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# Repayment Enforcement and Informational Advantages: Empirical determinants of trade credit use

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# Repayment enforcement and informational advantages: Empirical determinants of trade credit use

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Abstract

Using unique data we test various trade credit theories and find the following. First, the length of a buyer-seller relationship has a positive impact on the use of trade credit, especially for longer-term credit. In contrast, short-term trade credit is extended based on buyers' hard information. Second, trade credit is more frequently used for transactions in differentiated goods, and the relative bargaining power between the buyer and the seller also matters for the use/non-use of trade credit. Third, we find that the reduction of transaction costs is an important determinant of the use of trade credit. We interpret these findings in light of various theories of trade credit.

Keywords: Trade credit, transaction costs, information production, relationships, signaling, collateral, repayment enforcement
JEL classification codes: G32, M41



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## 1. Introduction

This paper investigates the determinants of the use of trade credit, which is one of the main sources of financing for firms. In the United States the ratio of accounts payable to total assets is 20% for small and medium-sized enterprises (SMEs), while in Japan it is 12.7% for large firms and 15.0% for small firms.[2] Reflecting this widespread use of trade credit, a large body of theoretical literature providing a variety of explanations for the use of trade credit has developed. Similarly, there is an abundance of empirical studies seeking to discover the motives underlying the use of trade credit.

Yet, because of the lack of detailed data, existing empirical studies suffer from various shortcomings.[3] By using a unique dataset from a survey in Japan, we try to overcome these shortcomings and provide direct evidence on the determinants of trade credit use. We analyze about 2,000 firms' use or non-use of trade credit with respect to their transactions with their main suppliers. As the survey captures different aspects of inter-firm transactions, we test different theories of trade credit. We also identify the main suppliers of these firms, which enables us to identify demand as well as supply factors.

Furthermore, we also exploit a relatively unique institutional feature of the trade credit market in Japan. That is, similar to business practices in other countries, buyer firms in Japan ordinarily receive invoices from their suppliers and settle payments by bank transfer (wire transfer) or by sending checks; however, in Japan, as in some other Asian countries,[4] there exists another method of payment: promissory bills issued by buyers. The typical duration until the maturity of such promissory bills is three months longer than the trade credit involved in the use of bank transfers, which is about a month. We can thus infer which determinants

[2] The figure for the United States is from the 1998 Survey of Small Business Finance reported in Giannetti et al. (2008), while the figures for Japan are from the *Financial Statements Statistics of Corporations by Industry* (Ministry of Finance, Government of Japan).
[3] A detailed critical survey of existing studies is provided in Section 4.
[4] Examples are Korea and Taiwan.

influence the use of short-term or long-term trade credit by examining how firms use these two distinct types of credit payment (i.e., bank transfers or promissory bills).

Examining the factors that contribute to the use of trade credit, we find the following. First, the length of the relationship between buyers and sellers has a positive impact on the use of long-term trade credit. This result is consistent with the informational advantage hypothesis that attributes the use of trade credit to sellers' superior information.[5] Also, buyer firms' observable creditworthiness has a significant positive impact on the use of short-term trade credit. This implies that short-term trade credit is similar to banks' transaction-based lending rather than relationship lending.[6]

Second, we find that long-term trade credit is more frequently used when transactions between the buyer and the supplier involve differentiated goods. This finding is consistent with the moral hazard hypothesis, which predicts that transactions in differentiated goods make it more costly for the buyer to engage in opportunistic behavior because it is difficult for the buyer to use such goods for purposes other than those originally intended (the diversion hypothesis: Burkart and Ellingsen 2004), or because these transactions increase the cost of switching (replacing) sellers (the switching cost hypothesis: Cuñat 2007). However, we also find that trade credit is less frequently used when the supplier is irreplaceable for the buyer, which is inconsistent with the switching cost hypothesis and lends support to the diversion hypothesis. This finding, in turn, is consistent with the bargaining power hypothesis, which predicts that the stronger the buyer's bargaining power vis-à-vis the seller, the more likely is the use of trade credit. Our finding that the use of trade credit depends on the relative size of buyer and seller firms is also consistent with this interpretation.

Third, in addition to these factors we find evidence that there is a purely transactional

[5] Theories of trade credit are presented in detail in Section 4.
[6] For details on transaction vs. relationship lending by banks, see Stein (2002) and Berger and Udell (2002).

(non-financial) reason for the use of trade credit. That is, we find that long-term trade credit is more frequently used as the number of days needed for paperwork increases. This finding is consistent with the transaction cost hypothesis, which suggests that firms aim to reduce transaction costs by deferring payments.

Using a unique dataset, this paper adds to the empirical literature examining various trade credit theories. Some preceding studies on trade credit employ variables from firms' financial statements, which are only remotely linked to the determinants of trade credit we would like to examine and make it difficult to identify the true determinants. Other studies use good proxies for the determinants of trade credit use, but each of these studies examines only one or two hypotheses rather than examining a wide spectrum of hypotheses on trade credit all at once.[7]

Two recent studies mark an important departure from these approaches. The first is Giannetti et al. (2008), which tests different hypotheses from multiple angles. However, this study still suffers from a lack of information on the trading counterparties, which not only makes it difficult to distinguish supply and demand factors but also produces an omitted variables problem.[8] The second study is Klapper et al. (2010), which uses firm-level data linking buyer and seller information. However, because their variables are limited in number and in quality, the level of detail at which they can test different trade credit theories is limited when compared with Giannetti et al. (2008) or our study, as will be elaborated further below. Furthermore, the buyers (borrowers) in their dataset consist of 56 very large global companies, so that some of the theories do not appear relevant to such buyers (such as theories based on the assumption that the seller has an informational advantage). In contrast, our sample, which

[7] Examples include Bougheas et al. (2009), Long et al. (1993), Deloof and Jegers (1996), Cuñat (2007), McMillan and Woodruff (1999), Johnson et al. (2002), Fisman and Raturi (2004), and Uchida et al. (2008). See Section 4 for more details.

[8] Following Petersen and Rajan (1997), Giannetti et al. (2008) try to resolve this problem using an elaborated methodology, but they nevertheless use only information on either buyers or sellers at any one time.

includes many small and medium buyers, does not limit the theories we can test.

The remainder of the paper is organized as follows. Section 2 provides a description of the data we use. Section 3 then explains trade credit practices in Japan, presents the model to be estimated here, and introduces our dependent variables. Next, Section 4 provides an overview of different theories of trade credit use, reviews existing empirical findings, and shows the explanatory variables we employ to test each of these theories. Section 5 reports the results, while Section 6 extends our empirical analysis by taking into account different terms of trade credit including the trade credit period, an early payment discount, a late payment penalty, and collateral. Section 7 concludes the paper with an extensive discussion of our findings.

## 2. Data

The data used in this study are from the *Survey on Transactions with Firms and Financial Institutions* conducted by RIETI in February 2008 (referred to as the "RIETI survey" hereafter). This survey asks firms about their characteristics, their relationships with their main suppliers, the payment terms, and their relationships with their banks. The survey questionnaire was sent to 17,018 firms chosen from among firms that had responded to previous government surveys compiled by the Small and Medium Enterprise Agency.[9] The number of firms that responded is 6,079 (35.7%).

This survey has three notable features when it comes to testing trade credit theories. First, the main supplier of the responding firm is identified as the supplier from which the responding firm purchases the most, and rich information about the identified supplier-customer relationship is available. Second, the survey asks responding firms to specify the goods that they primarily purchase from their main suppliers, and we can thus identify whether these

[9] All these firms are in the database of Tokyo Shoko Research (TSR), a business database company that maintains information on more than 1.2 million Japanese firms.

goods are either differentiated or standardized. This enables us to construct – but in a more reliable manner – the same variables as those used by Giannetti et al. (2008). Finally, the survey also asks firms about their relationship with their primary (lending) financial institution, allowing us to examine how bank-firm relationships affect the provision of trade credit.

Based on this survey, we construct a variety of variables to test different theories of trade credit and control variables, which we explain in the next section. Because of occasional missing answers, however, using all these variables reduces the number of sample firms from the original 6,079 firms (= total number of respondents) to 1,770 firms, which constitute our base sample. Compared with the initial 6,079 firms, these 1,770 firms are on average slightly larger and older.

## 3. Empirical approach

Our approach is to run a regression where the dependent variable represents the use of trade credit and the independent variables are proxies for different motives underlying the use of trade credit as well as control variables. The remainder of this section describes trade credit practices in Japan, followed by an explanation of our dependent variables and the regression model. Our independent variables, together with the underlying theories, are presented in Section 4.

### 3.1 *Trade credit practices in Japan*

Corporate payments in Japan from a buyer's perspective typically proceed in the following manner.[10] Suppose the buyer makes a purchase and the product is delivered to the buyer at $t = t_d$. It then takes time for the seller to complete the necessary paperwork, issue an invoice, and present the invoice to the buyer (say, $t = t_i$). Accounts payables/receivables (open account

[10] See Emery and Ariga (1996) for more information.

debts/credit) are recorded on the buyer's/seller's book either on $t_d$ or on $t_i$.[11]

After a certain credit period, the buyer makes a payment on the *payment day*. Payment is usually made electronically by *bank transfer* (or wire transfer), that is, a transfer from the buyer's checking account to the seller's account.[12] Once the transfer is made on the payment day, the seller can immediately withdraw the cash.

In Japan, there is however another method of payment, a payment using a *promissory bill* (promissory note, or *tegata* in Japanese). In the case of promissory bills, the buyer issues, and the seller receives, a bill after an invoice is issued. At or after the due date of the bill, the seller deposits the bill at a bank, the bank takes the bill to a regional clearinghouse (which is run by banks and is open every business day), and the bill is settled and cleared through the bank settlement system.[13] One important difference between bank transfer and a promissory bill is that the former is processed electronically while the latter is paper-based.[14] The maturity of promissory bills is long, which is also one of the major differences between the two forms of credit payment. The RIETI survey shows that the credit period in the case of promissory bills is on average 3-4 months longer than in the case of bank transfers: the mean (median) length of credit period for bank transfer is 51 (45) days, while that for promissory bills is 157 (155) days. The use of promissory bills as a method of payment is not unique to Japan. For example, they are also being used in a few other Asian countries such as Korea and Taiwan.[15] Moreover, a

[11] This is an open account credit (debt), which is the most common form of trade credit in many countries. The evidence of a buyer's indebtedness is the seller's entry of the transaction in the sales ledger for that customer (Emery and Ariga 1996).

