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The Role of Trade Credit for Small Firms: An Implication from Japan's Banking Crisis *

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Abstract

Trade credit is one of the most important sources of short-term external finance for small firms. Previous literature has focused mainly on the substitution of bank loans for trade credit during monetary tightening among many firms, but in this paper we investigate the role of trade credit during the banking crisis in Japan. The basic motivation is to explore whether the substitution hypothesis still holds even under serious financial turbulence. Our main results suggest that the substitution hypothesis held in Japan when the banking sector was healthy, but broke down during the banking crisis. More precisely, both bank loans and trade credit contracted simultaneously during the crisis. Deteriorated bank health might have been primarily responsible for the widespread declines of credit to small and medium size firms in Japan during the banking crisis.

Key words: Trade credit, Bank-firm relationship, Unlisted firms
JEL #: G21, G33,.G32

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1. Introduction

The Japanese economy experienced a prolonged slump after the collapse of the asset price bubble of the late 1980s. Many studies have investigated the reasons why the slump had been so prolonged. Although their conclusions vary, it is widely recognized that the problem of "bad loans" was a major source for "the lost-decade" in Japan. Figure 1 shows the amounts of bad loans (risk management loans) of all banks and major banks from FY1992 to FY2003. It is easy to see that bad loans started to increase in the early 1990s and continued to accumulate until 2001, causing a large amount of losses related to the disposal of non-performing loans. Small and medium companies faced particularly serious problems in finding alternative sources of funding during that financial turbulence.[1] Standard macroeconomic adjustments did not work in solving the prolonged recession under the banking crisis.

The purpose of this paper is to investigate the role of trade credit during the banking crisis in Japan. Trade credit is a short-term loan a supplier provides to its customer upon purchase of a product. In previous literature, it was widely discussed that firms may substitute bank loans with trade credit during monetary tightening. Melzer (1960) showed that during monetary tightening in the United States, firms with relatively large cash balances increased the average length of time for which trade credit was extended. Authors such as Oliner and Rudebusch (1996) and Gertler and Gilchrist (1993) questioned the robustness of Melzer's "substitution hypothesis." However, several recent studies provide further empirical support for the substitution hypothesis (see, for example, Nielsen [2002], and Blasio [2005]). Bank loans are important, but are not the only source of credit for small firms. For firms in poorly developed financial markets, implicit borrowing in the form of trade credit may provide an alternative source of funds.[2] Financially constrained small firms may raise working capital by borrowing more trade credit through delayed payment of their bills.[3]

As in the other industrialized countries, trade credit is a significant part of the balance sheets of Japanese firms. This is particularly true for small firms that cannot rely on commercial paper as an alternative source of short-term credit. Several

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[1] Fukuda, Kasuya, and Akashi (2005) investigated how large impacts impaired bank health had on default risk od small and medium size firms in Japan during the prolonged recession.

[2] Fisman and Love (2002) show that industries with a higher dependence on trade credit financing exhibit higher rates of growth in countries with weaker financial institutions.

[3] The other motive for trade credit is the transaction motive. For example, Ferris (1981) suggested that trade credit reduces the transaction costs of paying bills. Delayed payment can facilitate exchange by allowing the buyer to verify product quality before paying.

authors thus explored whether the substitution hypothesis still holds in Japan (see, for example, Ono [2001], Ogawa [2003], and Uesugi and Yamashiro [2004]). However, after the collapse of the Japanese stock market in the early 1990s, the Japanese banking sector began to face considerable problems, limiting its ability to renew loans and to extend new loans to firms. The problems became especially serious in the late 1990s, when several major financial institutions turned out to be in default. Deteriorating bank health had much larger impacts on small and medium firms, which relied on close banking relationships. It is therefore interesting to explore whether small and medium size firms could substitute bank loans with trade credit even during the prolonged financial crisis in Japan.

Several previous empirical studies conclude that the role of banks in reducing the costs of financial distress did not work when bank health deteriorated in Japan. For example, Gibson (1995) found that firm investment was sensitive to the main bank's rating. Kang and Stulz (2000) showed that firms that relied more on bank finance suffered significantly larger wealth losses during the first three years of the 1990s. Klein, Peek, and Rosengren (2002) found that the financial difficulties of Japanese banks reduced the number of FDI projects by Japanese firms into the United States. During the prolonged financial crisis, the demand for trade credit was thus particularly large for small and medium size firms.

In previous literature, Petersen and Rajan (1997) emphasize that trade credit provides contractual solutions to information problems concerning product quality and buyer creditworthiness. If supplies may have an advantage in some information gathering and monitoring over banks, trade credit may be able to overcome the financial distress of their customers through giving a more stable, informed, and committed source of financing. However, using trade credit for finance can be a limited substitute to bank loans, partly because it is tied to the purchase of goods and partly because the supplier usually requires trade credit repayment, typically within a short period. Furthermore, the customer's trade credit provider is not a finance specialist. Therefore, it may become reluctant to provide trade credit either when the default risk of its customers increases or when its credit availability is tightened.

In the following analysis, we investigate the role of trade credit in substituting declined bank loans under the banking crisis in Japan. The environment and events in Japan provide a "natural experiment" that allows empirical testing. First, because of the importance of the main bank system, many Japanese firms rely more on bank finance. While the role of banks became relatively smaller for larger companies in the 1990s, banks continued to play a dominant role in the financing of smaller firms.

Second, Japan experienced a dramatic collapse in the financial condition of its banking system in the 1990s. We should thus be better able to identify the impacts of negative shocks on default risk when a large amount of losses related to the disposal of non-performing loans damaged the financial health of many banks in the late 1990s. Third, suitable data are available to test the hypothesis based on bank- and firm-level data. We obtained a detailed list of major lenders for each unlisted company from the Tokyo Shoko Research (TSR) Database Service. We then matched borrowers' financial data to the relevant financial data of the "main banks."

In investigating the substitution hypothesis under the banking crisis, we estimate the fixed effect model (within-group estimator) by using unbalanced panel analysis for a sample of 4,555 unlisted Japanese companies in the late 1990s and early 2000s. Given bank health measures, trade credit was negatively correlated with bank borrowings. This implies that, without a banking crisis, the substitution hypothesis is supported for our small and medium size firms in Japan. However, deteriorated bank health has various perverse impacts on trade credit.

In the estimation, we focus on two types of "main" banks for the health measures. One is the "main" bank of the borrowing firm and the other is that of the main trade partner. We show that the bank health of both types had significant impacts on trade credit. Deteriorated bank health will damage borrowers through reducing their potential profitability and through increasing their default risk. The trade credit thus declined when the borrower's main bank faced problems associated with a financial crisis. Deteriorated bank health would also affect the credit availability of the borrower's trade partners. When it risks potential credit availability of trade credit suppliers, it may reduce trade credit to small and medium size firms.

