
21. See Okina, Shirakawa, and Shiratsuka (2001) for a discussion of the definition of the bubble period in Japan.

leverage ratio, is included to control for the balance-sheet condition of the firms. $Cash\_Flow_{h,i,t}/Sales_{h,i,t}$ is included because firms use internally generated cash as a primary financial resource. If the firms have plenty of cash, they do not need to borrow externally. Thus, firms may extend trade payables and short-term borrowing when their cash flow decreases.

ST_Rate_t, LT_Rate_t, $Unemployment\_Rate_t$, and $Growth\_Rate_t$ are included to control for macroeconomic conditions. $Trend_t$, $Q2\_Dummy$, $Q3\_Dummy$, and $Q4\_Dummy$ are included for trend removal and seasonal adjustment.[22]

V. Empirical Results

In this section, we report the empirical results. In Section V.A, we explain an important heterogeneity across industries and firm size as well as its implication for the literature. In Section V.B, we report the results of the trade receivables (per sales) regression. In Section V.C, we report the results of the trade payables per short-term financial institution borrowing regression, the trade payable regression, and the short-term financial institution borrowing regression.

A. Heterogeneity across Industries and Firm Sizes

We begin by explaining our motivation for using disaggregated data to take into account any heterogeneity across different groups (industries and firm sizes). To see whether there is a non-negligible heterogeneity across different groups, we estimate the parsimonious specification model using the short-term financial institution borrowing as the dependent variable, group by group. We report the sign of the estimated coefficient on the *Tankan* index and its significance in Table 14 (see also Tables 15 and 16). Clearly there exists an important heterogeneity across different groups. In some industries and firm sizes, the estimated coefficient on the *Tankan* index is negative rather than positive, meaning that those firms reduce their short-term borrowing when financial institutions become more willing to lend. Overall, the firms in the manufacturing sector tend to increase the short-term borrowing while those in the non-manufacturing sector tend to decrease it, when the financial institutions become more willing to lend.[23] If we aggregate both the manufacturing and non-manufacturing sectors, we may miss some important information, because the behavior in the manufacturing sector and that in the non-manufacturing sector may be canceled out. Therefore, we use a subsample that includes only industries in the manufacturing sector and a subsample that includes only industries in the non-manufacturing sector, respectively, for estimation of the random effect model. We also estimate the random effect model using all industries in the manufacturing

22. See Goldberger (1991, pp. 185–189) for trend removal and seasonal adjustment.
23. Some readers might suspect that the firms in the non-manufacturing sector reduce their short-term borrowing but increase their long-term borrowing when the financial institutions become more willing to lend. To explore this possibility, we use the long-term financial institution borrowing or the sum of short- and long-term financial institution borrowing in place of the short-term financial institution borrowing in the estimation. We obtain similar results to those obtained from the estimation using the short-term financial institution borrowings. See Tables 15 and 16.

Table 14 Effect of the *Tankan* Index on the Level of Short-Term Borrowing

Industry	Large	Medium	Small
Food & beverages	+***	+***	+
Textiles	+***	+***	–
Lumber & wood products	+	+	+**
Pulp & paper	+***	+*	–
Chemicals	+	+***	–
Petroleum & coal products	+**	+	–
Ceramics, stone & clay	+	+	+**
Iron & steel	+	+	+*
Nonferrous metals	+***	+***	+**
Processed metals	+***	+***	+***
Industrial machinery	+	+	–
Electrical machinery	+	+***	+**
Motor vehicles	–	+**	–
Precision machinery	–	+***	–***
Other manufacturing	–	+	+
Mining	–	–	+**
Construction	–	–	–
Transportation	–	+	–
Wholesaling	–	+	–
Retailing	–***	+	–*
Real estate	+	–**	–
Services	–	–	–

Note: *** denotes significant at 1 percent, ** denotes significant at 5 percent, and * denotes significant at 10 percent.

Table 15 Effect of the *Tankan* Index on the Level of Long-Term Borrowing

Industry	Large	Medium	Small
Food & beverages	–***	–	–
Textiles	+	+	–
Lumber & wood products	+	+	–
Pulp & paper	–	–	–***
Chemicals	–*	+	+
Petroleum & coal products	+***	–	–
Ceramics, stone & clay	–	–	+
Iron & steel	+***	–	–
Nonferrous metals	–***	+	–
Processed metals	+	–	–**
Industrial machinery	+	–	–
Electrical machinery	–*	+***	–
Motor vehicles	–	–	–
Precision machinery	–	+	–
Other manufacturing	–**	–	–*
Mining	+	+	+
Construction	+	–	–
Transportation	–**	–	–***
Wholesaling	–	–	–
Retailing	–***	–	–***
Real estate	–	–	–
Services	–	–	–

Note: *** denotes significant at 1 percent, ** denotes significant at 5 percent, and * denotes significant at 10 percent.

Table 16 Effect of the *Tankan* Index on the Level of Short-Term and Long-Term Borrowing

Industry	Large	Medium	Small
Food & beverages	+	+**	–
Textiles	+***	+***	–
Lumber & wood products	+	+	+
Pulp & paper	+*	+	–*
Chemicals	–	+***	+
Petroleum & coal products	+***	+	–
Ceramics, stone & clay	+	+	+
Iron & steel	+**	–	+
Nonferrous metals	+***	+***	+
Processed metals	+***	+	–
Industrial machinery	+	+	–
Electrical machinery	+	+***	+
Motor vehicles	–	+	–
Precision machinery	–	+**	–**
Other manufacturing	–	+	–
Mining	–	–	+**
Construction	–	–	–
Transportation	–*	+	–***
Wholesaling	–	–	–
Retailing	–***	–	–***
Real estate	–	–*	–
Services	–	–	–

Note: *** denotes significant at 1 percent, ** denotes significant at 5 percent, and * denotes significant at 10 percent.

sector and the non-manufacturing sector to see how the dependent variable behaves at the aggregate level.[24]

The negative effect of the *Tankan* index on financial institution borrowing has important implications for the literature. First, it has an important implication for the debate on whether trade credit and financial institution borrowing are substitutes or complements. The literature argues that trade credit and financial institution borrowing are complements if trade credit increases when financial institutions become more willing to lend.[25] An implicit assumption behind this argument is that the firms increase their short-term borrowing when financial institutions become more willing to lend (i.e., the effect of the *Tankan* index on financial institution borrowing is assumed to be positive). But if this assumption fails in some industries and firm sizes, as is found here, trade credit and financial institution borrowing may not be complements even if trade credit increases when financial institutions

24. The usual random effect model assumes the heterogeneity across different groups in terms of the constant term (industry-specific residual) in the regression. The heterogeneity we find here is beyond just the constant term, because this suggests different groups *react* in the opposite direction when the lending willingness of financial institutions changes. That is why we separate the manufacturing sector and the non-manufacturing sector for the given-sized firms first. Then we apply the random effect model for each sector, assuming there is no difference across industries within the same sector except for the difference in the constant term. We also estimate the random effect model by using all industries in both the manufacturing and non-manufacturing sectors, to see which sector's behavior dominates when the two sectors' behavior differs.