[12] Interviews with practitioners suggest that the use of checks as a method of payment on the payment day is very rare. As checks are immediately refundable, they are used as an alternative to immediate cash payment (i.e., not for credit payment).

[13] Promissory bills and checks share similar characteristics. Both are paper-based and are cashed at a bank. One important difference is that checks can be cashed on demand, whereas promissory bills cannot be cashed until their due date.

[14] Once the bill is issued, the accounts payables (receivables) are turned to bills payables (receivables) on buyer's (seller's) book and the bill serves as evidence of a buyer's indebtedness.

[15] In Korea, about 30-35% (35-40%) of trade credit during the period 1990-1995 consisted of bills receivables (payables) (Bank of Korea, *Financial Statement Analysis*, various years). Since 1996, the breakdown of trade credit is no longer reported.

similar method of payment, bills of exchange, was used in the U.K. until the nineteenth century (Bates and Hally 1982, p.168). And firms in the U.S. in the past also have used bills as a last resort to obtain credit when encountering serious financial difficulties (Steffen 1964, p.724). However, nowadays, these methods are not extensively used in the U.K. or in the U.S.

The relatively extensive use of promissory bills in Japan may be linked to the legal framework, which makes it easy to liquidate bills. In Japan, sellers can endorse promissory bills and use them as a method of payment (as long as the receiver accepts them). The right of bona fide endorsees is protected by law. Sellers are also able to liquidate promissory bills at a discount before the due date by having a bank discount them (bills discounting) or use the bills as collateral for a loan (loan on bills; also conditional on banks' acceptance).[16] However, even in these cases, the endorsee or the bank has recourse against the seller when the original buyer defaults, so the seller still assumes all the credit risk. Also, these methods of discounting promissory bills do not change the duration of original credit extended to buyers.

That being said, the use of promissory bills in Japan has been steadily declining over the past few decades. This can be seen in Figure 1, which shows the ratio of the outstanding amount of bills issued to the total amount of trade credit. What the cause is of this decline, and whether Japanese firms will completely cease to use promissory bills, are interesting questions, which, however, are beyond the scope of this paper.[17] At the moment, though, promissory bills still remain widespread as a form of trade credit and therefore provide a useful subject matter for our analysis.

**=== Figure 1 ===**

[16] See Matsumura and Ryser (1995) and Miwa and Ramseyer (2008) for details on these methods of bills discounting.

[17] As for bills of exchange in the U.K., Bates and Hally (1982) suggest that "nowadays bills of exchange are used mainly (but not entirely) in the export trade" because "[m]ost businesses prefer the looser and more flexible form of book credits" (p.168).

### 3.2 *Dependent variable*

Our dependent variable represents whether or not trade credit is used. The RIETI survey asks responding firms which methods of payment they primarily use to pay their main supplier. Multiple answers are allowed from the following 5 options: (1) Bank transfer after receiving an invoice; (2) Promissory bills; (3) Cash or check payment at the time of delivery; (4) Cancelling out with accounts receivable; and (5) Endorsements of promissory bills received from other firms. Options 1 and 2 are the methods of credit payment most commonly used in Japan.

The Venn diagram shown in Figure 2 provides a schematic representation of the combinations of answers provided by firms. The upper ellipse represents firms that do not use trade credit, i.e., those that answered "yes" to options 3 through 5. The lower-left and lower-right ellipses respectively represent firms that answered "yes" to the use of bank transfers (option 1) and promissory bills (option 2). As multiple answers are allowed, the ellipses overlap, and there are seven possible groups of firms represented by regions (0) through (6). The number of observations for each group of firms is as follows: 114 firms in region (0), 101 firms in region (1), 75 firms in region (2), 111 firms in region (3), 640 firms in region (4), 506 firms in region (5), and 223 firms in region (6).

**=== Figure 2 ===**

Based on this grouping, we construct dummy variables representing trade credit use. Because promissory bills have specific characteristics (see Section 3.1), we first categorize firms in regions (2), (3), (5) and (6) as firms using bills and denote this group by TC_BILLS (N=915). We then categorize firms in regions (1) and (4) as those using bank transfers but not promissory bills and denote this group by TC_BKTRANS (N=741). Finally, we categorize the rest (i.e.,

those in the region (0)) as firms not using trade credit as NON_TC (N=114). Based on these dummy variables, we define a multiple choice variable, STATUS, which is used in our multinomial logit analysis, taking the following values: STATUS=0 if NON_TC=1, STATUS=1 if TC_BKTRANS=1, and STATUS=2 if TC_BILLS=1.[18]

### 3.3 *Regression*

For the empirical analysis, we run the following multinomial regression:

$$\text{STATUS} = f(\text{proxies for the determinants of trade credit use, control variables}), \quad (1)$$

where the dependent variable takes different values for the use/non-use and the types of trade credit:

| | | | | |
|---|---|---|---|---|
| STATUS | = 0 | if | NON_TC = 1 | (non-credit payment) |
| | = 1 | if | TC_BKTRANS = 1 | (credit payment using bank transfer) |
| | = 2 | if | TC_BILLS = 1 | (credit payment using promissory bills). |

Since bank transfers (electronically processed, shorter credit period) and promissory bills (paper-based, longer credit period) are distinct from each other (see Section 3.1), we allow for differences in their determinants by employing the multinomial logit model for estimation. Our independent variables are proxies for the determinants of trade credit use as well as control variables, all of which are explained below.

## 4. Determinants of trade credit: theories, evidence, and our tests

In this section, we explain trade credit theories and our independent variables. In each of the six subsections below (Sections 4.1-4.6), the theory part is followed by a discussion of how

[18] Some firms with TC_BKTRANS=1 responded that they make a transfer within 10 days after receiving an invoice, which is akin to immediate payment. The main results are unchanged if we treat such firms as STATUS=0.

the theory has been, and should ideally be, tested. We then present our variables and tests. Other factors that may affect trade credit use as well as control variables to represent them are explained in Section 4.7. Table 1 summarizes the definitions of the variables, Table 2 presents descriptive statistics of the variables, and Table 3 provides an overview of our tests and the predicted impact of our main variables, all of which are explained below.

**=== Table 1 , 2 and 3===**

## 4.1 *Transaction costs*

### *4.1.1 Theory*

From a theoretical point of view, one of the most important reasons for the use of trade credit is that it reduces transaction costs (**transaction cost hypothesis**). Credit must be granted if, for example, a seller needs time for paperwork or if a buyer needs time to check the quality of the product. Trade credit may also be used in the case of repeated, uncertain, or seasonal sales to make payments periodical, i.e., to accumulate credit/debts during a certain period of time to clear and settle at once. This reduces the transaction costs of both sellers and buyers, e.g., the costs of having excessive inventories or retaining unprofitable reserves. Some studies specifically focus on the cost reduction due to reduced inventories (inventory hypothesis; Emery 1987 and Bougheas et al. 2009) and suggest that firms granting more trade credit have a lower level of inventory. Periodical payments may also reduce the risk that buyers and sellers face (Ferris 1981).[19]

[19] There are a number of other hypotheses that are closely related to the transaction cost hypothesis. However, we do not examine these here due to the lack of relevant data. Brick and Fung (1984), for example, suggest that trade credit is used to take advantage of arbitrage opportunities due to tax differentials between buyers and sellers (tax hypothesis). Other studies suggest that under informational asymmetry trade credit may be used to guarantee (signal) quality with regard to the product transacted (quality guarantee hypothesis) (Lee and Stowe 1993, Emery and Nayar 1998, and Long et al. 1993). Empirical evidence supporting this quality guarantee hypothesis is provided by Long et al. (1993) and

### *4.1.2 Existing evidence*

Empirical tests of the transaction cost hypothesis to date have employed a rather rough methodology. For example, Ferris (1981) tests the hypothesis by regressing accounts payables or receivables on the bond market interest rate, business receipts, and cost of sales, but such a regression allows for a variety of interpretations. A more appropriate test would be to focus on specific mechanisms through which transaction costs are reduced. For example, one can test whether trade credit is more frequently granted when transactions are more frequent, uncertain, or seasonal. However, the empirical evidence of studies employing such an approach does not necessarily support the transaction cost hypothesis (e.g., Ng, et al. 1999 and Marrotta 2005).

### *4.1.3 Our test*

In order to examine the transaction cost hypothesis, we proxy transaction costs by the number of days that buyers need for the paperwork to check an invoice. The transaction cost hypothesis predicts that NOD_CHK has a positive coefficient for TC_BKTRANS and TC_BILLS (STATUS=1 and 2).

Note that in practice, firms in Japan typically have their own closing day, usually in each month, e.g., the end of each month, on which they consolidate multiple invoices received during the month, offset receivables if any, and determine the net balance to settle accounts with each seller.[20] The RIETI survey reports that 90.3% (= 5,150 / 5,706) of the responding firms set a closing day, which indicates that buyers consolidate payments in order to reduce transaction costs. This piece of evidence lends support to the transaction cost hypothesis.

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Deloof and Jegers (1996).

[20] The closing day falls somewhere between the day of invoicing and the payment day.

### 4.2 *Price discrimination*

#### *4.2.1 Theory*

Some studies suggest that trade credit is used by monopolistic sellers to discriminate between buyers (**price discrimination hypothesis**). This hypothesis suggests that, analogous to the ordinary price discrimination described in the literature on industrial organization, when there are buyers with heterogeneous preferences (due to differences in, e.g., buyers' price elasticity of demand, discount rate, and reservation price), sellers with monopoly power can extract larger rents from buyers by offering different terms of trade credit to different types of buyers (see, e.g., Schwartz and Whitcomb 1979, Brennan, Maksimovic, and Zechner 1988, and Petersen and Rajan 1997).

#### *4.2.2 Existing evidence*

An ideal test of this theory would be to investigate whether sellers' decisions to grant credit differ, or whether credit terms differ, depending on buyers' preferences. As such information is difficult to obtain, existing studies take an indirect approach and test whether greater monopoly power of sellers (e.g., firms' price-cost margin) increases trade credit provision (firms' own trade receivables). The evidence, however, is mixed. Petersen and Rajan (1997) and Marotta (2005) find evidence supporting that this is the case, while Giannetti et al. (2008) find evidence that is weakly supportive and Niskanen and Niskanen (2006) find no supportive evidence.