Our paper proceeds as follows. After presenting some macroeconomic evidence in Section 2, Section 3 specifies the basic model, and Section 4 explains our data. Section 5 reports our main empirical results. Section 6 extends the analysis, allowing for some health measures of trade partners. Section 7 explores the impacts of "parent" companies. Section 8 summarizes our main results and considers their implications.

2. Some Macroeconomic Evidence

Before analyzing disaggregated firm-level data, this section uses macro time-series data to view correlations between trade credit and bank loans in Japan. Based on *Financial Statements Statistics of Corporations by Industry,* published by the Ministry of Finance, Figures 2-1 to 2-4 report how trade credit (bills and accounts payable) and

bank loans (short-term borrowings) grew from 1975 to 2004. The data is annual growth rates of trade credit and bank loans to Japanese corporations with different capital sizes in the manufacturing and non-manufacturing sectors. Both figures show that both series have clear-cut cyclical movements, although growth rates declined substantially in the 1990s.

In the figures, it is worthwhile to note that the correlation of the two cyclical series alternated signs during the past decades. The correlation was negative in the 1980s and early 2000s. For example, when pooling the data of corporations of all sizes, the correlation was -0.3405 in the 1980s and -0.6294 in the 2000s for all industries, -0.2224 in the 1980s and -0.3996 in the 2000s for the manufacturing sector, and -0.1324 in the 1980s and -0.6231 in the 2000s for the non-manufacturing sector. These negative correlations suggest that trade credit might have been a major substitutable source of finance in the 1980s and early 2000s.

In contrast, when using the 1980s data, the correlation was positive. For example, when pooling the data of corporations of all sizes, the correlation was 0.1944 for all industries, 0.1125 for the manufacturing sector, and 0.2653 for the non-manufacturing sector. The positive correlations suggest that trade credit, on the contrary, declined simultaneously when bank loans declined in the 1990s. The simultaneous declines of trade credit and bank loans were particularly serious in the late 1990s, when the banking crisis broke out in Japan. In the late 1990s, the lending attitudes of financial institutions became very tight, especially for small and medium companies.

The "Tankan Survey" of the Bank of Japan confirms that the lending attitudes of financial institutions became very tight in the late 1990s. The lending attitudes for large companies were tight, but only temporarily. The tight attitudes for small and medium companies, in contrast, persisted and showed slow recovery throughout the 1990s and early 2000s (see Figure 3). The evidence suggests that, during the financial turbulence, small and medium companies faced serious problems in finding alternative sources of funding that might have been available during previous recessions.

3. The Basic Model

In the following sections, we examine how various measures of bank health changed the amount of trade credit to Japanese unlisted firms. The use of firm-level data of unlisted firms has several advantages in detecting the effects of bank health on the amount of trade credit. First, we should be better able to identify the impacts of shocks to the banking sector on firms that have stronger reliance on bank finance. Second,

reverse causality from firms to banks will be less of a problem in a firm-level regression for unlisted firms than it will be for listed firms. The borrower's performance may affect the bank's financial health if the firm's loans from its bank were relatively large compared to the bank's capital. This is likely for listed firms but less likely for unlisted firms. The use of unlisted firms' data thus allows us to avoid possible simultaneous bias without using ad hoc instrument variables.

The basic equation we estimate in the following analysis is:

$$(1)\quad TC_{i,t}/A_{i,t} = \alpha\, Y_{i,t-1}/A_{i,t-1} + \beta\, \Pi_{i,t-1}/A_{i,t-1} + \gamma\, D_{i,t-1}/A_{i,t-1} + \delta\, Main1_{i,t} + \varepsilon\, Main2_{i,t} + \eta_i,$$

where $TC_{i,t}$ = trade credit (bills and account payable), $A_{i,t}$ = total asset, $Y_{i,t}$ = total sales, $\Pi_{i,t}$ = profits, $D_{i,t}$ = bank borrowings, $Main1_{i,t}$ = main bank's health measures of the borrowing firm, and $Main2_{i,t}$ = main bank's health measures of the borrower's main trade partner. Subscript *i* is the firm index, and subscript *t* denotes time period *t*. Equation (1) may be interpreted as a reduced form of demand and supply functions for trade credit.

The three explanatory variables, $Y_{i,t}$, $\Pi_{i,t-1}$, and $D_{i,t}$ are the financial conditions of the borrowing firm. In the analysis, we normalize them dividing by the total assets. It is natural that the amount of trade credit differs when the firm's financial conditions are different. Even if the total assets are the same, the firm would rely on more trade credit when its total sales are larger. The transaction motive is the basis for a direct relationship between trade credit and the amount of the firm's transactions. We can thus expect the sign of α to be positive. As for proxies of the individual firm's profits, we use operating profits and special losses. To the extent that firms with lower profitability need more trade credit, we expect that $\beta < 0$ for operating profits and $\beta > 0$ for special losses. The coefficient of bank borrowings captures how bank loans are correlated with trade credit. The substitution hypothesis relies on trade credit being an alternative to bank credit as a source of finance. It would be negative when the firms substitute bank loans with trade credit. The estimation examines the existence of negative correlations that control other conditions the firm faced. In the estimation, we include both short-term and long-term borrowings as separate explanatory variables.

Each of the explanatory variables $Main1_{i,t}$ and $Main2_{i,t}$ denotes a vector of health measures of the "main" banks. The health measures are key variables in the following analysis. In the estimation, we focus on two types of main banks for the health measures. One is the main bank of the borrowing firm. Given a close bank-firm

relationship, it is highly possible that the newly deteriorated health of the bank will reduce the borrowers' potential profitability and increase their default risk. To the extent that the trade partners are not financial specialists, the supply of trade credit may thus decline when the borrower's main bank faces problems associated with financial crisis. The other is the main bank of the borrower's main trade partner. Deteriorated health of the "main" bank may affect profitability of the trade partner through various channels. To the extent that it risks potential credit availability, the trade partner would reduce trade credit to small and medium size firms.

There are several alternative proxies to measure bank health. In the following analysis, we use two bank health measures: (i) ratio of nonperforming loans (NPLs) and (ii) stock price. The first measure of bank health is the ratio of NPLs. In Japan, banks sometimes underreported the amount of nonperforming loans on their books to conceal the true extent of their problems. However, nonperforming loans continued to accumulate until 2001, causing huge losses related to the disposal of non-performing loans for the banks. As a result, NPL ratios were regarded as an important indicator of bank health throughout the 1990s and into the early 2000s. In particular, the Japanese government repeatedly warned the banks that it was imperative to solve the non-performing loans problems to recover confidence in Japan's financial system. It is thus highly possible that increases in NPL ratio would increase borrowers' default risk through the tightening of lending attitudes among banks.

The second measure is the bank's stock price, normalized by its book value. Stock prices are indicators that reflect the market valuation of banks. While the ratios of NPLs are backward-looking, stock prices are forward-looking. The forward-looking market valuation of the bank is sometimes volatile and deviates from its economic value. However, the forward-looking measure has a preferable property, since what matters to the firm is the availability of the bank's help if it gets into financial distress.