25. See Ono (2001) and Ogawa (2003).

become more willing to lend if financial institution borrowing does not concomitantly increase. Second, the heterogeneity above implies that there is a reallocation of financial institution lending across industries and firm sizes. Put another way, the volume of lending does not always uniformly change across industries and firm sizes when the willingness of financial institutions to lend changes. When financial institutions become more (or less) willing to lend, some reallocation of financial institution lending occurs across industries and firm sizes: lending may increase in some industries and firm sizes, while it may decrease in others. Further investigation of this reallocation may be worthwhile.

B. Trade Receivables

We begin by examining whether companies in different size categories increased their supply of trade credit. Our empirical results in Table 17 show how much in trade receivables (per sales) *h*-size firms would issue conditional on X (*h* = large, medium, small), in other words, how much trade credit *h*-size firms would provide conditional on X. However, they do not show to whom *h*-size firms provide trade credit, because we cannot identify who receives the credit provided by *h*-size firms in our data. Because all large, medium-sized, and small firms can potentially receive the trade credit, we include all *Tankan* variables, $Tankan_{large,i,t}$, $Tankan_{medium,i,t}$, and $Tankan_{small,i,t}$, in our estimation.

Large and small firms issue more trade receivables when financial institutions are more willing to lend to medium-sized firms. This means that the trade credit channel and financial institution lending channels are complements, rather than substitutes, *if medium-sized firms receive more trade credit as well as borrow more from financial institutions in such a situation*. However, from the data it is not clear who receives trade credit. Thus, we cannot be sure whether or not the results actually indicate that trade credit and financial institution lending are complements. Most coefficients on the crunch dummy are positive and 13 out of 27 are significantly positive, meaning that firms provide more trade credit during credit crunch periods. This would be generally consistent with an expansion of the trade credit channel that provides SME financing when there is a contraction in the bank lending channels. In contrast to the crunch dummy, most coefficients on the bubble dummy are negative, implying a contraction of the trade credit channel during the bubble period. This suggests that the trade credit channel and the financial institution lending channel are substitutes during the bubble period, given the fact of an expansion of the financial institution lending channel during the same period, as will be confirmed below.

One other interesting finding in the receivables regression is the positive and significant coefficient on the commercial paper dummy, *CP_Dummy*. This indicates that the introduction of commercial paper was associated with more extension of trade credit in general. This is consistent with the possibility that large firm access to the short-term capital markets allows them to extend more trade credit consistent with findings in the United States (Calomiris, Himmelberg, and Wachtel [1995]).

Table 17 Trade Receivables/Sales

Independent variable	Large			Medium			Small		
	All	Manufacturing	Non-manufacturing	All	Manufacturing	Non-manufacturing	All	Manufacturing	Non-manufacturing
$Tankan_{large}$	0.000	–0.001**	0.010***	0.000	0.000	0.002	–0.001***	–0.002***	–0.004***
$Tankan_{medium}$	0.001***	–0.001	0.006***	0.000	–0.002***	0.007***	0.001***	–0.001	0.008***
$Tankan_{small}$	0.000	0.001	–0.005***	–0.001**	0.002***	–0.005***	0.000	0.002***	–0.002***
Bubble_Dummy	–0.013	–0.027	0.065	–0.044***	–0.025	–0.070	0.004	–0.005	–0.035
CP_Dummy	0.081**	–0.062	0.263**	0.035	0.008	0.028	0.023	–0.054*	0.112**
$Crunch\_Dummy_1$	0.054**	0.053*	0.155	0.044***	0.046*	0.100	0.041***	0.047*	0.063
$Crunch\_Dummy_2$	0.013	0.041*	–0.164**	0.038***	0.055***	–0.017	0.058***	0.072***	0.029
$Crunch\_Dummy_3$	0.027	0.026	0.247***	0.024	0.021	0.208***	–0.001	–0.009	0.063
$Inv_{large,i,t-1}$	0.203***	0.108***	0.231***	0.052***	0.033	–0.103**	–0.005	0.071**	–0.154***
$Inv_{medium,i,t-1}$	–0.116***	0.718***	–0.150**	0.107***	0.860***	0.082*	–0.028*	0.485***	0.058*
$Inv_{small,i,t-1}$	–0.031	0.481***	–0.190***	0.000	0.388***	–0.006	0.072***	0.484***	0.078***
$Leverage_{large,i,t-1}$	1.735***	0.213**	3.987***	–0.100	0.649***	1.214***	0.042	0.546***	0.113
$Leverage_{medium,i,t-1}$	0.584***	0.112	1.987***	–0.013	0.254*	–0.547	–0.059	0.297**	–0.062
$Leverage_{small,i,t-1}$	–0.092	0.764***	–2.145***	–0.098	1.112***	–1.839***	0.026	0.594***	–0.975***
$Cash\_Flow_{large,i,t}$	6.837***	4.220***	5.285***	1.109**	4.084***	0.354	0.695**	4.906***	1.001**
$Cash\_Flow_{medium,i,t}$	–3.622**	–0.806	5.312**	3.607***	0.619	5.486***	–1.448**	–3.102**	–2.722**
$Cash\_Flow_{small,i,t}$	–0.573	2.926**	–10.900***	–1.027	2.462*	–4.633***	1.258**	3.805***	1.864***
Trend	0.000	0.000	0.013***	–0.004***	0.001	–0.001	–0.002***	0.001	–0.005***
$Unemployment\_Rate_t$	–0.015	–0.019	–0.069	0.004	–0.006	–0.021	–0.008	–0.033**	0.031
ST_Rate	0.002	–0.027***	0.157***	–0.001	–0.026***	0.056**	–0.008***	–0.028***	–0.019
LT_Rate	–0.007	0.018*	–0.090*	–0.008	0.017**	–0.050*	–0.005	0.010	0.006
Growth_Rate	–0.814***	–0.146	–3.225***	–0.447**	–0.697**	–0.476	–0.373***	–0.789***	–0.026
Q2_Dummy	0.006	0.068***	–0.001	0.031***	0.048***	0.130***	–0.026***	0.000	–0.010
Q3_Dummy	–0.059***	0.033	–0.113	–0.003	0.034*	0.017	–0.030***	0.006	–0.033
Q4_Dummy	–0.015	0.072***	–0.082	–0.005	0.032*	0.048	–0.045***	–0.005	–0.039
Constant	–1.107***	–0.682***	–4.863***	1.331***	–1.546***	1.812**	1.270***	–0.797***	2.078***
R^2	0.004	0.393	0.606	0.013	0.461	0.437	0.038	0.352	0.531

Note: *** denotes significant at 1 percent, ** denotes significant at 5 percent, and * denotes significant at 10 percent.