#### *4.2.3 Our test*

Following the approach of previous studies, we use the main supplier's price-cost margin, S_PROFIT_SR (= profit/sales), to proxy for its monopoly power. The price discrimination hypothesis predicts a positive coefficient. Note that existing studies use data only from the

supply side of transactions, i.e., they link sellers' profit margin with their provision of trade credit. In our test, we control for both supply and demand factors by using suppliers' profit margin while controlling for characteristics of the buyer. Note that we can calculate S_PROFIT_SR only for those main suppliers for which financial statement information is available, so when we test this hypothesis a smaller sample is used.

### 4.3 *Informational advantage*

#### *4.3.1 Theory*

The **informational advantage hypothesis** assumes that sellers have a special ability to provide credit because they have superior information about buyers' creditworthiness and can thereby mitigate problems stemming from informational asymmetry, e.g., credit rationing. Sellers may elicit information through daily transactions. Those transacting with multiple buyers may also compare them to produce additional information. Information production may be a byproduct of transactional activities and provide the seller with a cost advantage.[21]

Some studies go further and specify where sellers' informational advantages stem from. Smith (1987) suggests that sellers screen heterogeneous buyers by offering both cash and credit payments (screening hypothesis). Miwa and Ramseyer (2008) argue that trade creditors specialize in short-term lending through daily monitoring (short-term monitoring hypothesis).[22] Bond (2004), extending Diamond's (1984) model on the role of banks, shows that if firms raise funds and invest in their own investment project as well as in other firms via trade credit, the overall costs of monitoring multiple projects are reduced (delegated monitoring hypothesis).[23]

[21] Although rigorous theoretical models have not been presented, many studies implicitly or explicitly point out the use of trade credit based on sellers' informational advantage (e.g., Mian and Smith 1992, Ng et al. 1999, Jain 2001, and Fabri and Menichini 2006).
[22] On the other hand, they argue that banks specialize in long-term lending by taking collateral or guarantees at the beginning of the transaction and doing nothing afterwards.
[23] Jain (2001) demonstrates that when the monitoring costs of sellers are smaller than those of banks, "dual intermediation" (i.e., banks lending to sellers that provide trade credit) is efficient.

Other studies suggest that soft information about buyers is accumulated through stronger seller-buyer relationships (e.g., through relationships of a longer duration or broader scope) (McMillan and Woodruff 1999, Johnson et al. 2002, Fisman and Raturi 2004, and Uchida et al. 2008). This **relationship lending hypothesis** is based on theories of relationship lending by banks.[24]

The role played by information also forms the basis of another hypothesis, which takes into account that the information sellers obtain may be different from the information that other lenders obtain. Biais and Gollier (1997) demonstrate that when a seller and other lenders (banks) obtain different information (signal) about a buyer's creditworthiness, an equilibrium exists in which the buyer buys a product on account from the seller and borrows from the bank at the same time, so that the credit available to the buyer is increased. In this equilibrium, the lending decision by one lender emits a good signal to other lenders (**mutual signaling hypothesis**).

### *4.3.2 Existing evidence*

It is difficult to test the informational advantage hypothesis, or its variants, because it is difficult to measure how much information sellers accumulate. However, the relationship lending hypothesis can be indirectly tested, as it is in banking studies, by examining whether a stronger buyer-seller relationship is associated with increased credit availability.[25] Doing so, McMillan and Woodruff (1999) and Johnson et al. (2002) find that trade credit is indeed used more frequently as the duration (years) of the buyer-seller relationship increases. A similar test is conducted by Giannetti et al. (2008), who, however, use firm age as their proxy, which is a less precise proxy for the strength of a relationship than its duration, and come to a similar

[24] See, for example, Boot (2000) for a detailed discussion of relationship lending by banks.
[25] See, for example, Petersen and Rajan (1994) and Berger et al. (2005) for studies on banking relationships.

conclusion.

The mutual signaling hypothesis can be tested by examining whether trade credit promotes other types of lending and vice versa. Petersen and Rajan (1997) do not find a significant effect of longer relationships *with banks* on trade credit granted, which is inconsistent with the hypothesis. In contrast, Giannetti et al. (2008) find that firms using trade credit tend to borrow from arm's length banks and interpret this finding as evidence in favor of the hypothesis.[26]

### *4.3.3 Our test*

We have several variables to proxy for information production by suppliers. The informational advantage hypothesis in its general form can be tested by investigating whether trade credit is chosen more frequently when the seller is better informed. We do so by using a variable we label KNOW1_S, which represents the extent to which the main supplier knows about the responding firm's business conditions and which takes a value from 5 (knows the buyer's business conditions very well) to 1 (does not know the buyer's business conditions). By definition, a positive coefficient on the variable would suggest that more information (which is likely to be good information) promotes trade credit use, which would be consistent with the informational advantage hypothesis in its general form.

As for the relationship lending hypothesis, we use S_DURATION, which measures the years of transaction between the responding firm and the main supplier.[27] A more direct proxy for the relationship lending hypothesis is KNOW4_S, which is a categorical variable similar to

[26] Another testable implication of the mutual signaling hypothesis is that trade credit and bank credit are complementary to each other, i.e., they move in the same direction. There are many studies on the complementarity vs. substitutability of bank loans and trade credit, but the evidence is mixed (see, e.g., Atanasova and Wilson 2003, 2004, Love et al. 2007, and Gama et al. 2008).

[27] We also employ a variable that measures the frequency of meetings between the responding firm and the main supplier as a proxy and find that the estimation results are qualitatively similar to the case in which we use lnS_DURATION.

KNOW1_S but represents the degree of knowledge that the buyer has about the strength of the responding firm but that cannot be quantified, i.e., the *soft* information that the buyer has. The hypothesis predicts positive a impact of stronger relationships (larger S_DURATION) and more soft information (larger KNOW4_S) on the use of trade credit (STATUS=1 or =2).

Finally, to test the mutual signaling hypothesis, we use a variable that represents responding firms' relationship with their *main bank*. B1_DURATION is the years of transaction between the responding firm and the main bank. The main bank is defined here as the financial institution that extends the largest amount of loans to the firm.[28] Based on the mutual signaling hypothesis, we would expect a positive sign on this variable.

### 4.4 *Collateral*

#### *4.4.1 Theory*

Some studies argue that sellers have a special ability to dispose of collateral when a buyer goes bankrupt (**collateral hypothesis**). A seller may have a higher valuation of pledged assets, or may be able to sell them at a higher value, than financial institutions could, so that they may be willing to lend more than a financial institution (Longhofer and Santos 2003 and Frank and Maksimovic 2005). An important (often implicit) assumption underlying this hypothesis is that trade credit is secured by the goods being transacted, or that, even if it is not secured, a seller can repossess the goods when the buyer goes bankrupt.

#### *4.4.2 Existing evidence*

To empirically test this hypothesis is difficult due to the lack of relevant data. Previous studies therefore have taken indirect approaches which examine whether trade credit is more

[28] We take the natural logarithm of B1_DURATION following the practices of previous studies including Giannetti et al. (2008), who take the natural logarithm of firm age in order to take into account any possible nonlinear effects.

frequently used when the fraction of finished goods in a buyer's inventory (a proxy for the difficulty of collection) is high (Petersen and Rajan 1997), or when differentiated goods are transacted (Giannetti et al. 2008).

However, little attention has been paid to the implicit assumption underlying this hypothesis that a seller can repossess the goods sold when the buyer goes into bankruptcy. In many countries, trade creditors are not secured, but are only one group among general creditors, and therefore do not have an automatic lien on the goods sold when the buyer goes bankrupt. This fact is inconsistent with the hypothesis. An exception is the case of the United States, where a seller can repossess the goods sold to an insolvent buyer within 10 days from delivery, which implies that the collateral hypothesis may be valid only for trade credits of a duration of 10 days or less.[29]

### *4.4.3 Our test*

In Japan, as in many other countries, the commercial code does not automatically give a lien on the product to a seller when the buyer goes into bankruptcy unless specified otherwise by the arrangement between the seller and the buyer. Thus, the question is whether the buyer actually pledges the purchased goods as collateral on the trade credit. The RIETI survey reports that only about 3 percent of the firms pledge purchased goods as collateral to the main supplier. This evidence rejects the collateral hypothesis and we will therefore not investigate the hypothesis in the regression analysis.

[29] For details, see Giannetti et al. (2008).

### 4.5 *Moral hazard*

#### *4.5.1 Theory*

Trade credit may be used even in the absence of any information advantage or superior ability to collect debt on the part of sellers, because it may prevent buyers from taking opportunistic behavior (**moral hazard hypothesis**). There are two variants of this hypothesis. The first is the **switching cost hypothesis**. Cuñat (2007), for example, argues that buyers and sellers in a longer-standing relationship may customize their products and thus increase their mutual specificity. As the seller becomes irreplaceable, the costs of switching sellers increase for the buyer, so that the buyer refrains from strategic default.[30] The second variant of the moral hazard hypothesis is the **diversion hypothesis**. Burkart and Ellingsen (2004), for example, suggest that trade credit may mitigate moral hazard problems when the possibility of "diversion," in which case buyers use acquired cash or purchased goods for unintended purposes, is taken into account. That is, cash borrowed from a bank can be costlessly diverted from its originally intended purposes, but goods bought from a seller are more difficult to divert. Trade credit thereby mitigates the moral hazard problem, so that sellers are prepared to lend more than banks. An implication of this theory is that the harder it is for a buyer to divert the transacted goods, the more trade credit is granted (Giannetti et al. 2008).

#### *4.5.2 Existing evidence*

The moral hazard hypothesis (both the switching cost hypothesis and the diversion

[30] In the context of repeated game models, McMillan and Woodruff (1999) and Johnson et al. (2002) argue that even without such trade specificity, long-term buyer relationships serve as relational contracts, which make it costly for the buyer to engage in opportunistic behavior such as strategic default. Another closely related argument is made by Smith (1987), who suggests that sellers and buyers make relationship- or industry-specific investments and therefore may be less likely to engage in opportunistic behavior (industry-/relationship-specific investment hypothesis).

hypothesis) implies that the likelihood of trade credit use is higher when transactions involve specific (differentiated) goods rather than general-purpose goods. Using a variety of variables to represent goods characteristics, Giannetti et al. (2008) find that firms in industries which produce differentiated products or services are more likely to supply trade credit, which is consistent with the moral hazard hypothesis.