4. The Data

(i) Data of Financial Variables

To estimate equation (1), we need firm-level data on financial variables, data on the measures of the bank health, information on the "main" bank, and information on major trading partners. We collected the firm-level financial data of Japanese non-financial firms that are *not* listed on any stock exchange in Japan. The data are taken from the Tokyo Shoko Research (TSR) Database Service. The database covers all available financial data of non-financial corporations with capital of 100 million yen and over.

We, however, excluded firms whose relevant financial data were not available for five years in the data set. We also excluded the data of public or semi-public firms, non-profit organizations, firms that had no borrowings from banks, and firms for which relevant financial variables were missing or seemed unreliable. This approach allowed us to use the data of 4,555 Japanese unlisted firms.

Table 1 reports average, standard deviation, minimum, median, and maximum of each financial variable. The standard deviation is generally large, implying that a variety of firms exist in our sample. However, comparing trade credit (bills and accounts payable) with short-term bank loans, we see that averaged trade credit is slightly larger than averaged short-term bank loans when normalized by total assets. This means that trade credit was an important source of external funds for our sampled firms. The profit rate is positive on average, but its standard deviation is very large. Reflecting prolonged recessions during the 1990s, a minimum of profits takes large negative values, while a maximum of special losses takes large positive values. Health measures of the main banks and trade partners also have large standard deviations. Their averages are quite bad, and reflect the banking crisis.

Figure 4 shows scattered charts that plot trade credit (vertical line) and short-term bank loans (horizontal line) to our sampled firms for each fiscal year. Each variable is normalized by total assets, and its logarithm is taken. We can see some negative correlation in the simple correlation. This implies that our sampled unlisted firms tend to rely more on trade credit when they have smaller short-term bank borrowings. However, we can also see a large number of outliers that cannot be explained by a simple substitution hypothesis.

(ii) Data on Measures of Bank Health

As for the two alternative measures of bank health, we constructed the data by the following steps. First, we identified the name of the firm's "main" bank based on *CD Eyes,* supplied by TSR Database Service. *CD Eyes* provides a list of major lenders for each unlisted company for each year. We defined the "main bank" as a bank that appeared first in the list for each year. We then collected the relevant financial data of the "main banks" from *Financial Statements of All Banks,* published by the Japan Bankers Association, *Financial Statements of Shinkin Banks (Credit Cooperatives),* published by the National Association of Shinkin Banks, and *Financial Statements of Shinyo Kumiai (Credit Unions),* published by the Community Bank Shinyo Kumiai. The data set covers the period from 1996 through 2002.

To calculate a proxy for the ratios of NPLs, we used the amount of risk management

loans divided by total loans outstanding. Following the standards set by the Federation of Bankers Associations of Japan, each bank discloses the amount of "risk management loans" each year. Specifically, risk management loans are comprised of "overdue loans" in arrears by three months or more, and "restructured loans" with changes in terms and conditions, as well as loans to borrowers in legal bankruptcy.

In our data set, nearly 60 percent of the "main" banks are either city banks, long-term credit banks, or trust banks, and 33 percent of the main banks are first regional banks. This implies that large banks still play dominant roles as main banks, even for most unlisted firms capitalized at 100 million yen and over in our sample. Almost all of the unlisted firms in our sample, however, borrow from multiple banks; nearly 90 percent of the firms borrow from more than three banks, and nearly 65 percent of the firms borrow from more than five banks.

(iii) Dummy Variables

We added several dummy variables when the relevant bank health measures were missing. These dummy variables are the dummy for firms without a main bank, the dummy for firms that had no trade partners, and the dummies when either NPL ratio or stock price were not available for the main banks. The dummy for firms without a main bank takes a value of one when the firm had no main bank, and zero otherwise. In our sample, about 3 percent of the firms had no main bank. Thus, by definition, we could not obtain our bank health measures for those firms. The dummy for no main-bank firms thus not only captures the effect that a weak bank-firm relation may have, but also identifies the impact that missing bank health measures may cause.

The dummies for no NPL ratio and no stock price take one when the main bank does not provide the corresponding data, and zero otherwise. Even if the firms had a main bank, the main banks may provide neither the data of NPL nor stock prices when they are small, unlisted banks. However, since more than 93 percent of the main banks are either city banks, long-term credit banks, trust banks, or first regional banks, the number of such main banks was very small in our sampled firms.

5. Basic Empirical Results

We estimated the basic equation (1) by the fixed effect model (within-group estimator) with and without time dummies. The use of the fixed effect model controls for firm-specific or industry-specific factors that may affect the amount of trade credit.

The estimation period is from 1997 through 2002.[4] Although data from some corporations were partially missing, we included them by using unbalanced panel analysis. To avoid the problem of instantaneity bias, we took a lag of one period for independent variables except for $Main1_{i,t}$ and $Main2_{i,t}$. The estimation results appear in Table 2.

Before discussing the bank health effects, we discuss whether the selected financial variables of borrowing firms have sensible impacts on trade credit. All types of financial variables—$Y_{i,t}$, $\Pi_{i,t-1}$, and $D_{i,t}$—have statistically significant impacts. The sales-assets ratio has a positive impact, as expected, implying that the firm would rely on more trade credit as its transaction becomes more active. Ordinary profits have a positive impact, while special losses have a negative impact. To the extent that less-profitable firms have smaller internal funds, the trade partner will provide more trade credit when the borrowing firm runs short of liquidity.

The coefficient of the bank borrowing-asset ratio is negative. This is true not only for short-term borrowings but also for long-term borrowings. This implies that our sampled unlisted firms tend to rely more on trade credit when they have smaller short-term and long-term bank borrowings. The result is consistent with the substitution hypothesis, in which firms may substitute bank loans with trade credit. However, when interpreting the coefficient, we need to note that other conditions are controlled for when obtaining a significantly negative sign. In particular, the effects of alternative health measures of the "main" banks are not reflected in the coefficient.

The most noteworthy result in Table 2 is that the alternative measures of the bank health have statistically significant impacts. Without time dummies, the coefficient of the NPL ratio is significantly negative, and that of the stock price is significantly positive both for $Main1_{i,t}$ and $Main2_{i,t}$. This implies that trade credit declined in the late 1990s and early 2000s, when either the "main" bank of the borrowing firm or the "main" bank of the borrower's main trade partner faced financial difficulties. When time dummies are included, the results become less significant. But even with time dummies, the coefficient of the NPL ratio is significantly negative for $Main1_t$ and that of the stock price is significantly positive for $Main2_{i,t}$.