C. Trade Payables and Short-Term Financial Institution Borrowing

Our empirical results in Tables 18 and 19 show how much trade payables (per financial institution borrowing) h-size firms would receive conditional on X (h = large, medium, small), that is, how much trade credit h-size firms would receive conditional on X. However, they do not show from whom h-size firms receive trade credit. In other words, we cannot identify who provides this trade credit.

Surprisingly, most coefficients on the credit crunch dummies for SMEs are *negative*, and many of them are significant. This is surprising given the fact that most coefficients on the credit crunch dummies are positive in the trade receivable (per sales) regression. The increase in trade receivables during the credit crunch periods should match the increase in trade payables during the same period.[26] Given the alleged increase in trade payables during the credit crunch periods, the decrease in the ratio of trade payables to the short-term financial institution borrowing during the credit crunch periods implies an increase in short-term financial institution borrowing. To see this more clearly, we estimate the random effect models using trade payables and short-term financial institution borrowing as the dependent variable, respectively.

We report the results in Tables 20 to 23. As is conjectured above, many coefficients on the credit crunch dummies in the trade payable regression and those in the short-term financial institution borrowing regression are significantly positive. Thus, trade payables and financial institution borrowing increase significantly during the credit crunch periods, after controlling for the effects of other explanatory variables.[27] A possible interpretation of the increase in the trade payables is that a kind of spontaneous "convoy system" of Japanese private firms like *keiretsu* might serve as a mutual insurance system during those periods, though we cannot verify this from our data. Regarding the increase in financial institution borrowing, there are two possible interpretations. First, these findings might be inconsistent with the credit crunch hypothesis, which is in line with those papers that cast doubt on the existence of a credit crunch during the Japanese banking crisis because of the "convoy system" used by policymakers to manage the crises and evergreening and moral hazard problems (e.g., Nakaso [2001], Caballero, Hoshi, and Kashyap [2006], Horiuchi and Shimizu [1998], Watanabe [2006], and Iwatsubo [2007]). Second, these findings might be consistent with the credit crunch hypothesis, in the sense that private financial institutions decreased their lending during this period (i.e., the credit crunch occurred in the private sector), but public financial institutions canceled out this negative effect by increasing their lending. Unfortunately, from our data we cannot conclude which interpretation is correct, because we cannot distinguish in them between private financial institution borrowing and public financial institution borrowing.

26. There is a caveat. In the sample, we use the firms whose equity capital is larger than ¥10 million. Therefore, it might be the case that some of the trade receivables from the sample firms correspond to the trade payables of much smaller firms that are not included in the sample. As is shown below, however, the results show that the trade payables of the sample firms increase during the credit crunch periods, as with trade receivables.

27. The introduction of the Special Credit Guarantee Program for Financial Stability during 1998–2001 may explain why the coefficient on $Credit\_Crunch_3$ is significantly positive. See Ono and Uesugi (2005) for a discussion of the role of this program in SME financing in Japan.

Table 18 Trade Payables/Short-Term Financial Institution Borrowing

Independent variable	Large			Medium			Small		
	All	Manufacturing	Non-manufacturing	All	Manufacturing	Non-manufacturing	All	Manufacturing	Non-manufacturing
$Tankan_{large}$	–0.001***	–0.004***	0.001	–0.003***	–0.005***	–0.006***	–0.002**	–0.003**	–0.005**
$Tankan_{medium}$	0.000	0.004***	0.010***	–0.002*	–0.004**	0.014***	–0.005***	–0.011***	0.010***
$Tankan_{small}$	0.001	–0.001	0.003*	–0.001	0.001	0.001	0.000	0.011***	–0.002
Bubble_Dummy	–0.156***	–0.237***	–0.045	–0.152***	–0.261***	–0.073	–0.446***	–0.577***	–0.033
CP_Dummy	–0.003	0.024	0.110	–0.032	–0.032	0.224*	0.275***	0.371**	0.186
$Crunch\_Dummy_1$	–0.170***	–0.205**	0.123	–0.274***	–0.327***	0.051	–0.183**	–0.246**	–0.043
$Crunch\_Dummy_2$	0.007	–0.063	–0.142**	–0.015	–0.084	–0.104	–0.040	–0.012	–0.062
$Crunch\_Dummy_3$	0.055	0.011	0.211***	–0.184***	–0.220**	0.017	–0.106	–0.112	–0.008
$Inv_{large,i,t-1}$	–0.210***	–0.604***	–0.097**	–0.216***	0.004	–0.373***	–0.318***	0.310*	–0.337***
$Inv_{medium,i,t-1}$	0.025	–0.899***	0.009	–0.076	–0.780***	0.110	0.216**	0.284	0.057
$Inv_{small,i,t-1}$	0.046	0.574***	–0.022	0.103*	0.851***	0.039	0.006	–0.951***	0.015
$Leverage_{large,i,t-1}$	–0.934***	–5.450***	0.263	1.196***	–0.232	3.308***	–0.322	2.092***	2.210***
$Leverage_{medium,i,t-1}$	0.803***	1.611***	0.560	0.196	3.035***	–0.733	–0.212	2.590***	0.856
$Leverage_{small,i,t-1}$	–0.613***	0.169	–1.897***	–0.656***	0.940**	–1.805***	–0.101	–0.347	–1.612***
$Cash\_Flow_{large,i,t}$	2.122*	–4.016**	–1.596*	1.360	4.679**	–0.224	–3.276*	2.251	2.293**
$Cash\_Flow_{medium,i,t}$	–3.163	–0.069	–4.754***	–5.438*	10.195**	–10.367***	7.652*	24.794***	–11.682***
$Cash\_Flow_{small,i,t}$	0.872	1.232	–1.900*	4.326**	–3.340	3.227**	1.882	–7.117	2.011
Trend	0.008***	–0.002	0.015***	0.005***	0.003	0.006	–0.019***	–0.016***	–0.003
$Unemployment\_Rate_t$	–0.077***	0.003	0.061	–0.092***	–0.009	0.067	0.070	0.120	0.145**
ST_Rate	–0.017	–0.017	0.053*	–0.060***	–0.061***	0.007	–0.068***	–0.026	–0.085**
LT_Rate	0.110***	0.122***	0.048	0.145***	0.160***	0.064	0.098***	0.047	0.150***
Growth_Rate	2.536***	3.242***	0.173	3.026***	2.208**	–0.131	3.619***	0.752	0.813
Q2_Dummy	–0.023	–0.026	–0.058***	0.022	0.117**	–0.038	0.112**	0.157**	–0.095
Q3_Dummy	–0.025	0.014	–0.144***	0.028	0.058	–0.132*	0.127**	0.079*	–0.168**
Q4_Dummy	–0.004	0.012	–0.063	0.051	0.039	–0.028	0.101**	–0.016	–0.056
Constant	0.424	4.331***	–0.606	0.277	–2.744***	–0.406	4.315***	–0.426	0.163
R^2	0.068	0.379	0.695	0.140	0.217	0.640	0.314	0.390	0.535

Note: *** denotes significant at 1 percent, ** denotes significant at 5 percent, and * denotes significant at 10 percent.