A different test that is specifically relevant for the switching cost hypothesis devised by Giannetti et al. (2008) and Cuñat (2007) is to examine whether decisions to grant trade credit change as buyer-seller relationships mature. They employ firm age as a proxy, which is a rather coarse measure for the duration of relationships, and find supportive evidence for the hypothesis. Note that the same relationship is also predicted by the relationship lending hypothesis outlined in the previous subsection and so it is difficult to distinguish these two hypotheses based on this test only.

#### *4.5.3 Our test*

Following Giannetti et al. (2008), and Cuñat (2007), we employ similar but better variables to examine the moral hazard hypothesis. To represent the characteristics of goods, we first construct (as in Giannetti et al. 2008) variables based on the categorization of goods provided by Rauch (1999). Rauch classified internationally traded commodities into three categories based on the international trade classification code (SITC): (i) commodities traded on organized exchanges, (ii) commodities not traded on organized exchanges but for which reference prices are available, and (iii) other commodities that he considers to be differentiated goods. As we know the name of the good that a buyer most frequently purchases from its main supplier, we can determine their SITC code and based on this create two dummy variables: RGOODS

(corresponding to (ii) above) and DGOODS ((iii) above).[31] The default category (RGOODS = DGOODS = 0) is goods traded on organized exchanges (i.e. (i) above), which we consider to be standardized goods.

Note that our variables are superior to those used by Giannetti et al. (2008). Due to data limitations, their variables are constructed at the industry level, while our dummies are constructed using transaction-level (goods-level) data and therefore convey richer and more accurate information. Because some firms provided no answers, we can define these dummies only for 4,650 out of the initial 6,079 firms.[32] About half of these firms transact in differentiated goods with their main suppliers.

We also use other variables to test the moral hazard hypothesis. In addition to the name of the good transacted, the survey also asks about the availability of the same good from other suppliers. Based on this information, we constructed the dummy variable SUBSTITUTE, which takes a value of one if the responding firm purchases the product from the main supplier only and cannot purchase it from other suppliers. A mirror image of this variable is S_SUBSTITUTE, which equals one if the main supplier sells the product only to the responding firm and cannot sell it to other companies. Further, in contrast to previous studies that only employ firm age as a proxy for the buyer-seller relationship, we employ the number of transaction years between a buyer and a seller, S_DURATION.

If the moral hazard hypothesis holds, we would expect DGOODS, RGOODS, SUBSTITUTE,

[31] Based on the name of the good that respondents provided in the survey answer sheet, we first assign a Standard International Trade Classification (SITC) code (four digits at most) for each of the goods. We then referred to the classification table available through James Rauch's homepage to construct the two dummy variables, RGOODS (goods with reference prices) and DGOODS (differentiated goods), leaving goods traded on organized exchanges as the default category (see "Rauch Classification of Goods [Revised July 2007]" available at http://www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade. Resources/TradeData.html#Rauch). Note that Rauch provides a "conservative" classification (which is more likely to classify goods as differentiated) and a "liberal" classification (which is less likely to classify goods as differentiated). As both classifications produced similar results, we only report the results using the conservative classification.

[32] There were some respondents that provided the name of a service instead of a good even though the questionnaire asked them not to do so. We excluded such firms from our analysis.

S_SUBSTITUTE, and S_DURATION to have a positive impact on trade credit use. More specifically, the switching cost hypothesis implies that SUBSTITUTE, S_DURATION, DGOODS, and RGOODS should have a positive sign because it holds that opportunistic behavior by buyers is mitigated when sellers are irreplaceable, while the diversion hypothesis implies the same for S_SUBSTITUTE, DGOODS, and RGOODS because it predicts that trade credit is used when differentiated goods are traded.

## 4.6 *Relative bargaining power*

### *4.6.1 Theory*

The relative bargaining power between a seller and a buyer may affect the use of trade credit (**bargaining power hypothesis**). If a buyer depends too much on a seller, the seller is in a superior bargaining position and may be able to force immediate payment. On the other hand, if a seller depends too much on a buyer, the buyer may pay late. A similar theory provided by Fisman and Raturi (2004) argues that when buyers need to undertake upfront investments to establish their own creditworthiness, buyers that cannot find alternative sellers expect holdups, reduce relation-specific investments, and thus cannot receive as much trade credit ex ante as those to which alternative sellers are available.

### *4.6.2 Existing evidence*

Fisman and Raturi (2004) (using data from Africa), Van Horen (2007) (Eastern Europe) and Fabbri and Klapper (2008) (China) investigate the effect of bargaining power on the use of trade credit and find evidence in favor of the bargaining power hypothesis. The variables these studies employ to proxy for buyers' bargaining power are a dummy variable representing that an alternative supplier is available (Fisman and Raturi), a dummy representing a high dependence

on specific customers in terms of sales (Van Horen), and multiple measures of customer concentration (Fabbri and Klapper).

#### *4.6.3 Our test*

As proxies for relative bargaining power, we use two different measures of firm size: EMP is the number of employees of the responding firm (buyer size), and S_EMP_NUM represents the number of employees of the main supplier (seller size).[33] Note that SUBSTITUTE and S_SUBSTITUTE mentioned above may also proxy for relative bargaining power because they indicate that the main supplier is irreplaceable. The hypothesis predicts a positive impact of EMP and S_SUBSTITUTE, and a negative impact of S_EMP_NUM and SUBSTITUTE, on trade credit use. The predicted signs for S_SUBSTITUTE and SUBSTITUTE are exactly the opposite of those in the case of the moral hazard hypothesis.

### ***4.7 Other determinants of trade credit use***

#### *4.7.1 Creditworthiness*

Other than the factors explained thus far, the use of trade credit may also depend on other factors. Because it is credit, trade credit is likely to be constrained by the buyer's creditworthiness. As a proxy for buyers' credit risk, we use SCORE, which is the credit score provided by Tokyo Shoko Research Incorporated (TSR), a business database company. This score is assigned by TSR researchers based on firms' management ability, outstanding assets, growth potential, stability, reputation, and willingness to disclose, and takes a value from 0 to 100, with 50 meaning an average level of riskiness. Although the assessment is subject to researchers' discretion, firms purchase the scores of prospective or existing transaction

[33] In the regression analysis, we take the natural logarithm of these variables.

counterparties as reliable third-party information to judge whether or not to start or keep transacting with them.

### *4.7.2 Other controls*

Other control variables are shown in Table 1. We use variables representing the characteristics of responding firms as proxies for trade credit demand, and variables representing the main supplier's characteristics as proxies for supply. Further, in order to capture industry-specificity of trade credit practices, we use industry dummies for responding firms and the main suppliers. Since Giannetti et al. (2008) find significant within-industry idiosyncrasies in the use of trade credit, not only industry dummies but also the firm-specific variables may be very important for the estimation.

## 5. Results

Table 4 reports our baseline results from the estimation of the multinomial logit model with STATUS as the dependent variable. In each of the panels (1) and (2), the estimated parameters for the different outcomes – STATUS=0 (non-credit payment, NON_TC=1), STATUS=1 (bank transfer, TC_BKTRANS=1), and STATUS=2 (promissory bills, TC_BILLS=1) – are shown in separate columns. Panel (1) reports the results for the larger sample when S_PROFIT_SR (monopoly power of the main supplier) is not used, while panel (2) reports the ones for the smaller sample when S_PROFIT_SR is included in the estimation. The coefficients represent marginal effects.[34]

To test the hypotheses above, we look at the effects of our independent variables on the

[34] An underlying assumption of multinomial logit models is the Independence from Irrelevant Alternatives (IIA). As a robustness check, we also estimated a multinomial probit model, which relaxes this assumption by allowing for non-zero covariances between the three outcomes. The results were qualitatively similar to those reported in Table 4.

outcome of NON_TC, i.e., whether they affect the use or non-use of trade credit. We also look at the marginal effects on the outcomes of TC_BKTRANS and TC_BILLS to examine if firms use longer-term trade credit instead of shorter-term trade credit, or vice versa.

**=== Table 4 ===**

Turning now to the coefficients on the individual variables, we find the following. The number of days it takes for firms to check invoices (NOD_CHK) has not only a weakly negative impact on the use of trade credit, but also a significantly positive impact on the use of longer-term trade credit. In addition to the observation before that firms in Japan typically use a particular closing day (see Section 4.1.3), the finding here serves as strong evidence for the *transactions cost hypothesis*. On the other hand, the variable measuring the main supplier's price-cost margin, S_PROFIT_SR, in panel (2) is insignificant, meaning that the *price discrimination hypothesis* is not supported. That is, suppliers' monopoly power has no impact on the use of trade credit.

Next, we find a weak but significantly negative (positive) impact of KNOW1_S, the variable that represents supplier's general knowledge about the responding firm, on TC_BKTRANS (TC_BILLS). Sellers are likely to provide credit for a longer period (promissory bills) if they have superior knowledge about buyers that mitigates problems stemming from asymmetric information. The *informational advantage hypothesis* in its generic form is thus supported.

The duration of the buyer-seller relationships, lnS_DURATION, has a positive impact on TC_BILLS, a negative impact on TC_BKTRANS, and no significant impact on NON_TC. These results are consistent with the *relationship lending hypothesis* and the *switching cost hypothesis*, and suggest that buyer-seller relationships are important for the provision of

longer-term trade credit.[35] Note, however, that we find no significant impact of KNOW4_S (the extent to which the supplier knows about the buyer regarding its strengths that cannot be numerically measured) on NON_TC, TC_BKTRANS, or TC_BILLS. On balance, these results are supportive of the *relationship lending hypothesis*, especially when firms use longer-term trade credit.

In contrast, firms' credit score (SCORE) is positively related to TC_BKTRANS, negatively related to TC_BILLS, and has no impact on NON_TC. This suggests that firms' credit score is more important for shorter-term credit. In the banking literature, relationship lending, which is considered as monitoring-intensive and thus costly, is mostly adopted by small banks, while transaction lending based on hard information is adopted by large banks (e.g. Berger and Udell 2002 and Stein 2000). Our finding here together with the above finding for the r*elationship lending hypothesis* for longer-term trade credit may imply that trade credit using bank transfer and trade credit using promissory bills respectively are comparable to transaction lending and relationship lending.

Turning to the *mutual signaling hypothesis*, we find that lnB1_DURATION, the natural log of the number of years of transacting with the main bank, has no impact on the use/non-use of trade credit. This implies that a stronger bank-firm relationship does not promote trade credit use, which is inconsistent with the *mutual signaling hypothesis*.