The estimated equation is a reduced form of demand and supply functions for trade credit. We may generally need interpretations from both demand and supply sides. However, it is less likely that the borrower reduces demand for trade credit when bank

[4] Many companies close their books in March, but not all the companies covered by the analysis did so. Data are, thus, arranged on the basis of fiscal year when books were closed.

health is deteriorated. It is thus natural to conclude that the impacts of $Main1_{i,t}$ and $Main2_{i,t}$ reflected shifts of the supply function under the banking crisis. When firms rely on a close bank relationship, it is highly possible that deteriorated bank health will damage the borrowers through reducing their potential profitability and through increasing their default risk. This is particularly true for small and medium size firms which have few alternative sources of finance. The significant impact of $Main1_{i,t}$ implies that trade credit may decline when the borrower's main bank faces problems under financial crisis. Deteriorated bank health would also affect credit availability of the borrower's trade partner. For most of our sampled firms, the major trade partners are large firms that are less likely to face liquidity constrains under monetary tightening. The significant impact of $Main2_{i,t}$, however, suggests that even the large trade partners became conservative in supplying trade credit during the banking crisis. Trade partners are not financial specialists; they did not serve as a lender of last resort when the banking crisis reduced their potential credit availability.

The above results provide a reasonable explanation of why the correlation between trade credit and bank loans became positive in the 1990s. The Japanese banking sector faced considerable problems in the 1990s, which limited its ability to renew loans and to extend new loans to firms. During the banking crisis, the tightened lending attitudes reduced the small and medium size firms' profitability and increased default risk. It also increased the potential risk of liquidity constraints among trade credit suppliers. A firm's creditworthiness should affect how much credit it is offered. Consequently, both bank loans and trade credit contracted simultaneously during the crisis. The substitution hypothesis no longer held for unlisted Japanese companies during the financial turbulence of the late 1990s and early 2000s.

6. The Effects of the Major Trade Partner's Health

In the last section, we showed that deteriorated bank health had perverse effects on trade credit to Japanese unlisted firms. In particular, not only the health of the borrowing firm's bank but also that of its trade partner affected the amount of trade credit under the banking crisis. It is very likely that trade credit declines when its provider's potential credit availability becomes tight. Health of the trade partner's bank would thus affect trade credit when it changes the trade partner's credit availability. However, health of the trade partner may be a more direct measure for credit availability. This section examines whether the health measures of trade partners have additional effects on trade credit to unlisted borrowing firms.

Specifically, we estimate the following equation:

$$(2)\quad TC_{i,t}/A_{i,t} = \alpha\, Y_{i,t-1}/A_{i,t-1} + \beta\, \Pi_{i,t-1}/A_{i,t-1} + \gamma\, D_{i,t-1}/A_{i,t-1} + \delta\, Main1_{i,t} + \varepsilon\, Main2_{i,t} + \phi\, H_{i,t-1} + \eta_i,$$

where $H_{i,t-1}$ = health measures of the major trading partner at period t-1. Except that $H_{i,t-1}$ is included, equation (2) is the same as equation (1).

There are several alternative proxies to measure the trade partner's health. In the following analysis, we use two health measures: (i) ratio of operating profits to total assets and (ii) stock price normalized by its book value. The ratio of operating profit to total asset reflects the trade partner's current profitability. The current operating profit is usually a good predicator for its future profitability. Its lagged value may proxy the amount of internal funds for the trade partner. Stock prices are, in contrast, forward-looking indicators that reflect the market valuation of current and future profitability of the trade partners. We calculated the stock prices by averaging their maximum and minimum in the last period.

We estimated the basic equation (2) by the fixed-effect model (within-group estimator) with and without time dummies. The estimation period is from 1997 through 2002, although we use an unbalanced panel when the data are missing. The estimation results appear in Table 3. The estimated five coefficients, α, β, γ, δ, and ε, were essentially the same as those in Table 2. In particular, the coefficient of the bank borrowing-asset ratio was negative. The result, however, is consistent with the substitution hypothesis only when health measures of the "main" banks are controlled for. As in Table 2, the impacts of $Main1_{i,t}$ and $Main2_{i,t}$ were statistically significant, indicating that trade credit declined in the late 1990s and early 2000s when the main banks faced financial difficulties.

The most noteworthy result in Table 3 is that the health measures of the major trade partner have only limited impacts on trade credit. The profit ratio was not only insignificant but also had the wrong sign. The stock price had a positive impact but its significance level was marginal. The less-significant impacts of H_{t-1} are in marked contrast with significant impacts of $Main2_t$. The deteriorated health of the trade partner's main bank led to a larger reduction of trade credit than that of the trade partner.

One possible explanation for this result is that most borrowing firms have several alternative sources of trade credit from various trade partners. If they substitute with one another, borrowing firms could increase their trade credit from the other trade

partners when the major trade's health deteriorates. In contrast, it is likely that trade partners have a common "main" bank, especially when they have a horizontal relationship. The deteriorated health of the bank would thus have more widespread impacts on trade partners and squeeze trade credit among them.

7. The Role of "Parent" Companies

In general, the relationship with trade partners can be either vertical or horizontal. In terms of information acquisition through transaction, neither type of relationship may make a big difference. However, under a vertical relationship, the "parent" company is not only a trade partner but also a dominant equity holder. The "parent" company may thus have more incentive to reduce the costs of financial distress for their buyers than the other trade partners. If this is the case, trade credit from parent companies may be a way for small firms with better access to alternative credit market. The purpose of this section is to examine whether parent companies play any special role in providing trade credit.

Using a dummy variable, we examined whether parent companies may provide additional trade credit to unlisted borrowing firms. We estimated the following equation:

$$(3)\quad TC_{i,t}/A_{i,t} = \alpha\, Y_{i,t-1}/A_{i,t-1} + (\beta + \eta Dummy_{i,t})\, \Pi_{i,t-1}/A_{i,t-1} + \gamma\, D_{i,t-1}/A_{i,t-1} + \delta\, Main1_{i,t} + \varepsilon\, Main2_{i,t} + \phi\, H_{i,t-1} + \varphi\, Dummy_{i,t} + \eta_i,$$

where $Dummy_{i,t}$ = dummy variable for "parent" companies at period *t*. The dummy variable takes one when the major trade partner is a major stock holder and zero otherwise. We include $Dummy_{i,t}$ not only as a constant term dummy but also as a coefficient dummy of $\Pi_{i,t-1}/A_{i,t-1}$. Except for the fact that the $Dummy_{i,t}$'s are included, equation (3) is essentially the same as equation (2). However, since the profit-total asset ratio of the major trade partner was not significant, we did not use it for $H_{i,t-1}$.

Table 4 reports the estimation results. The estimated six coefficients, α, β, γ, δ, ε, and ϕ, are essentially the same as those in Table 3. We can conclude that the substitution hypothesis holds only when the main banks are healthy and that trade credit declines when the main banks face financial difficulties.