Table 19 Trade Payables/Short-Term Financial Institution Borrowing: Parsimonious Specification

Independent variable	Large			Medium			Small		
	All	Manufacturing	Non-manufacturing	All	Manufacturing	Non-manufacturing	All	Manufacturing	Non-manufacturing
Tankan	–0.002***	–0.002***	0.002**	–0.006***	–0.006***	0.002*	–0.006***	–0.005***	–0.002*
Bubble_Dummy	–0.143***	–0.199***	–0.028	–0.175***	–0.225***	–0.010	–0.365***	–0.430***	–0.010
CP_Dummy	–0.150***	–0.124*	–0.228***	0.019	0.018	–0.036	0.273***	0.247**	0.035
$Crunch\_Dummy_1$	–0.267***	–0.259***	–0.057	–0.317***	–0.320***	–0.094*	–0.205***	–0.168*	–0.104*
$Crunch\_Dummy_2$	–0.045	–0.046	–0.075**	–0.069	–0.085	–0.048	–0.031	0.020	–0.063
$Crunch\_Dummy_3$	0.033	0.053	0.080*	–0.172***	–0.183***	–0.063	–0.057	–0.065	0.014
$Inv_{i,t-1}$	–0.129***	–0.825***	0.048**	–0.183***	–1.067***	–0.119***	–0.078	–1.158***	–0.129***
$Leverage_{i,t-1}$	–0.844***	–0.607	–1.159***	0.337***	1.376***	–0.735***	0.094	0.929**	–0.605**
$Cash\_Flow_{i,t}$	0.262	1.495	–0.582*	–1.488	2.226	–4.464***	5.423***	11.476***	–4.316***
Trend	0.014***	0.012***	0.017***	0.005***	0.004*	0.009***	–0.013***	–0.014***	0.000
$Unemployment\_Rate_t$	–0.169***	–0.175***	–0.092***	–0.084***	–0.053	–0.085***	0.091**	0.133**	0.017
ST_Rate	–0.029**	–0.023*	0.001	–0.050***	–0.036**	–0.010	–0.041***	–0.026	–0.078***
LT_Rate	0.130***	0.120***	0.082***	0.161***	0.149***	0.086***	0.149***	0.146***	0.144***
Growth_Rate	3.562***	3.334***	1.634***	3.314***	3.151***	–0.002	1.222*	–0.897	0.823
Q2_Dummy	–0.014	–0.001	–0.051*	–0.003	0.028	–0.093***	0.041	0.057	–0.040
Q3_Dummy	–0.010	–0.004	–0.059**	–0.028	0.011	–0.148***	0.073	0.145**	–0.118***
Q4_Dummy	0.007	–0.004	–0.006	–0.005	0.000	–0.075**	0.054	0.066	–0.031
Constant	0.043	0.689	–0.761*	0.454***	0.124	0.528	2.369***	2.037***	1.479***
R^2	0.161	0.199	0.119	0.198	0.178	0.448	0.320	0.348	0.403

Note: *** denotes significant at 1 percent, ** denotes significant at 5 percent, and * denotes significant at 10 percent.

Table 20 Trade Payables

Independent variable	Large			Medium			Small		
	All	Manufacturing	Non-manufacturing	All	Manufacturing	Non-manufacturing	All	Manufacturing	Non-manufacturing
$Tankan_{large}$	–0.003***	–0.008***	–0.051***	–0.001**	–0.001	–0.050***	–0.003	0.001	–0.100***
$Tankan_{medium}$	–0.001	–0.001	0.108***	0.000	0.003***	0.087***	–0.003	0.005***	0.188***
$Tankan_{small}$	0.008***	0.018***	0.042***	0.001	–0.001	0.027**	0.004	–0.006***	0.072***
Bubble_Dummy	–0.117*	–0.355**	–0.560	–0.005	–0.057	–0.213	–0.054	–0.027	–0.699
CP_Dummy	0.055	0.256	2.258**	0.191***	0.050	1.630**	0.310**	–0.092	3.678**
$Crunch\_Dummy_1$	0.085	–0.304	1.636*	0.042	–0.004	1.017	0.177	0.093	3.325**
$Crunch\_Dummy_2$	0.100	–0.002	–0.376	0.086**	–0.020	–0.263	0.440***	0.115	–0.568
$Crunch\_Dummy_3$	0.113	0.006	1.189*	0.039	0.020	0.442	0.065	0.020	1.221
$Inv_{large,i,t-1}$	–0.207**	1.398***	–3.785***	–0.012	–0.094	–4.147***	–0.021	–1.020***	–8.405***
$Inv_{medium,i,t-1}$	0.053	–2.026***	1.907***	–0.049	–0.561***	2.112***	0.076	0.314**	4.372***
$Inv_{small,i,t-1}$	–0.057	–2.229***	0.598	–0.036	–0.248***	1.110***	–0.351**	–0.489***	1.833**
$Leverage_{large,i,t-1}$	4.192***	–8.816***	27.467***	0.695**	–3.330***	20.973***	1.536*	–5.754***	41.245***
$Leverage_{medium,i,t-1}$	3.802***	7.923***	–1.656	1.315***	1.920***	–0.278	1.595**	1.799***	–2.449
$Leverage_{small,i,t-1}$	1.172***	–4.074***	–9.810***	0.190	–0.923***	–4.205	1.236**	–0.176	–9.379
$Cash\_Flow_{large,i,t}$	–2.050	–12.352**	–17.796**	–0.131	1.541	–14.892**	0.037	8.675***	–42.386***
$Cash\_Flow_{medium,i,t}$	–5.756	29.799***	–40.994**	–2.056	–1.685	–30.250**	–2.196	–20.608***	–50.901
$Cash\_Flow_{small,i,t}$	–0.487	–11.511	6.110	–0.280	–0.937	11.283	–3.769	2.055	9.696
Trend	0.041***	–0.005***	0.056*	0.010***	–0.004***	0.021	0.016***	–0.003	0.031
$Unemployment\_Rate_t$	–0.220***	0.180***	0.744	–0.103***	0.024	0.706*	–0.491***	–0.146**	0.836
ST_Rate	0.006	0.091*	0.279	–0.013	0.020*	0.121	–0.076**	0.004	0.170
LT_Rate	0.098***	0.000	–0.059	0.044***	0.009	–0.044	–0.013	0.003	–0.501
Growth_Rate	2.345**	–2.977	–3.041	0.929*	0.018	–1.374	–0.660	1.792*	–12.237
Q2_Dummy	–0.118**	–0.014	0.379	–0.047	–0.008	0.818*	–0.149*	–0.061	1.752*
Q3_Dummy	–0.142**	–0.073	–0.397	–0.062*	–0.034	0.087	–0.228**	–0.113*	–0.062
Q4_Dummy	–0.037	–0.131	0.158	0.013	–0.015	0.608	–0.045	–0.026	1.168
Constant	–9.400***	5.429***	–14.942*	–1.478**	2.860***	–12.325*	–0.146	5.606***	–13.274
R^2	0.164	0.190	0.690	0.143	0.418	0.639	0.144	0.378	0.666