As for goods characteristics, the negative impact of RGOODS (transactions in goods with a reference price) on NON_TC that we find is consistent with the *moral hazard hypothesis*. Also, DGOODS (transactions in differentiated goods) and RGOODS have a positive impact on TC_BILLS, while they have a negative impact on TC_BKTRANS, which provides evidence that

[35] As an alternative we employed S_MEETING, an index for the frequency of meetings of buyers with their suppliers, as a proxy for informational advantage and found that the variable has a positive impact on TC_BILLS, no significant impact on TC_BKTRANS, and a weakly negative impact on NON_TC (results not reported). This also provides evidence for the *relationship lending hypothesis* and the *switching cost hypothesis*.

transactions in differentiated goods contribute to the use of longer-term trade credit. However, we find a positive and weakly significant impact of SUBSTITUTE, which indicates that a firm purchases a product from the main supplier only, on NON_TC, while the signs of its impact on TC_BKTRANS and TC_BILLS are mixed. These findings are inconsistent with the *switching cost hypothesis*. Taken together, the results are rather supportive of the *diversion hypothesis*, especially for longer-term credit.

The positive impact of SUBSTITUTE on NON_TC and TC_BKTRANS, which implies that buyers that are dependent on their main supplier use shorter or no credit, are more consistent with the *bargaining power hypothesis* than the *switching cost hypothesis*. The negative coefficient on lnEMP, the natural log of the number of employees of the buyer, and the positive coefficient on lnS_EMP_NUM, the (natural log of the) number of employees of the main supplier, for NON_TC are also consistent with this interpretation. Relative bargaining power appears to be relevant in determining the use/non-use of trade credit.

On balance, our findings suggest that there are multiple determinants of the use of trade credit. We also find that different mechanisms work in the case of bank transfer and of promissory bills. The results imply that credit is granted based on hard information on the buyer's creditworthiness in the case of the use of bank transfers, while enforcement of repayment (mitigation of moral hazard) is important for the use of promissory bills. We also find a positive association between a stronger buyer-seller relationship and the use of promissory bills. Relative bargaining power is also an important determinant of the use of trade credit.

The different length of credit involved in the use of bank transfers and promissory bills likely explains the different impact that the explanatory variables have on TC_BKTRANS and TC_BILLS. Sellers using bank transfer and extending short-term credit may rely on observable

information on buyers' characteristics. Their underlying motivation may be to avoid frequent monitoring of borrowers and to avoid costly production of soft information. These sellers resemble financial institutions that rely on hard information on borrowers' creditworthiness and undertake transaction lending. In contrast, sellers who accept promissory bills and thereby act as long-term creditors may be exposed to a higher risk of delinquency than short-term trade creditors. Hence, they may be concerned about moral hazard on the part of the buyer and thus tend to rely on payment enforcement mechanisms and stronger buyer-seller relationships to mitigate such risk.

At this point of the analysis, however, these are mere conjectures. In the next section, we will examine these issues further through additional analysis and find that these conjectures are indeed supported. In the analysis, we take into account other trade credit terms, including the credit period, early payment discounts, late payment penalties, and collateral.

## 6. Credit terms and the motivation behind trade credit use

### 6.1 *Credit periods and the use of trade credit*

One of the important differences between bank transfer and promissory bills is the duration of the credit period. We create two variables to represent the duration: NOD_BKTRANS represents the duration (number of days) until bank transfers are made, and NOD_BILLS the duration (number of days) for promissory bills.[36] The top panel of Table 5 shows descriptive statistics for these variables. As explained before, the duration of credit in the case of promissory bills is on average 3-4 months longer than that in the case of bank transfers.

[36] To take account of the business practice in Japan that firms typically set a closing day, consolidate multiple invoices, and settle the net balance in each month (see Section 4.1.3), the RIETI survey asks responding firms about the typical duration from the closing day to the payment day. To measure the actual duration of the credit period, we thus need to add the duration from the day when goods are delivered (or when an invoice is issued) to the closing day. If the delivery day is randomly distributed in a month, the latter duration is on average 15 days. Thus, we add 15 to the answer regarding the typical duration from the closing day to the payment day.

Our results in Section 5 imply that this difference may matter in choosing bank transfer or promissory bills. The duration is, however, one of the credit terms and is itself a choice variable. It is highly probable that the duration is simultaneously determined with whether or not trade credit is provided. It is therefore necessary to investigate how these two decisions are linked.

**=== Table 5 ===**

To take into account the simultaneous determination of the use/non-use of trade credit and the duration of the credit period, we rerun the multinomial regression by breaking down the dependent variable STATUS into bank transfer with a shorter (NOD_BKTRANS<=45) versus a longer (NOD_BKTRANS>45) credit period, and into promissory bills with a shorter (NOD_BILLS<=135) versus a longer (NOD_BILLS>135) credit period.[37]

**=== Table 6 ===**

Table 6 reports the results and shows the following. First, the marginal effect of NOD_CHK is positive for longer-term promissory bills and weakly negative for shorter-term bank transfers. Although we do not find a significant effect of NOD_CHK on NON_TC, these findings support the *transactions cost hypothesis* in the sense that a larger number of days it takes the buyer to process invoices increases the use of longer-term trade credit.

Second, as for the *informational advantage hypothesis*, our findings are qualitatively similar to those in Table 4. lnS_DURATION has a positive impact on the use of promissory bills and a

[37] According to the information provided in Kinzai Institute for Financial Affairs (2008), the ordinary credit period for promissory bills ranges from 135 to 165 days. We employ the lower bound of the range (135 days) rather than the median value of the sample (155 days) as the threshold value in order to classify those that follow ordinary practice in the same group.

negative impact on the use of bank transfer. KNOW1_S has a weakly negative impact on shorter-term bank transfers and a positive impact on shorter-term promissory bills. In contrast, KNOW4_S has little impact on either type of trade credit. Furthermore, the positive impact of SCORE on the use of shorter-term bank transfers and the negative impact on the use of longer-term promissory bills support the view that short-term trade credit can be considered as transaction lending.

Third, as for the *mutual signaling hypothesis*, we again find that lnB1_DURATION has a negative but barely significant impact on the use/non-use of trade credit. Again, this finding does not support the *mutual signaling hypothesis*.

Fourth, on balance, DGOODS and RGOODS have a negative impact on NON_TC and short-term bank transfers, and a positive impact on longer-term promissory bills. These findings suggest that longer-term credit is provided when the goods transacted are differentiated, because they accompany strong repayment enforcement (the *moral hazard hypothesis*).

Finally, lnEMP has a negative coefficient and lnS_EMP_NUM and SUBSTITUTE have a positive coefficient for NON_TC. Trade credit is thus less frequently used when the size of the buyer is small, when the size of the seller is large, and when the buyer cannot purchase the goods transacted from other suppliers. These findings are consistent with our prior interpretation that the relative bargaining power between the seller and the buyer matters. Also, the positive impact of SUBSTITUTE is inconsistent with the *switching cost hypothesis*.

### *6.2 Early payment discounts and late payment penalties*

The results thus far suggest that enforcement of repayment (the *moral hazard hypothesis*, especially the *diversion hypothesis*) is one of the most important determinants of the use of

long-term trade credit. It is worthwhile to note here that in the case of bank transfer, there are two other credit terms that are closely related to repayment enforcement, an early payment discount and a late payment penalty.[38] The information on whether an early payment discount or a late payment penalty is prescribed in the contract is available from the RIETI survey. As shown in the second and the third panels of Table 5, about 6% and 11% of the sample firms use trade credit with an option of an early payment discount or a late payment penalty, respectively.

As it is highly likely that these terms are also simultaneously determined with the use/non-use of trade credit, we take these credit terms into account by breaking down sample firms with TC_BKTRANS=1 (STATUS=1) into those with and without the provision of an early payment discount, and into those with and without the provision of a late payment penalty.

**=== Table 7 and 8 ===**

The results are shown in Table 7 (early payment discount) and in Table 8 (late payment penalty). From Table 7 we find that DGOODS and RGOODS have a negative impact on the use of bank transfer, but the size of the marginal effect is smaller when an early payment discount is prescribed in the contract. Similar relationships are found with respect to the late payment penalty, as shown in Table 8. These findings are consistent with the *moral hazard hypothesis* in that product differentiation ensures payment by buyers and thus reduces the need for suppliers to resort to other mechanisms to enforce payment, i.e., an early payment discount or a late payment penalty.

One notable difference from the previous results is that, in Tables 7 and 8, we now find a negative and weakly significant impact of lnB1_DURATION on NON_TC. This finding is

[38] Anecdotal evidence shows that promissory bills are not accompanied by such a discount or penalty.

consistent with the *mutual signaling hypothesis*.

It should be stressed here that the rare use of early payment discounts and late payment penalties serves as evidence for the low cost of trade credit. The interest rate on trade credit has long been considered to be high, since Petersen and Rajan (1995) calculated that the effective interest for typical trade credit in the United States is 44.6% because a credit term of 2/10 net 30 (the payment is due in 30 days and there is a 2 percent discount for the payment in the first 10 days) is often used. However, as Giannetti et al. (2008) point out, the formula to calculate the interest rate is inappropriate. Moreover, as Miwa and Ramseyer (2005) suggest, discounts are not frequently used, even in the United States, and in that case the interest rate is zero.[39] Further evidence that interest rates on trade credit are low is provided by Marotta (1997). Our descriptive statistics in Table 5 show that, in Japan, like in the United States, discounts are not frequently used.

What is more, the RIETI survey also asks responding firms whether they have *actually* paid early and obtained a discount (irrespective of whether an early payment discount was prescribed in the contract). The answers indicate that the fraction of firms that have paid early and obtained a discount is even smaller than the 6% of sample firms that use trade credit with a (contracted) option of an early payment discount. In other words, the actual exercise of the early payment with discounts is even lower than the frequency of the existence of such a provision suggests.

### *6.3 Collateral*

We further investigate whether pledging collateral has any impact on the use of trade credit. As we have already explained, the pledging of goods traded with the main supplier as collateral

[39] Klapper et al. (2010) also report that trade credit contracts that involve an early payment discount make up only 13% of their sample.

is very rare. However, a non-negligible number of responding firms answered that they pledge real estate or assets *other than* traded goods as collateral to the main supplier. S_COLL shown in Table 5 is a dummy variable representing whether or not the responding firms pledge such assets as collateral. About 18% of the sample firms pledge assets as collateral to the main supplier.