The coefficient of $Dummy_{i,t}$ is positive but not statistically significant when it is included as a constant dummy. This indicates that "parent" companies may provide slightly larger trade credit than the other trade partners, but the difference is very

small. In contrast, $Dummy_{i,t}$ has a significantly negative impact when we include it as a coefficient dummy of the profit-asset ratio. The magnitude of the parent company impact is more than three times as large as that of the non- parent company impact. A decline of the profit-asset ratio generally increases trade credit because firms with smaller cashflow need more credit. But the significant coefficient dummy implies that "parent" companies increase more credit when the borrower's profit declines. To the extent that less-profitable firms have smaller internal funds, parent companies may be a special trade credit provider when the borrowing firm runs short of liquidity.

The above results suggest that at least part of the pattern of trade credit can be explained by the existence of "parent companies." To check the robustness of this hypothesis, it is constructive to include more coefficient dummies. Table 5 reports the estimation results when adding $Dummy_{i,t}$ to $Main1_{i,t}$ and $Main2_{i,t}$ as coefficient dummies. The constant dummy was excluded because it remained insignificant. In the estimation without a time dummy, the stock price of the borrower's main bank was significantly negative. This may suggest marginal evidence that the parent company may increase its trade credit when the borrowing firm's main bank faced problems. However, the other coefficient dummies are not significant. None of the coefficient dummies was significant with time dummies. When bank health deteriorated, the role of "parent" companies, if there is any role at all, is very limited in substituting declined bank loans.

8. Conclusions

Trade credit is one of the most important sources of short-term external finance for small firms. Trade credit may provide access to capital for firms that are unable to raise it through more traditional channels. Suppliers may be better than specialized financial institutions in evaluating and controlling the credit risk of their buyers. If this is the case, trade credit may be a way for small firms with better access to credit markets. In this paper, we investigated the role of trade credit during the banking crisis in Japan. The basic motivation was to explore whether the substitution hypothesis still holds, even under serious financial turbulence. Our main results suggest that the substitution hypothesis held in Japan when the banking sector was healthy, but did not hold during the banking crisis. Rather, both bank loans and trade credit contracted simultaneously during the crisis. Using trade credit for finance can be a limited substitute to bank loans partly because it is tied to the purchase of goods and partly because the supplier usually requires trade credit repayment within a short

period. Furthermore, the customer's trade credit provider is not a finance specialist. Therefore, it may become reluctant to provide trade credit either when the default risk of its customers increases or when its own credit availability is tightened.

One may argue that deteriorated bank health caused misallocation of credit not only through a credit crunch, but also through "evergreening" lending. For example, Peek and Rosengren (2005) showed that troubled Japanese banks allocated credit to severely impaired borrowers to avoid the realization of losses on their own balance sheets.[5] It was probably true that troubled banks increased lending to some insolvent large firms. However, it was less likely that they did so to small firms whose impacts on the banks' balance sheets were negligible. Fukuda, Kasuya, and Nakajima (2006) showed that evergreening lending did not prevail among small and medium size firms, whose credit quality is especially important in determining whether credit is offered. Deteriorated bank health may be primarily responsible for the widespread declines of credit to small and medium size firms in Japan seen during the banking crisis.

[5] In addition, Caballero, Hoshi, and Kashyap (2006) confirmed that zombie-dominated industries exhibit more depressed job creation, lower productivity, and greater excess capacity. Fukuda and Koibuchi (2006) found that a lack of "shock therapy" was a source of the prolonged bad loan problem during Japan's banking crisis.

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Table 1. Basic Statistics of the Financial Data

	average	standard deviation	maximum	minimum
(Bills and Accounts Payable)/Total Assets	25.3	16.1	114.2	0.04
Sales/Total Assets	134.7	79.9	1353.8	1.4
Short-term Bank Loan/Total Assets	22.6	15.5	250.7	0.0004
Long-term Bank Loan/Total Assets	19.1	17.7	658.8	0.0006
Operating Profit/Total Assets	2.3	4.0	40.5	-99.0
Special Loss/Total Assets	1.9	4.9	396.7	0.00001
The Main Bank's Non-Performing Loan (NPL) Ratio	6.8	4.2	52.4	0.2
The Main Bank's Stock Price	572.2	414.1	1790.0	57.0
The Major Trade Partner's Operating Profit/Total Assets	2.1	2.9	35.5	-20.7
The Major Trade Partner's Average Stock Price	289.1	804.3	17450.0	10.0
NPL Ratio of the Major Trade Partner's Main Bank	6.5	3.1	53.2	0.3
Stock Price of the Major Trade Partner's Main Bank	755.4	449.9	1790.0	57.0

Note) The Major Trade Partner's Average Stock Price＝(Maximum Stock Price + Minimum Stock Price)/2.

Table 2. Basic Estimation Results

Dependent Var. = (Bills and Accounts Payable)/Total Assets	Coef.	(standard err.)		Coef.	(standard err.)	
Sales/Total Assets	0.0231	(0.0016)	**	0.0211	(0.0016)	**
Short-term Bank Loan/Total Assets	-0.0487	(0.0060)	**	-0.0490	(0.0060)	**
Long-term Bank Loan/Total Assets	-0.0546	(0.0056)	**	-0.0592	(0.0055)	**
Operating Profit/Total Assets	-0.0689	(0.0130)	**	-0.0839	(0.0129)	**
Special Loss/Total Assets	0.0460	(0.0081)	**	0.0547	(0.0080)	**
The Main Bank's Non-Performing Loan (NPL) Ratio	-0.0350	(0.0109)	**	-0.0218	(0.0103)	*
The Main Bank's Stock Price/1000	0.0076	(0.0015)	**	-		
NPL Ratio of the Major Trade Partner's Main Bank	-0.0569	(0.0156)	**	-		
Stock Price/1000 of the Major Trade Partner's Main Bank	0.0120	(0.0014)	**	0.0036	(0.0014)	*
Time Dummy (1997)				0.0231	(0.0014)	**
Time Dummy (1998)				0.0102	(0.0014)	**
Time Dummy (1999)				0.0133	(0.0014)	**
Time Dummy (2000)				0.0179	(0.0012)	**
Time Dummy (2001)				0.0007	(0.0012)	
No Main Bank (MB) Dummy	0.0148	(0.0036)	**	0.0058	(0.0032)	
Unknown Dummy (the Main Bank's NPL Ratio)	0.0011	(0.0023)		0.0006	(0.0020)	
Unknown Dummy (the Main Bank's stock Price)	0.0018	(0.0018)		-		
Unknown Dummy (the Major Trade Partner)	0.0044	(0.0021)		0.0017	(0.0017)	
Unknown Dummy (NPL Ratio of Trade Partner's MB)	-0.0142	(0.0039)	**	-		
Unknown Dummy (Stock Price of Trade Partner's MB)	0.0091	(0.0020)	**	0.0029	(0.0018)	

Note: **,* denote staristical significance at the 1%,5% levels respectively.