Note: *** denotes significant at 1 percent, ** denotes significant at 5 percent, and * denotes significant at 10 percent.

Table 21 Short-Term Financial Institution Borrowing

Independent variable	Large			Medium			Small		
	All	Manufacturing	Non-manufacturing	All	Manufacturing	Non-manufacturing	All	Manufacturing	Non-manufacturing
$Tankan_{large}$	–0.001	–0.004**	–0.017**	0.001**	0.000	–0.003	0.001	0.001	–0.026*
$Tankan_{medium}$	–0.003*	0.000	0.021***	–0.001	0.003***	0.010**	–0.010***	0.005***	0.044***
$Tankan_{small}$	0.008***	0.015***	0.022***	–0.003***	–0.002***	0.000	–0.005	–0.007***	0.031**
Bubble_Dummy	0.336***	0.015	0.281	0.164***	0.019	0.215	0.515***	0.045	1.027*
CP_Dummy	0.220	0.043	1.634*	0.079	0.026	0.622*	–0.155	–0.056	0.685
$Crunch\_Dummy_1$	0.215**	–0.070	1.040**	0.030	0.039	0.474	0.242	0.056	2.226***
$Crunch\_Dummy_2$	0.262***	0.155*	0.344	0.169***	–0.002	0.223	0.563***	0.049	0.776
$Crunch\_Dummy_3$	0.247**	0.178*	0.223	0.155***	0.062**	0.244	0.035	0.090	0.280
$Inv_{large,i,t-1}$	–0.045	1.394***	–1.945***	0.170***	–0.142***	–1.495***	0.047	–0.767***	–2.415***
$Inv_{medium,i,t-1}$	0.186	–0.815***	1.302***	0.364***	–0.377***	1.326***	0.567***	–0.276**	2.164***
$Inv_{small,i,t-1}$	0.275***	–1.290***	0.255	0.408***	–0.130**	0.724***	1.157***	–0.125	1.621***
$Leverage_{large,i,t-1}$	13.140***	1.473***	28.490***	2.750***	–1.927***	6.684***	6.370***	–3.951***	11.766***
$Leverage_{medium,i,t-1}$	0.642	0.358	2.463	1.253***	0.006	2.300	1.746**	–1.219***	–0.604
$Leverage_{small,i,t-1}$	3.549***	–2.127***	2.272	0.952***	–0.428***	3.861***	4.166***	0.364	7.597**
$Cash\_Flow_{large,i,t}$	6.939**	–0.317	3.794	0.022	1.220*	–11.322***	–2.981	3.393**	–40.739***
$Cash\_Flow_{medium,i,t}$	–14.091**	8.310	–2.310	3.845	–6.068***	16.525**	10.116	–20.854***	46.540**
$Cash\_Flow_{small,i,t}$	–2.477	–3.593	–20.633***	–1.936	1.226	–14.732***	–9.466	1.581	–36.063***
Trend	0.042***	0.005	0.045***	0.012***	–0.005***	0.008	0.037***	–0.004	0.074**
$Unemployment\_Rate_t$	–0.333***	–0.003	–0.245	–0.128***	0.020	0.053	–0.628***	–0.123***	–0.784
ST_Rate	0.011	0.075***	0.161	–0.010	0.014**	0.056	–0.103***	0.001	0.345
LT_Rate	–0.054	–0.070*	–0.409**	–0.026*	–0.020**	–0.218*	–0.070	–0.037	–0.865**
Growth_Rate	–2.230*	–4.585***	–9.010**	0.391	–0.057	–1.449	0.817	1.386	–12.529
Q2_Dummy	–0.159**	–0.013	0.021**	–0.017	–0.031*	0.570***	–0.048	–0.092**	1.326**
Q3_Dummy	–0.176**	–0.073	–0.124	–0.007	–0.027	0.226	–0.009	–0.105**	0.679
Q4_Dummy	–0.160**	–0.074	–0.241	–0.019	–0.005	0.228	–0.024	–0.036	0.685
Constant	–14.913***	0.786	–25.445***	–4.298***	3.075***	–7.783**	–9.550***	6.554***	–12.349
R^2	0.431	0.208	0.789	0.405	0.458	0.702	0.444	0.396	0.669

Note: *** denotes significant at 1 percent, ** denotes significant at 5 percent, and * denotes significant at 10 percent.

Table 22 Trade Payables: Parsimonious Specification

Independent variable	Large			Medium			Small		
	All	Manufacturing	Non-manufacturing	All	Manufacturing	Non-manufacturing	All	Manufacturing	Non-manufacturing
Tankan	–0.001	0.002**	–0.011***	–0.001	0.001***	–0.004	–0.002	0.002***	0.011
Bubble_Dummy	–0.044	0.158**	–0.288*	–0.023	0.004	–0.060	0.004	0.176***	–0.271
CP_Dummy	0.087	–0.169	0.637***	0.222***	0.024	0.602***	0.338**	–0.164***	1.453***
$Crunch\_Dummy_1$	0.199**	0.067	0.357	0.054	0.016	0.258*	0.129	–0.048	1.621***
$Crunch\_Dummy_2$	0.201***	0.097	0.586***	0.088**	0.008	0.337***	0.474***	0.261***	0.762**
$Crunch\_Dummy_3$	0.220***	0.205**	0.098	0.056	0.055***	0.070	0.204*	0.110**	0.180
$Inv_{i,t-1}$	–0.133**	–0.990***	–0.068	–0.083**	–0.646***	–0.023	–0.345***	–1.086***	–0.965***
$Leverage_{i,t-1}$	4.668***	3.735***	–0.184	1.410***	1.796***	0.926	1.543***	1.165***	1.725
$Cash\_Flow_{i,t}$	–5.282***	–15.890***	–2.209	–2.174*	–1.057*	1.032	–5.867*	–2.563**	–20.638**
Trend	0.033***	0.035***	0.015**	0.008***	0.007***	0.007	0.015***	0.017***	0.000
$Unemployment\_Rate_t$	–0.264***	-0.291***	–0.243**	–0.090***	–0.030**	–0.194**	–0.466***	–0.227***	–1.096***
ST_Rate	0.001	0.054**	–0.058	–0.009	0.022***	0.003	–0.061**	0.004	–0.197
LT_Rate	0.067**	0.015	0.083	0.044***	0.010	–0.002	0.051	0.048***	–0.355*
Growth_Rate	2.707***	3.575***	2.305	0.924*	–0.005	0.282	–2.265*	–1.370***	–8.871*
Q2_Dummy	–0.094**	–0.057	–0.332***	–0.049*	0.002	–0.116	–0.134**	–0.015	–0.580**
Q3_Dummy	–0.095**	–0.043	–0.293**	–0.060**	–0.012	–0.125	–0.243***	–0.076**	–0.907***
Q4_Dummy	0.003	0.021	–0.102	0.015	0.008	0.071	–0.075	–0.053*	–0.304
Constant	–4.436***	–3.416***	3.131	–0.693	–1.577***	1.407	1.662	–1.262***	13.218**
R^2	0.172	0.001	0.061	0.105	0.008	0.000	0.096	0.096	0.200