If a seller is concerned about moral hazard on the part of the buyer, the seller may require the buyer to pledge collateral when extending trade credit. An implication of the *moral hazard hypothesis* is that a seller of more standardized goods is more likely to require the buyer to pledge collateral because sellers of such goods are more susceptible to buyer moral hazard. To test this we break down the outcome STATUS=1 (bank transfer) and the outcome STATUS=2 (promissory bill) into whether S_COLL=1 or =0.

**=== Table 9 ===**

The results in Table 9 show that the collateral requirement seems to reduce the need to rely on other repayment enforcement mechanisms.[40] DGOODS and RGOODS have significant positive coefficients for the outcome of TC_BILLS without collateral, but they become insignificant for the outcome of TC_BILLS with collateral. Transactions in differentiated goods are likely to decrease the probability of buyer moral hazard and thus to reduce the need to require the buyer to provide collateral. Similar to our finding in the previous subsection, this finding is consistent with the *moral hazard hypothesis* in that product differentiation ensures repayment by buyers and thus allows suppliers to extend credit without resorting to other mechanisms to enforce payment, i.e., collateral.

[40] Because some variables have insufficient variation within each outcome, we are unable to calculate the marginal effects when we used the same independent variables as in the original specification. Thus, S_SUBSTITUTE and lnPURCHASE are omitted in the estimation reported in Table 9.

## 7. Discussion and conclusion

Employing a unique firm-level dataset that matches buyer firms with their main suppliers, we test various theories on the use of trade credit. We arrive at three main findings: First, we find evidence suggesting that sellers with an informational advantage provide significantly more long-term credit to buyers than those without such an advantage. We also find that short-term trade credit is extended based on hard information about the buyer. Second, we find relatively abundant evidence for the *moral hazard hypothesis* (especially the *diversion hypothesis*) and the *bargaining hypothesis*. And third, we find that trade credit is used to reduce transaction costs.

To conclude the paper, we discuss these findings, taking into account evidence from existing studies. First, McMillan and Woodruff (1999) find that longer buyer-seller relationships increase the use of trade credit. Our detailed analysis suggests that the mechanism working behind this association is more intricate. We find that longer relationships increase the use of longer-term trade credit in the form of promissory bills but reduce the use of shorter-term trade credit in the form of bank transfers. We also find that hard information about buyers' creditworthiness is important in the decision to extend short-term trade credit. Short-term trade creditors resemble arm's length lenders, whereas long-term creditors resemble relationship lenders.

Second, Giannetti et al. (2008), using industry-level information for differentiated goods, find that firms (industries) that are less likely to divert purchased goods to purposes other than those they were originally intended for (i.e., firms that purchase differentiated goods) tend to receive more trade credit. We also find a similar relationship using goods-level information for differentiation. We additionally find that buyer moral hazard may also be prevented by other mechanisms including early payment discounts, late payment penalties, and collateral.

Third, Petersen and Rajan (1997) and McMillan and Woodruff (1999) find more frequent use of trade credit for longer buyer-seller relationships. We also find a similar relationship, but additionally find that buyers with no alternative sellers less frequently receive long-term trade credit than those with alternative sellers. This result is inconsistent with the *switching cost hypothesis*, but rather is consistent with the *bargaining power hypothesis*. This interpretation is also supported by our finding that buyers' size has a positive and sellers' size a negative impact on the use of trade credit. Our result in favor of the *bargaining power hypothesis* is in line with evidence obtained by Fisman and Raturi (2004), Van Horen (2007), and Fabbri and Klapper (2008).

Finally, although previous studies do not find clear evidence for this, our findings suggest that trade credit is also used for a pure transactional (non-financial) reason as well, i.e., late payment is necessary to allow time to carry out the paperwork involved. This suggests that firms aim to reduce transaction costs by using trade credit. The Japanese government has recently introduced a scheme for transactions in an electronic version of promissory bills. This scheme is expected to significantly reduce the transaction costs involved in using promissory bills, and to promote the use of longer-term trade credit in Japan.

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**Table 1. Definition of variables**

This table provides a summary of the definitions of our dependent variable (STATUS) and independent variables used in the estimation.

| Variable | | Definition |
|---|---|---|
| Trade credit use | STATUS | = 0 if no trade credit use (NON_TC=1), 1 if bank transfer is used but bills not used (TC_BKTRANS=1), and 2 if bills are used (TC_BILLS=1) |
| Transaction costs | NOD_CHK | Number of days needed for the firm to check the invoice |
| Price discrimination | S_PROFIT_SR | The ratio of main supplier's profits to sales |
| Information production by the main supplier | S_DURATION | Number of years of transactional relationship with the main supplier |
| | KNOW1_S | Extent the main supplier knows about the firm regarding its business condition. The extent of knowledge is measured categorically: 5 (good knowledge), 4 (relatively good knowledge), 3 (average knowledge), 2 (relatively little knowledge), and 1 (no knowledge). |
| | KNOW4_S | Extent the main supplier knows about the firm regarding its strength that cannot be numerically measured. The extent of knowledge is measured categorically: 5 (good knowledge), 4 (relatively good knowledge), 3 (average knowledge), 2 (relatively little knowledge), and 1 (no knowledge). |
| | B1_DURATION | The number of years of transactional relationship with the main bank |
| Goods characteristics | SGOODS | = 1 if the transacted goods are standardized and 0 otherwise |
| | DGOODS | = 1 if the transacted goods are differentiated and 0 otherwise |
| | RGOODS | = 1 if the transacted goods have a reference price and 0 otherwise |
| | SUBSTITUTE | = 1 if the firm purchases the product from the main supplier only and cannot purchase it from other suppliers, and 0 otherwise. |
| | S_SUBSTITUTE | = 1 if the main supplier sells the product only to the responding firm and cannot sell it to other companies, and 0 otherwise. |
| Controls: Firm characteristics | EMP | Number of employees |
| | AGE | Firm age in years |
| | PURCHASE | Amount of purchased goods |
| | SCORE | Credit score assigned by Tokyo Shoko Research, a business database company, based on the firm's management ability, outstanding assets, growth potential, stability, reputation, and disclosure, which takes a value from 0 to 100, with 50 meaning an average level of riskiness. |
| | INVENTORY_SR | The ratio of inventory to sales |
| | SALESCOST_SR | The ratio of sales costs to sales |
| | Industry dummies | CONSTRUCTION (construction: default), MANUFACTURING (manufacturing), INFO_TECH (information technology), TRANSPORT (transportation), WHOLESALE (wholesale), RETAIL (retail), REALESTATE (real estate), RESTAURANTS (restaurants), OTHER_NONSERVICE (other non-service), and OTHER_SERVICES (other services) |
| Controls: Characteristics of the main supplier | S_EMP_NUM | The main supplier's number of employee. Based on the categorical response (1-5, 6-20, 21-50, 51-100, 101-300, or more than 300 employees), the values used are the median for each category (e.g., 1302.5 for the "more than 300 employees" category). |
| | Industry dummies | S_CONSTRUCTION (construction: default), S_MANUFACTURING (manufacturing), S_INFO_TECH (information technology), S_GENERAL_TRADE (transportation), S_SPECIAL_TRADE (special trading company), S_OTHER_WHOLESALE (other wholesale), S_RETAIL (retail), S_REALESTATE (real estate), S_RESTAURANTS (restaurants), and S_OTHERINDUSTRY (others) |
| | S_RELATION1 - S_RELATION9 | Dummy variables to represent the type of relationship with the main supplier: the main supplier (1) is the parent company, (2) a subsidiary, (3) a company belonging to the same keiretsu, (4) a customer as well, (5) a firm with which the responding firm is in technical collaboration, (6) a foreign-affiliated company in Japan, (7) a foreign company, (8) a company to which the responding firm dispatches a board member or an employee, (9) and/or a company that dispatches a board member or an employee to the responding firm. |

## Table 2 Descriptive statistics

This table reports the descriptive statistics of the variables we use in our analysis. For their definition, see Table 1.

| variables | | N | mean | median | std. dev. | min | max |
|---|---|---|---|---|---|---|---|
| Trade credit use | STATUS | 1770 | 1.453 | 2 | 0.614 | 0 | 2 |
| Transaction costs | NOD_CHK | 1770 | 5.016 | 3 | 5.859 | 1 | 60 |
| Price discrimination | S_PROFIT_SR | 1302 | -0.118 | 0.008 | 4.814 | -173.7 | 0.732 |
| Information production by the main supplier | lnS_DURATION | 1770 | 3.117 | 3.258 | 0.702 | 0.693 | 4.615 |
| | KNOW1_S | 1770 | 4.068 | 4 | 1.014 | 1 | 5 |
| | KNOW4_S | 1770 | 3.654 | 4 | 1.155 | 1 | 5 |
| | lnB1_DURATION | 1770 | 3.215 | 3.434 | 0.753 | 0 | 4.875 |
| Goods characteristics | SGOODS | 1770 | 0.088 | 0 | 0.283 | 0 | 1 |
| | DGOODS | 1770 | 0.560 | 1 | 0.497 | 0 | 1 |
| | RGOODS | 1770 | 0.353 | 0 | 0.478 | 0 | 1 |
| | SUBSTITUTE | 1770 | 0.150 | 0 | 0.357 | 0 | 1 |
| | S_SUBSTITUTE | 1770 | 0.044 | 0 | 0.205 | 0 | 1 |
| Controls: Firm characteristics | lnEMP | 1770 | 3.601 | 3.466 | 1.239 | 0.693 | 10.39 |
| | lnAGE | 1770 | 3.575 | 3.689 | 0.520 | 1.099 | 4.727 |
| | lnPURCHASE | 1770 | 1.552 | 0 | 2.902 | 0 | 13 |
| | SCORE | 1770 | 55 | 54 | 6.793 | 29 | 79 |
| | INVENTORY_SR | 1770 | 0.093 | 0.054 | 0.118 | 0 | 1.111 |
| | SALSESCOST_SR | 1770 | 0.789 | 0.826 | 0.155 | 0 | 2 |
| | CONSTRUCTION | 1770 | 0.207 | 0 | 0.406 | 0 | 1 |
| | MANUFACTURING | 1770 | 0.302 | 0 | 0.459 | 0 | 1 |
| | WHOLESALES | 1770 | 0.256 | 0 | 0.437 | 0 | 1 |
| | RETAIL | 1770 | 0.095 | 0 | 0.293 | 0 | 1 |
| | OTHER_INDUSTRY | 1770 | 0.140 | 0 | 0.347 | 0 | 1 |
| Controls: Characteristics of the main supplier | lnS_EMP_NUM | 1770 | 5.393 | 5.306 | 1.848 | 1 | 7 |
| | S_RELATION1 | 1770 | 0.043 | 0 | 0.203 | 0 | 1 |
| | S_RELATION3 | 1770 | 0.079 | 0 | 0.269 | 0 | 1 |
| | S_RELATION4 | 1770 | 0.219 | 0 | 0.413 | 0 | 1 |
| | S_MANUFACTURING | 1770 | 0.334 | 0 | 0.472 | 0 | 1 |
| | S_GENERAL_TRADE | 1770 | 0.111 | 0 | 0.315 | 0 | 1 |
| | S_SPECIAL_TRADE | 1770 | 0.209 | 0 | 0.407 | 0 | 1 |
| | S_OTHER_TRADE | 1770 | 0.172 | 0 | 0.378 | 0 | 1 |
| | S_OTHER_INDUSTRY | 1770 | 0.173 | 0 | 0.379 | 0 | 1 |