Table 3. Estimation Results with Trade Partner's Health Measures

Dependent Var. = (Bills and Accounts Payable)/Total Asset	Coef.	(standard err.)		Coef.	(standard err.)	
Sales/Total Assets	0.0230	(0.0016)	**	0.0210	(0.0016)	**
Short-term Bank Loan/Total Assets	-0.0486	(0.0060)	**	-0.0490	(0.0060)	**
Long-term Bank Loan/Total Assets	-0.0547	(0.0056)	**	-0.0593	(0.0055)	**
Operating Profit/Total Assets	-0.0699	(0.0131)	**	-0.0843	(0.0129)	**
Special Loss/Total Assets	0.0464	(0.0081)	**	0.0548	(0.0080)	**
The Main Bank's Non-Performing Loan (NPL) Ratio	-0.0360	(0.0109)	**	-0.0220	(0.0103)	*
The Main Bank's Stock Price/1000	0.0071	(0.0016)	**	-		
The Major Trade Partner's Operating Profit/Total Assets	-0.0082	(0.0258)		-0.0038	(0.0256)	
The Major Trade Partner's Average Logged Stock Price	0.0009	(0.0004)	*	0.0005	(0.0004)	
NPL Ratio of the Major Trade Partner's Main Bank	-0.0592	(0.0156)	**	-		
Stock Price/1000 of the Major Trade Partner's Main Bank	0.0104	(0.0015)	**	0.0037	(0.0015)	*
Time Dummy (1997)				0.0233	(0.0015)	**
Time Dummy (1998)				0.0105	(0.0015)	**
Time Dummy (1999)				0.0137	(0.0014)	**
Time Dummy (2000)				0.0183	(0.0014)	**
Time Dummy (2001)				0.0011	(0.0013)	
No Main Bank (MB) Dummy	0.0150	(0.0036)	**	0.0058	(0.0032)	
Unknown Dummy (the Main Bank's NPL Ratio)	0.0007	(0.0023)		0.0006	(0.0020)	
Unknown Dummy (the Main Bank's stock Price)	0.0013	(0.0018)		-		
Unknown Dummy (the Major Trade Partner)	0.0058	(0.0027)		0.0038	(0.0024)	
Unknown Dummy (the Trade Partner's Profit)	0.0026	(0.0023)		0.0018	(0.0023)	
Unknown Dummy (the Trade Partner's Stock Price)	0.0016	(0.0026)		0.0043	(0.0027)	
Unknown Dummy (NPL Ratio of Trade Partner's MB)	-0.0134	(0.0039)	**	-		
Unknown Dummy (Stock Price of Trade Partner's MB)	0.0074	(0.0021)	**	0.0030	(0.0019)	

Note: **,* denote staristical significance at the 1%,5% levels respectively.

Table 4. Estimation Results with "Parent" Company Dummy I

Dependent Variable = (Bills and Accounts Payable)/Total Assets	Coef.	(standard err.)		Coef.	(standard err.)	
Sales/Total Assets	0.0228	(0.0016)	**	0.0209	(0.0016)	**
Short-term Bank Loan/Total Assets	-0.0488	(0.0060)	**	-0.0491	(0.0060)	**
Long-term Bank Loan/Total Assets	-0.0558	(0.0056)	**	-0.0604	(0.0055)	**
Operating Profit/Total Assets	-0.0602	(0.0134)	**	-0.0745	(0.0132)	**
(Operating Profit/Total Asset)*Parent Company Dummy	-0.1547	(0.0458)	**	-0.1556	(0.0451)	**
Special Loss/Total Assets	0.0475	(0.0081)	**	0.0559	(0.0080)	**
Parent Company Dummy	0.0002	(0.0029)		0.0023	(0.0029)	
The Main Bank's Non-Performing Loan (NPL) Ratio	-0.0364	(0.0109)	**	-0.0223	(0.0103)	*
The Main Bank's Stock Price/1000	0.0071	(0.0015)	**	-		
The Major Trade Partner's Average Logged Stock Price	0.0006	(0.0003)	*	0.0003	(0.0003)	
NPL Ratio of the Major Trade Partner's Main Bank	-0.0585	(0.0156)	**	-		
Stock Price/1000 of the Major Trade Partner's Main Bank	0.0103	(0.0015)	**	0.0036	(0.0015)	*
Time Dummy (1997)				0.0233	(0.0015)	**
Time Dummy (1998)				0.0104	(0.0015)	**
Time Dummy (1999)				0.0136	(0.0014)	**
Time Dummy (2000)				0.0183	(0.0014)	**
Time Dummy (2001)				0.0011	(0.0013)	
No Main Bank Dummy	0.0148	(0.0036)	**	0.0057	(0.0032)	
Unknown Dummy (the Main Bank's NPL Ratio)	0.0006	(0.0023)		0.0005	(0.0020)	
Unknown Dummy (the Main Bank's stock Price)	0.0013	(0.0018)		-		
Unknown Dummy (the Major Trade Partner)	0.0042	(0.0023)		0.0026	(0.0018)	
Unknown Dummy (the Trade Partner's Stock Price)	-0.0001	(0.0022)		0.0030	(0.0023)	
Unknown Dummy (NPL Ratio of Trade Partner's Main Bank)	-0.0135	(0.0039)	**	-		
Unknown Dummy (Stock Price of Trade Partner's Main Bank)	0.0076	(0.0021)	**	0.0031	(0.0019)	

Note: **,* denote staristical significance at the 1%,5% levels respectively.

Table 5. Estimation Results with "Parent" Company Dummy II

Dependent Variable = (Bills and Accounts Payable)/Total Assets	Coef.	(standard err.)		Coef.	(standard err.)	
Sales/Total Assets	0.0228	(0.0016)	**	0.0209	(0.0016)	**
Short-term Bank Loan/Total Assets	-0.0486	(0.0060)	**	-0.0491	(0.0060)	**
Long-term Bank Loan/Total Assets	-0.0560	(0.0056)	**	-0.0603	(0.0055)	**
Operating Profit/Total Assets	-0.0597	(0.0133)	**	-0.0750	(0.0132)	**
(Operating Profit/Total Asset)*Parent Company Dummy	-0.1624	(0.0460)	**	-0.1508	(0.0446)	**
Special Loss/Total Assets	0.0476	(0.0081)	**	0.0558	(0.0080)	**
The Main Bank's Non-Performing Loan (NPL) Ratio	-0.0345	(0.0110)	**	-0.0225	(0.0108)	*
(The Main Bank's NPL Ratio)*Parent Company Dummy	-0.0234	(0.0411)		-		
The Main Bank's Stock Price/1000	0.0076	(0.0016)	**	-0.0014	(0.0017)	
(The Main Bank's Stock Price/1000)*Parent Company Dummy	-0.0110	(0.0051)	*	-0.0013	(0.0036)	
The Major Trade Partner's Average Logged Stock Price	0.0006	(0.0003)	*	0.0003	(0.0003)	
NPL Ratio of the Major Trade Partner's Main Bank (MB)	-0.0639	(0.0160)	**	-		
(NPL Ratio of the Trade Partner's MB)*Parent Company Dummy	0.0729	(0.0441)		-		
Stock Price/1000 of the Major Trade Partner's Main Bank (MB)	0.0102	(0.0015)	**	0.0038	(0.0015)	*
(Stock Price of the Trade Partner's MB)*Parent Company Dummy	0.0049	(0.0040)		-		
Time Dummy (1997)				0.0238	(0.0016)	**
Time Dummy (1998)				0.0110	(0.0016)	**
Time Dummy (1999)				0.0141	(0.0015)	**
Time Dummy (2000)				0.0187	(0.0014)	**
Time Dummy (2001)				0.0014	(0.0014)	
No Main Bank Dummy	0.0152	(0.0036)	**	0.0062	(0.0036)	
Unknown Dummy (the Main Bank's NPL Ratio)	0.0006	(0.0023)		0.0006	(0.0023)	
Unknown Dummy (the Main Bank's stock Price)	0.0012	(0.0018)		-0.0016	(0.0018)	
Unknown Dummy (the Major Trade Partner)	0.0039	(0.0023)		0.0027	(0.0018)	
Unknown Dummy (the Trade Partner's Stock Price)	-0.0001	(0.0023)		0.0030	(0.0023)	
Unknown Dummy (NPL Ratio of Trade Partner's Main Bank)	-0.0140	(0.0039)	**	-		
Unknown Dummy (Stock Price of Trade Partner's Main Bank)	0.0078	(0.0021)	**	0.0032	(0.0019)	