Note: *** denotes significant at 1 percent, ** denotes significant at 5 percent, and * denotes significant at 10 percent.

Table 23 Short-Term Financial Institution Borrowing: Parsimonious Specification

Independent variable	Large			Medium			Small		
	All	Manufacturing	Non-manufacturing	All	Manufacturing	Non-manufacturing	All	Manufacturing	Non-manufacturing
Tankan	0.001	0.004***	–0.024***	–0.003***	0.001**	–0.016***	–0.013***	0.001**	–0.017**
Bubble_Dummy	0.335***	0.313***	0.256	0.088**	0.055***	–0.030	0.391***	0.113***	1.189***
CP_Dummy	0.504***	–0.186***	1.560***	0.164***	0.009**	0.827***	0.072	–0.108**	0.603
$Crunch\_Dummy_1$	0.465***	0.138**	0.492	0.032	0.036	0.306*	0.260*	–0.043	1.788***
$Crunch\_Dummy_2$	0.417***	0.164***	0.826***	0.173***	0.019***	0.581***	0.576***	0.142***	1.644***
$Crunch\_Dummy_3$	0.324***	0.168***	–0.320	0.125***	0.076***	0.078	0.157	0.126***	–0.351
$Inv_{i,t-1}$	0.550***	0.581***	0.291**	0.781***	–0.156**	0.860***	1.471***	–0.252**	0.672**
$Leverage_{i,t-1}$	12.992***	1.509***	20.560***	2.098***	0.609***	2.559***	4.354***	1.089***	11.443***
$Cash\_Flow_{i,t}$	2.707**	–6.893***	6.490***	1.596	–1.089**	6.617*	–4.185	–3.197**	–24.291***
Trend	0.026***	0.014***	–0.004	0.003*	0.003***	–0.026***	0.016***	0.012***	0.011
$Unemployment\_Rate_t$	–0.249***	–0.141***	–0.326**	–0.079***	–0.006***	–0.073	–0.478***	–0.158***	–1.037***
ST_Rate	0.039	0.059***	–0.023	–0.024***	0.016	–0.097***	–0.131***	0.006	0.017
LT_Rate	–0.125***	–0.055***	–0.365***	–0.024	–0.020**	–0.190***	0.007	–0.025**	–0.787***
Growth_Rate	–4.425***	–0.265	–4.112	0.165	–0.329**	0.713	–0.131	–0.904**	–11.036**
Q2_Dummy	–0.111**	–0.037	–0.429**	–0.017	–0.003	–0.061	–0.090	–0.008	–0.396
Q3_Dummy	–0.046	–0.030	0.023	0.004	–0.006*	0.055	–0.026	–0.049*	–0.310
Q4_Dummy	–0.088*	0.008	–0.267	–0.015	0.009	–0.076	–0.031	–0.034	–0.458
Constant	–10.207***	–1.188**	–9.052***	–1.027***	–0.354***	4.694	–1.292	–0.925***	3.417
R^2	0.418	0.025	0.498	0.282	0.047	0.165	0.327	0.180	0.396

Note: *** denotes significant at 1 percent, ** denotes significant at 5 percent, and * denotes significant at 10 percent.

Irrespective of the interpretation, the bottom line here is that trade payables and short-term financial institution borrowing move in the same direction during the credit crunch periods in most cases. This suggests they work as complements during those periods.

All coefficients on the bubble dummy are negative, and almost all of them are significant in the trade payables per short-term borrowing regression. In most cases, trade payables and short-term financial institution borrowing move in the opposite direction during the bubble period. This suggests that trade credit and short-term borrowing work as substitutes during the bubble period, in contrast to the credit crunch periods. This finding is consistent with our argument in Sections III and IV that different types of financial shocks can affect different lending channels differently. A negative financial shock (e.g., a credit crunch) and a positive financial shock (e.g., a bubble) can affect the trade credit channel and the financial institution channel differently: as a result, the relation between the trade credit and the financial institution (complements or substitutes) can change across the credit crunch periods and the bubble period.

In the parsimonious specification, the coefficients on the *Tankan* index in the trade payable regression and those in the short-term borrowing regression have the same sign within each sector-size category, except for the small firms in the non-manufacturing sector (see Tables 22 and 23). This suggests that the trade credit channel and the financial institution lending channel work as the complements, in almost all sector-size categories, during the normal period. Notice that there is a sharp contrast between the manufacturing sector and the non-manufacturing sector.[28] In the manufacturing (non-manufacturing) sector, both trade payables and short-term financial institution borrowing increase (decrease) when financial institutions become more willing to lend. We argued in Section V.A on the reallocation of financial institution lending that the lending may increase in some industries and firm sizes, while it may decrease in others when financial institutions become more willing to lend. Since trade payables tend to move in the same direction as financial institution borrowing when the financial institution becomes more (or less) willing to lend, the effect of financial institution lending reallocation on SME finance would be magnified by the change in trade credit. This suggests the importance of investigating what drives the reallocation of financial institution lending.

Consistent with the findings on the commercial paper variable, *CP_Dummy,* in the receivables regression we find that the introduction of commercial paper was associated with a larger use of trade credit for small firms.

VI. Conclusion and Future Research

Recent research emphasizes the breadth of lending technologies that are available to minimize financing constraints faced by SMEs. This research has also emphasized that the feasibility and the mix of these lending technologies might differ across countries

28. Ono (2001) and Ogawa (2003) investigate the manufacturing sector only.

with different institutional and legal infrastructures. Missing from this static approach, however, is an analysis of how the mix of these technologies might be affected by macroeconomic conditions and, particularly, financial shocks such as changes in monetary policy, credit crunches, and financial crises. This paper builds on the static notion of lending technologies by introducing the dynamic concept of "lending channels."