## Table 3. Trade credit hypotheses and their predicted signs

This table summarizes the hypotheses of trade credit use and the signs of the coefficient of the independent variables the hypotheses predict. See Sections 4.1 - 4.6 for a more detailed exposition of the hypotheses and Table 1 for the definitions of the variables.

| | | Hypotheses / Variables | NOD_CHK | S_PROFIT_SR | KNOW1_S | S_DURATION | KNOW4_S | B1_DURATION | DGOODS | RGOODS | SUBSTITUTE | S_SUBSTITUTE | EMP | S\EMP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Transactions cost hypothesis (Section 4.1) | | Credit period is necessary for paperwork and for quality check of the product | + | | | | | | | | | | | |
| Price discrimination hypothesis (Section 4.2) | | Monopolistic sellers use trade credit to discriminate between heterogeneous buyers | | + | | | | | | | | | | |
| Informational advantage hypothesis (Section 4.3) | (General) | Informational advantage of sellers reduces informational asymmetry | | | + | | | | | | | | | |
| | Relationship lending hypothesis | Accumulation of soft information through strong transactional relationships reduces informational asymmetry | | | | + | + | | | | | | | |
| | Mutual signaling hypothesis | By lending simultaneously, banks and trade creditors mutually signal to each other that the buyer is creditworthy, which reduces informational asymmetry | | | | | | + | | | | | | |
| Moral hazard hypothesis (Section 4.5) | Switching cost hypothesis | Trade specificity through strong relationships makes opportunistic behavior costly for buyers | | | | + | | | + | + | + | | | |
| | Diversion hypothesis | Low diversion value of the goods makes it costly for buyers to engage in opportunistic behavior | | | | | | | + | + | | + | | |
| Bargaining power hypothesis (Section 4.6) | | The relative bargaining power between a seller and a buyer affects the use of trade credit | | | | | | | | | - | + | + | - |

## Table 4. Determinants of trade credit use

This table shows the *multinomial logit estimation results* for the determinants of trade credit use.
The *dependent variable* is the multinomial variable STATUS which represents the method of payment the sample firms use when they make payments to the main supplier. STATUS equals 0 if NON_TC = 1 (non-credit payment), 1 if TC_BKTRANS = 1 (credit payment using bank transfer), and 2 if TC_BILLS = 1 (credit payment using promissory bills). The base outcome is NON_TC=0 (non-credit payment). The main supplier is the supplier which accounts for the largest amount of a firm's purchases of supplies.
The *independent variables*, which are defined in Table 1, are proxies for different determinants of trade credit use implied by trade credit theories, and control variables. Suppliers' profit margin (S_PROFIT_SR) is not included in Panel (1), while it is included in Panel (2). A summary of the predicted signs of the coefficients on these variables suggested by the different theories, together with a brief description of the theories, is provided in Table 3.
***, **, or * means that the coefficient is statistically significant at the 1%, 5%, or 10% level, respectively.

| Dependant variable: STATUS | | | | | | | |
|---|---|---|---|---|---|---|---|
| Multinomial logit. Base outcome: NON_TC(STATUS=0) | | | | | | | |
| Independent variables | | NON_TC(STATUS=0) | | TC_BKTRANS(STATUS=1) | | TC_BILLS(STATUS=2) | |
| | | Marginal effect | z | Marginal effect | z | Marginal effect | z |
| Transaction costs | NOD_CHK | -0.001 | -1.69 * | -0.003 | -1.24 | 0.004 | 1.87 * |
| Price discrimination | | | | | | | |
| Information production | lnS_DURATION | 0.003 | 0.43 | -0.139 | -6.05 *** | 0.136 | 5.85 *** |
| | KNOW1_S | 0.001 | 0.27 | -0.029 | -1.89 * | 0.028 | 1.8 * |
| | KNOW4_S | -0.001 | -0.28 | 0.013 | 0.97 | -0.012 | -0.89 |
| | lnB1_DURATION | -0.010 | -1.64 | -0.024 | -1.07 | 0.034 | 1.49 |
| Goods characteristics | DGOODS | -0.020 | -1.41 | -0.268 | -5.35 *** | 0.288 | 5.66 *** |
| | RGOODS | -0.031 | -2.65 *** | -0.212 | -4.23 *** | 0.243 | 4.72 *** |
| | SUBSTITUTE | 0.025 | 1.73 * | 0.091 | 2.33 ** | -0.115 | -2.99 *** |
| | S_SUBSTITUTE | -0.010 | -0.71 | 0.009 | 0.13 | 0.001 | 0.01 |
| Controls: | lnEMP | -0.011 | -2.72 *** | 0.023 | 1.68 * | -0.012 | -0.89 |
| Firm characteristics | lnAGE | 0.00032 | 0.03 | -0.138 | -3.81 *** | 0.138 | 3.76 *** |
| | lnPURCHASE | 0.001 | 0.43 | -0.002 | -0.4 | 0.001 | 0.28 |
| | SCORE | -0.001 | -1.56 | 0.010 | 4.25 *** | -0.009 | -3.81 *** |
| | INVENTORY_SR | -0.086 | -1.84 * | -0.303 | -2.45 ** | 0.389 | 3.18 *** |
| | SALSESCOST_SR | 0.110 | 3.02 *** | -0.366 | -3.53 *** | 0.257 | 2.44 ** |
| Controls: | lnS_EMP_NUM | 0.013 | 4.81 *** | 0.005 | 0.62 | -0.018 | -2.14 ** |
| Characteristics of the main | S_RELATION1 | 0.053 | 1.67 * | 0.026 | 0.38 | -0.079 | -1.15 |
| supplier | S_RELATION3 | 0.004 | 0.28 | 0.025 | 0.49 | -0.029 | -0.57 |
| | S_RELATION4 | 0.058 | 3.76 *** | -0.044 | -1.33 | -0.014 | -0.43 |
| Industry dummies | | yes | | | | | |
| Supplier's industry dummies | | yes | | | | | |
| NOB | | 1770 | | | | | |
| LR chi2 | | 527.46 | | | | | |
| Prob > chi2 | | 0 | | | | | |
| Pseudo R2 | | 0.1689 | | | | | |
| Log likelihood | | -1297.86 | | | | | |

**Table 4 (continued)**
**Panel (2) Baseline results: with profit margin**

Dependant variable: STATUS
Multinomial logit. Base outcome: NON_TC(STATUS=0)

| Independent variables | | NON_TC(STATUS=0) | | TC_BKTRANS(STATUS=1) | | TC_BILLS(STATUS=2) | |
|---|---|---|---|---|---|---|---|
| | | Marginal effect | z | Marginal effect | z | Marginal Effect | z |
| Transaction costs | NOD_CHK | -0.001 | -1.36 | -0.001 | -0.4 | 0.003 | 0.92 |
| Price discrimination | S_PROFIT_SR | -0.019 | -0.7 | -0.224 | -0.8 | 0.243 | 0.79 |
| Information production | lnS_DURATION | 0.006 | 0.67 | -0.147 | -5.15 *** | 0.141 | 4.89 *** |
| | KNOW1_S | 0.003 | 0.54 | -0.015 | -0.82 | 0.012 | 0.64 |
| | KNOW4_S | -0.001 | -0.22 | 0.006 | 0.34 | -0.005 | -0.28 |
| | lnB1_DURATION | -0.011 | -1.55 | -0.031 | -1.16 | 0.043 | 1.57 |
| Goods characteristics | DGOODS | -0.020 | -1.15 | -0.324 | -5.3 *** | 0.344 | 5.54 *** |
| | RGOODS | -0.037 | -2.57 *** | -0.250 | -4 *** | 0.287 | 4.45 *** |
| | SUBSTITUTE | 0.024 | 1.44 | 0.065 | 1.46 | -0.090 | -2.01 ** |
| | S_SUBSTITUTE | -0.021 | -1.59 | -0.002 | -0.02 | 0.023 | 0.28 |
| Controls: | lnEMP | -0.008 | -1.63 | 0.035 | 2.19 ** | -0.027 | -1.71 * |
| Firm characteristics | lnAGE | -0.004 | -0.29 | -0.113 | -2.61 *** | 0.116 | 2.67 *** |
| | lnPURCHASE | 0.001 | 0.83 | 0.002 | 0.29 | -0.003 | -0.52 |
| | SCORE | -0.002 | -1.88 * | 0.008 | 3.07 *** | -0.007 | -2.54 ** |
| | INVENTORY_SR | -0.057 | -1.11 | -0.312 | -2.2 ** | 0.369 | 2.64 *** |
| | SALSESCOST_SR | 0.111 | 2.4 ** | -0.361 | -2.81 *** | 0.250 | 1.94 * |
| Controls: | lnS_EMP_NUM | 0.014 | 3.72 *** | 0.011 | 1.07 | -0.026 | -2.41 ** |
| Characteristics of the | S_RELATION1 | 0.071 | 1.77 * | 0.081 | 1.1 | -0.151 | -2.12 ** |
| main supplier | S_RELATION3 | 0.000 | 0.02 | 0.029 | 0.47 | -0.029 | -0.47 |
| | S_RELATION4 | 0.085 | 3.76 *** | -0.041 | -1.05 | -0.045 | -1.17 |
| Industry dummies | | yes | | | | | |
| Supplier's industry dummies | | yes | | | | | |
| NOB | | 1302 | | | | | |
| LR chi2 | | 407.68 | | | | | |
| Prob > chi2 | | 0 | | | | | |
| Pseudo R2 | | 0.1765 | | | | | |
| Log likelihood | | -951.2893 | | | | | |

# Table 5. Descriptive statistics for trade credit terms

This table shows descriptive statistics of the variables representing trade credit terms. NOD_BKTRANS is the duration (days) of the credit period when trade credit in the form of bank transfer is used, and NOD_BILLS is that when a promissory bill is used. DISCOUNT equals one if trade credit in the form of bank transfer is used and is accompanied by the provision of an early payment discount, and equals zero otherwise. PENALTY equals one if trade credit in the form of bank transfer is used and is accompanied by the provision of a late payment penalty, and equals zero otherwise. S_COLL equals one if the buyer provides the main supplier with collateral other than goods delivered by the main supplier, and equals zero otherwise.