Note: **,* denote staristical significance at the 1%,5% levels respectively.

Figure 1. Risk Management Loans

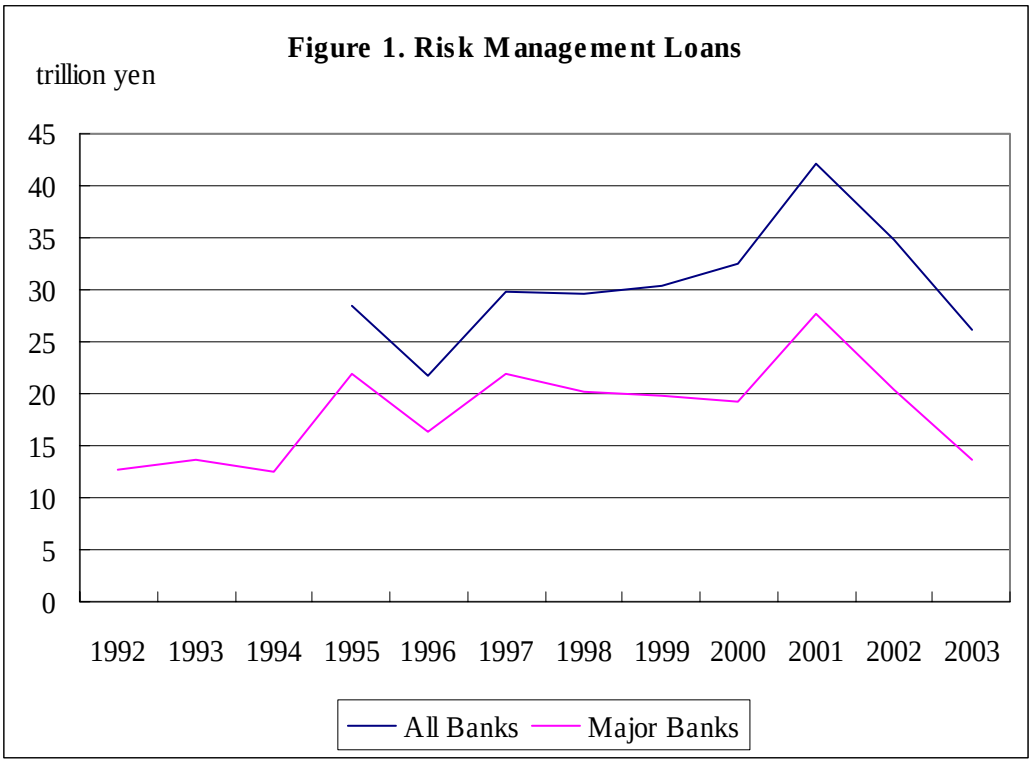

Figure 2-1. Trade Credit and Bank Loans:
All size corporations in all industries

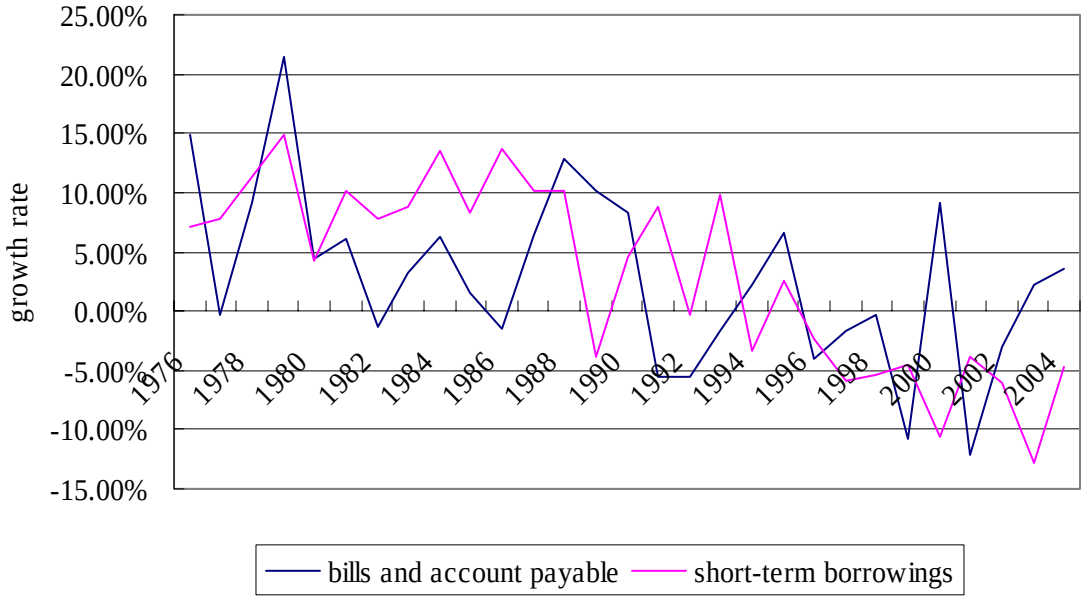

Figure 2-2. Trade Credit and Bank Loans:
All size corporations in manufacturing sector