A lending channel is a two-dimensional conduit that consists of a specific lending technology provided by a specific type of institution. For example, one lending channel might consist of relationship lending delivered by small banks. There appear to exist at least nine different lending technologies globally (i.e., available at least somewhere in the world) that may be used to underwrite SME lending: relationship lending, financial statement lending, trade credit, equipment lending, real estate-based lending, leasing, factoring, small business credit scoring, and asset-based lending (see BU [2006]). We hypothesize that all of these technologies but the last two were available in Japan during the banking crises. We also hypothesize that there were five types of institutions that delivered one or more of these technologies during the crisis. Furthermore, we hypothesize that during the Japanese banking crises the combination of lending technologies and institution types implied the likely existence of 24 other lending channels.

The primary focus of our paper is to investigate whether financial shocks lead to the contraction of some lending channels that may be offset by an expansion of others. The Japanese banking crisis may be an interesting test of this behavior given the concern that there may have been a contraction of bank credit in the SME sector during this period. Ideally, to test for relative changes in the importance of lending channels during financial shocks, we would use firm-level data on SMEs and firm-level data on lenders. These data would ideally be rich enough to distinguish among the different types of lending channels and how flows changed over time. To the best of our knowledge, no such data exist in the world today. Our data on Japan, however, allows us the opportunity for a limited test.

Using financial statement data on firms that were aggregated into three size categories (small, medium-sized, and large) we could uniquely identify one important lending channel, trade credit extended by corporations. We could also identify a combination of other lending channels—the lending channels provided by banks and nonbanks. We could not, however, distinguish among the many different bank and nonbank lending channels (e.g., relationship lending by small banks, leasing by regional banks, real estate lending by large banks, etc). Nevertheless, we could test for the possibility that during at least some periods of the Japanese banking crisis, the trade credit lending channel expanded relative to the combination of bank and nonbank lending channels, the financial institution lending channel. Such a finding would be consistent with evidence elsewhere that trade credit expands after financial shocks lead to a contraction of bank and nonbank credit. Specifically, there is evidence in the United States that large corporations issue more trade credit funded by commercial paper during periods of monetary tightening (Calomiris, Himmelberg, and Wachtel [1995]). Interestingly our analysis provided some evidence that the supply of trade credit did increase with the introduction of the commercial paper market to Japan independent of the effects of the banking crisis.

On balance, however we generally did not find that the trade credit channel expanded relative to the financial institution lending channel during the Japanese banking crisis, looking at both the extension of trade credit (changes in the level of accounts receivable) and the borrowing of trade credit (changes in the level of trade payables). We found some evidence that the trade credit and the financial institution lending move in the same direction during the Japanese banking crisis periods: the trade credit channel and the financial institution lending channel are complements during those periods. Moreover, we found some evidence that both the trade credit and the financial institution lending significantly increased during the Japanese banking crisis, after controlling for the effects of other explanatory variables. In contrast to complementarity of the trade credit channel and the financial institution lending channel during the credit crunch periods, we found some evidence that the trade credit channel and the financial institution lending channel are substitutes during the bubble period. This finding is consistent with our argument in Sections III and IV that different types of financial shocks can affect different lending channels differently. A negative financial shock (e.g., a credit crunch) and a positive financial shock (e.g., a bubble) can affect the trade credit channel and the financial institution channel differently: as a result, the relation between the trade credit channel and the financial institution channel (complements or substitutes) can change across the credit crunch periods and the bubble period.

Another possibility is that lending channel effects depended on the financial condition of individual firms. It is possible, for example, that the contraction of some of the bank lending channels was limited to credit-constrained firms that might have been particularly vulnerable to financial distress. This might have occurred, for example, if large banks contracted their supply of financial statement lending (i.e., a contraction of the large bank financial statement lending channel)—but *only* to financially constrained SMEs. Unfortunately, identification of financially constrained firms requires at a minimum firm-level data, which were not available to us. More complex measures of financial constraints require panel data (e.g., Fazzari, Hubbard, and Petersen [1988], Kaplan and Zingales [1997], Shikimi [2005], and von Kalckreuth [2006]).

Finally, we note that our data only allow us to uniquely identify one lending channel, the trade credit channel. Therefore, it was not possible to test for changes in most of the hypothesized lending channels during the Japanese banking crisis. This precludes, for example, testing whether regional banks increased their relationship lending to SMEs (i.e., whether the regional bank-relationship channel increased) to offset a decrease in large bank financial statement lending to SMEs. With 31 hypothesized lending channels, a very large number of channels could have been affected by the banking crises—most of which we are unable to observe from our data.

Without data that can clearly identify different lending technologies provided by different lenders, it may not be possible to adequately test our lending channel paradigm. Our empirical analysis here was quite limited and falls considerably short of a full test of the paradigm. Nevertheless, we conjecture that our lending channel paradigm may provide a useful framework for policymakers and bank regulators for analyzing the effects of financial crises on the availability. A growing body of empirical

evidence suggests that lending to SMEs is not delivered in a "one size fits all" package. Moreover, both the academic and practitioner literatures strongly suggest that the menu of the lending technologies is quite extensive—with many of these technologies delivered by organizationally distinct units and quite often by different types of institutions. Thus, our conjecture that lending technologies delivered by specific types of institutions constitute lending channels that may contract or expand in response to financial system shocks seems like a logical extension of the literature on SME credit availability. Better data and further research, however, are required to confirm the empirical and economic significance of our lending channel paradigm.

DATA APPENDIX

A. Financial Statements Statistics of Corporations by Industry (FSSC)

We explain how we use the FSSC in our estimation. In Section A.1, we explain the difference of data availability in the FSSC. In Section A.2, we explain which item(s) of the FSSC we pick up in constructing several variables in our estimation. After picking up the items, we need to adjust "discontinuities" in these items before constructing the variables in our estimation. We explain the adjustment in Section A.3.

1. Difference of data availability

We note that a significant portion of data in the FSSC is available in Japanese but not in English. There are two "versions" of the FSSC: one is an English version, and the other is a Japanese version. Both versions divide sample firms by size of capital stock and industry. In terms of size division, both versions divide firms into three categories, as explained above. In terms of industry division, however, there is a significant difference between these two versions. The English version is a "subset" of the Japanese version in terms of data availability. On the one hand, in the English version of the FSSC, firms are divided just into two sectors, manufacturing and non-manufacturing. On the other hand, in the Japanese version of the FSSC, firms are divided into more refined industries in each of the manufacturing sector and the non-manufacturing sector (e.g., food & beverages, textiles, construction, wholesaling, and so on). Put another way, not all the data available in Japanese are translated into English. Because there is no guarantee that each refined industry in the same sector behaves very similarly in terms of trade credit, we may miss some important information on trade credit if we aggregate such refined data into the manufacturing sector or the non-manufacturing sector. Therefore, we use the refined industry-level data in the Japanese version of the FSSC.

2. Construction of variables

$TR_{b,i,t}$ is the sum of "bills and accounts receivables" and "amounts of notes receivable discounted." The reason why we use the sum of these two items, instead of "bills and accounts receivables" only, is as follows.[29] "Bills and accounts receivables" includes only those that have not been discounted. "Amounts of notes receivable discounted" is the amount of trade notes receivable that has already been discounted but has not become due. If the issuer of the discounted notes (the commodity buyer) defaults on the liabilities, the firm (the commodity seller) is obliged by law to buy back the discounted notes from the bank that discounted them. In other words, the default risk of trade notes belongs entirely to the firm (the commodity seller), even after getting them discounted by banks. Therefore, the sum of "bills and accounts receivables" and "amounts of notes receivable discounted" shows the following: how much credit sellers are providing to their buyers. In contrast, "amounts of notes receivable discounted" shows something quite different: how much money sellers are borrowing from banks in the form of what has been discounted. That is why we use the sum of "bills and accounts receivables" and "amounts of notes receivable discounted" as trade receivables $TR_{b,i,t}$ in our estimation.

29. Here we follow an explanation by Ono (2001).

$TP_{h,i,t}$ is "bills and accounts payable." $ST\_Borrowing_{h,i,t}$ is "short-term bank borrowing." Note that short-term borrowing from *non-banks* is also included in the item "short-term bank borrowing," which is very misleading. That is why we describe $ST\_Borrowing_{h,i,t}$ as "short-term financial institution borrowing" in Table 13 rather than "short-term bank borrowing." $Cash\_Flow_{h,i,t-1}$ is the sum of "ordinary income" and "depreciation."

3. Adjustment for sample discontinuities in the FSSC

There are discontinuities in the quarterly time-series data of the FSSC. These arise from a complete renewal of medium-sized firms and small firms in the sample every April: samples are changed in the first quarter (April to June) of the fiscal year and fixed during the following three quarters. In contrast, large firms are sampled by the complete enumeration method, so that there is no problem of the sample renewal. We correct the effect of sample changes to keep the consistency of time-series data of medium-sized firms and small firms, following the Institute for Social Engineering (1976).

Let $\rho_{t-1,i}$ be the change rate of total assets per firm from the ith quarter of the fiscal year $t-1$ to the fourth quarter of the fiscal year $t-1$ and $n_{t-1,i}$ be the number of firms that are created between the first quarter of the fiscal year $t-1$ and ith quarter of the fiscal year $t-1$, respectively.

$$\rho_{t-1,i} = \left(\frac{A^{end}_{t-1,4}}{NF_{t-1,4}}\right) \Big/ \left(\frac{A^{end}_{t-1,i}}{NF_{t-1,i}}\right)$$

$$n_{t-1,i} = \frac{NF_{t,1} - NF_{t-1,4}}{4} i,$$

where $A^{end}_{t-1,i}$ is the total assets of the first-quarter samples of the fiscal year $t-1$ as of the end of the ith quarter of the fiscal year $t-1$[30] and $NF_{t,i}$ is the number of firms as of the ith quarter of fiscal year t.[31] The total assets per firms that newly enter the samples at the first quarter of fiscal year t are given by

$$\frac{A^{beginning}_{t,1} - A^{end}_{t-1,4}}{NF_{t,1} - NF_{t-1,4}},$$

where $A^{beginning}_{t,1}$ comprises the total assets of the first-quarter samples of fiscal year t as of the beginning of the first quarter of fiscal year t. The discontinuity-adjusted total assets can be calculated as follows.

30. The FSSC contains the figures in the balance sheet for both the beginning and end of each quarter covered for the same sample.
31. We spread out evenly over the past one fiscal year the increment of firms between the fourth quarter in fiscal year $t-1$ and the first quarter in fiscal year t.

$$\tilde{A}^{end}_{t-1,i} = \frac{A^{beginning}_{t,1} - A^{end}_{t-1,4}}{NF_{t,1} - NF_{t-1,4}} \frac{1}{\rho_{t-1,i}} n_{t-1,i} + A^{end}_{t-1,i}$$

$$= \frac{A^{beginning}_{t,1} - A^{end}_{t-1,4}}{NF_{t,1} - NF_{t-1,4}} \frac{(A^{end}_{t-1,i}/NF_{t-1,i})}{(A^{end}_{t-1,4}/NF_{t-1,4})} \frac{NF_{t,1} - NF_{t-1,4}}{4} i + A^{end}_{t-1,i}$$

$$= \left\{ \frac{(A^{beginning}_{t,1} - A^{end}_{t-1,4})}{4A^{end}_{t-1,4}} \frac{NF_{t-1,4}}{NF_{t-1,i}} i + 1 \right\} A^{end}_{t-1,i}.$$

Assuming that balance-sheet variables grow at the same rate between those firms that newly enter the samples and those that have been in the samples since the previous fiscal year, all the balance-sheet variables as of the ith quarter of fiscal year $t-1$ are multiplied by the following multiplier:

$$\frac{(A^{beginning}_{t,1} - A^{end}_{t-1,4})}{4A^{end}_{t-1,4}} \frac{NF_{t-1,4}}{NF_{t-1,i}} i + 1 \qquad \text{(A.1)}$$

Samples of firms with equity less than ¥100 million until the fourth quarter of fiscal 1988 are chosen from the lists as of January of calendar year $t-1$ and fixed throughout the fiscal year t. Following Institute for Social Engineering (1976) to correct for this sample selection lag for the small firms, we multiply all the balance-sheet variables as of the ith quarter of fiscal year $t-1$ by $NF_{t,1}/NF_{t-1,1}$ before we make adjustment of (A.1). Samples of firms with equity less than ¥100 million after the first quarter of fiscal 1989 are chosen from the lists as of October of calendar year $t-1$ and fixed throughout fiscal year t. Therefore, we multiply all the balance-sheet variables as of the ith quarter of fiscal year $t-1$ by $(NF_{t,i}/2 + NF_{t-1,i}/2)/NF_{t-1,i}$ before we make adjustment of (A.1).[32]

B. Short-Term Economic Survey of Enterprises in Japan (*Tankan*)

The survey asks the sample firms if banks are willing (X1), normally ready (X2), or unwilling (X3) to lend to them. Then the diffusion index (DI) for the lending attitude of financial institutions ("accommodative" minus "severe") is calculated as follows.

DI = {Number of firms answering (X1) − number of firms answering (X3)}/{number of respondents}.

32. We follow Hosono (2005).

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