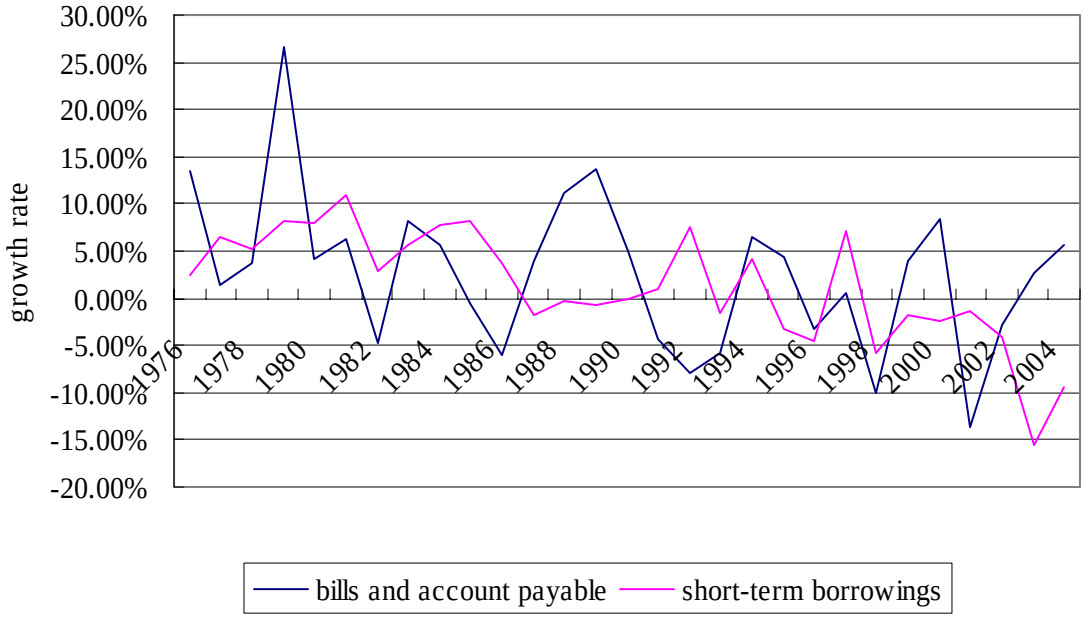

Figure 2-3. Trade Credit and Bank Loans:
All size corporations in non-manufacturing sector

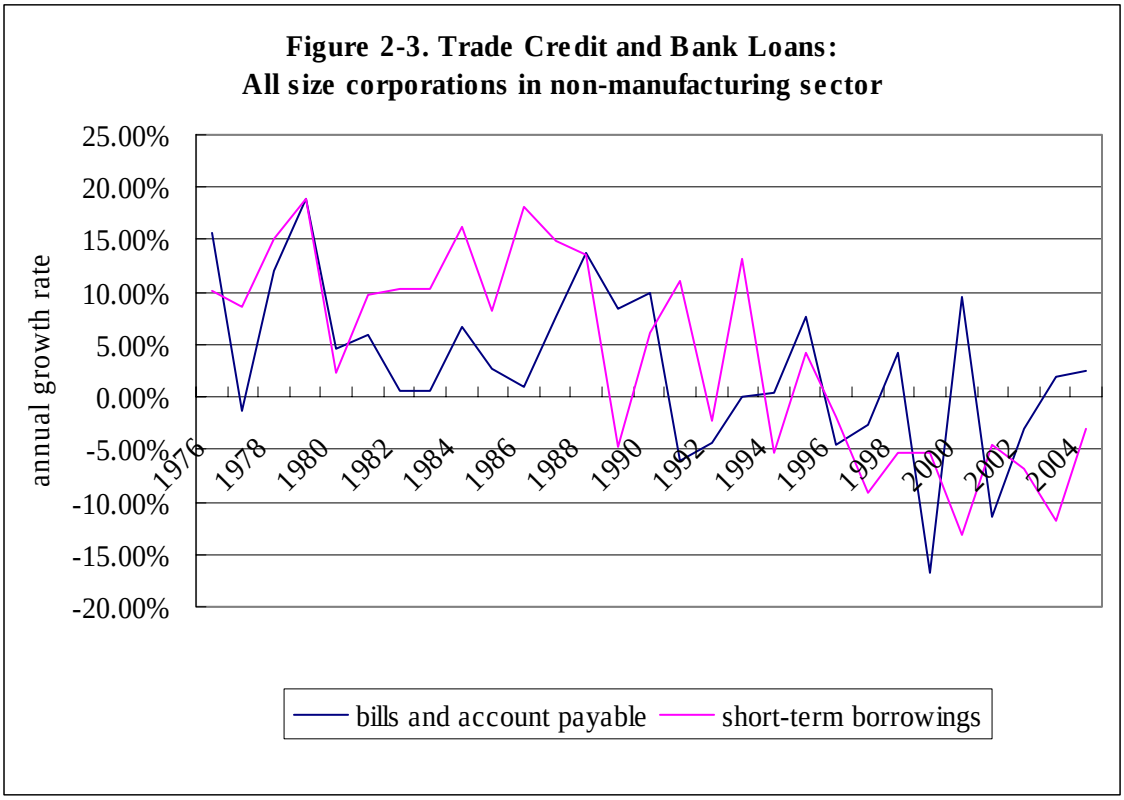

Figure 3. The "Tankan" DI: Lending Attitudes

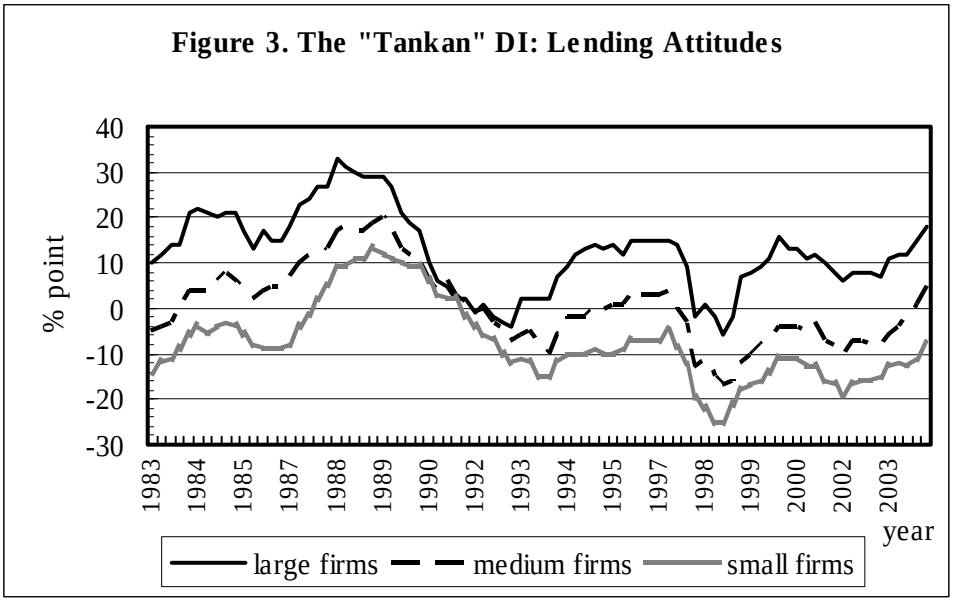

Figure 4. Simple Correlation between Trade Credit and Bank Loan