Panel (1) Duration of credit period

| | N | Mean | Median | Std. dev. | Min. | Max. |
|---|---|---|---|---|---|---|
| NOD_BKTRANS | 741 | 51.20378 | 45 | 25.43168 | 16 | 175 |
| NOD_BILLS | 915 | 156.9399 | 155 | 42.03455 | 45 | 355 |

Panel (2) Early payment discount

| DISCOUNT | Freq. | Percent |
|---|---|---|
| 0 | 694 | 93.66 |
| 1 | 47 | 6.34 |
| Total | 741 | 100 |

Panel (3) Late payment penalty

| PENALTY | Freq. | Percent |
|---|---|---|
| 0 | 656 | 88.53 |
| 1 | 85 | 11.47 |
| Total | 741 | 100 |

Panel (4) Trade credit use and provision of collateral

| | | S_COLL | | |
|---|---|---|---|---|
| | | 0 | 1 | Total |
| STATUS | 0 | 102 | 12 | 114 |
| | | 89.47 | 10.53 | 100 |
| | 1 | 607 | 134 | 741 |
| | | 81.92 | 18.08 | 100 |
| | 2 | 747 | 168 | 915 |
| | | 81.64 | 18.36 | 100 |
| | Total | 1,456 | 314 | 1,770 |
| | | 82.26 | 17.74 | 100 |

## Table 6. Determinants of trade credit use: Shorter vs. longer credit periods

This table shows the multinomial logit estimation results for the determinants of trade credit use. The dependent variable, the multinomial variable STATUS that is the dependent variable in Table 4, is further divided based on the credit period (in days). STATUS=1 (credit payment using bank transfer) is split based on whether the credit period is 45 days or shorter, or more than 45 days. STATUS=2 (credit payment using promissory notes) is split based on whether the credit period is 135 days or shorter, or more than 135 days. Apart from this, the same remarks as in Table 4 Panel (1) apply. ***, **, or * means that the coefficient is statistically significant at the 1%, 5%, or 10% level, respectively.

Dependant variable: STATUS
Multinomial logit. Base outcome: NON_TC(STATUS=0)

| Independent variables | | NON_TC(STATUS=0) | | TC_BKTRANS(STATUS=1) | | | | TC_BILLS(STATUS=2) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (a) NOD_BKTRANS<=45 | | (b) NOD_BKTRANS>45 | | (c) NOD_BKTRANS<=135 | | (d) NOD_BKTRANS>135 | |
| | | Marginal effect | z | Marginal effect | z | Marginal effect | z | Marginal effect | z | Marginal effect | z |
| Transaction costs | NOD_CHK | -0.001 | -1.63 | -0.004 | -1.84 * | 0.001 | 0.72 | -0.00084 | -0.47 | 0.005 | 2.54 ** |
| Information production | lnS_DURATION | 0.003 | 0.42 | -0.086 | -4.34 *** | -0.054 | -3.91 *** | 0.080 | 4.14 *** | 0.057 | 2.6 *** |
| | KNOW1_S | 0.001 | 0.26 | -0.026 | -1.85 * | -0.004 | -0.36 | 0.025 | 2.12 ** | 0.003 | 0.23 |
| | KNOW4_S | -0.001 | -0.3 | 0.007 | 0.57 | 0.007 | 0.72 | -0.008 | -0.86 | -0.004 | -0.3 |
| | lnB1_DURATION | -0.010 | -1.64 | 0.004 | 0.21 | -0.027 | -1.9 * | 0.018 | 1.04 | 0.015 | 0.69 |
| Goods characteristics | DGOODS | -0.023 | -1.59 | -0.273 | -6.36 *** | -0.008 | -0.25 | 0.004 | 0.12 | 0.300 | 5.35 *** |
| | RGOODS | -0.035 | -2.92 *** | -0.218 | -5.72 *** | -0.005 | -0.14 | -0.023 | -0.58 | 0.282 | 4.26 *** |
| | SUBSTITUTE | 0.025 | 1.7 * | 0.055 | 1.55 | 0.037 | 1.37 | -0.012 | -0.45 | -0.105 | -3.06 *** |
| | S_SUBSTITUTE | -0.011 | -0.72 | 0.038 | 0.6 | -0.023 | -0.6 | -0.022 | -0.44 | 0.017 | 0.27 |
| Controls: | lnEMP | -0.011 | -2.7 *** | -0.017 | -1.37 | 0.038 | 4.42 *** | -0.018 | -1.76 * | 0.008 | 0.6 |
| Firm characteristics | lnAGE | 0.000 | -0.03 | -0.044 | -1.38 | -0.088 | -4.07 *** | 0.054 | 1.83 * | 0.078 | 2.19 ** |
| | lnPURCHASE | 0.001 | 0.43 | 0.000 | -0.05 | -0.002 | -0.61 | 0.0006 | 0.18 | 0.001 | 0.19 |
| | SCORE | -0.001 | -1.57 | 0.007 | 3.46 *** | 0.003 | 1.85 * | -0.002 | -1.08 | -0.007 | -3.31 *** |
| | INVENTORY_SR | -0.091 | -1.84 * | -0.097 | -0.88 | -0.220 | -2.3 ** | 0.095 | 1.13 | 0.313 | 2.91 *** |
| | SALSESCOST_SR | 0.118 | 3.08 *** | -0.326 | -3.82 *** | -0.054 | -0.93 | -0.053 | -0.67 | 0.316 | 2.96 *** |
| Controls: | lnS_EMP_NUM | 0.014 | 4.82 *** | 0.007 | 1 | -0.002 | -0.36 | -0.006 | -0.87 | -0.014 | -1.71 * |
| Characteristics of the | S_RELATION1 | 0.056 | 1.68 * | -0.047 | -0.84 | 0.061 | 1.2 | -0.049 | -1.11 | -0.021 | -0.31 |
| main supplier | S_RELATION3 | 0.005 | 0.33 | 0.020 | 0.45 | 0.009 | 0.27 | 0.018 | 0.49 | -0.053 | -1.12 |
| | S_RELATION4 | 0.061 | 3.77 *** | -0.063 | -2.2 ** | 0.017 | 0.75 | -0.012 | -0.51 | -0.003 | -0.08 |
| Industry dummies | | yes | | | | | | | | | |
| Supplier's industry dummies | | yes | | | | | | | | | |
| NOB | | 1770 | | | | | | | | | |
| LR chi2 | | 674.83 | | | | | | | | | |
| Prob > chi2 | | 0 | | | | | | | | | |
| Pseudo R2 | | 0.1292 | | | | | | | | | |
| Log likelihood | | -2274.923 | | | | | | | | | |

## Table 7. Determinants of trade credit use: With vs. without early payment discount

This table shows the multinomial logit estimation results for the determinants of trade credit use. The dependent variable, the multinomial variable STATUS that is the dependent variable in Table 4, is further divided based on whether there is a provision for an early payment discount (DISCOUNT=1) or not (DISCOUNT=0) in the case of bank transfer. ***, **, or * means that the coefficient is statistically significant at the 1%, 5%, or 10% level, respectively.

Dependant variable: STATUS
Multinomial logit. Base outcome: NON_TC(STATUS=0)

| Independent variables | | NON_TC(STATUS=0) | | TC_BKTRANS(STATUS=1) (a) DISCOUNT=0 | | TC_BKTRANS(STATUS=1) (b) DISCOUNT=1 | | TC_BILLS(STATUS=2) | |
|---|---|---|---|---|---|---|---|---|---|
| | | Marginal effect | z | Marginal effect | z | Marginal effect | z | Marginal effect | z |
| Transaction costs | NOD_CHK | -0.001 | -1.7 * | -0.003 | -1.18 | -0.00004 | -0.14 | 0.004 | 1.84 * |
| Information production | lnS_DURATION | 0.003 | 0.48 | -0.141 | -6.22 *** | -0.001 | -0.32 | 0.139 | 5.97 *** |
| | KNOW1_S | 0.001 | 0.27 | -0.028 | -1.8 * | -0.001 | -0.66 | 0.028 | 1.77 * |
| | KNOW4_S | -0.001 | -0.24 | 0.010 | 0.77 | 0.001 | 0.95 | -0.011 | -0.79 |
| | lnB1_DURATION | -0.010 | -1.71 * | -0.018 | -0.8 | -0.003 | -1.73 * | 0.032 | 1.37 |
| Goods characteristics | DGOODS | -0.027 | -1.8 * | -0.195 | -3.73 *** | -0.027 | -2.53 ** | 0.249 | 4.68 *** |
| | RGOODS | -0.036 | -3 *** | -0.162 | -3.09 *** | -0.009 | -2.25 ** | 0.206 | 3.84 *** |
| | SUBSTITUTE | 0.024 | 1.68 * | 0.099 | 2.54 ** | -0.001 | -0.42 | -0.121 | -3.14 *** |
| | S_SUBSTITUTE | -0.010 | -0.69 | 0.009 | 0.14 | -0.003 | -0.54 | 0.003 | 0.05 |
| Controls: | lnEMP | -0.011 | -2.84 *** | 0.028 | 2.06 ** | -0.001 | -1.07 | -0.015 | -1.12 |
| Firm characteristics | lnAGE | 0.0008 | 0.08 | -0.145 | -4.01 *** | 0.003 | 0.78 | 0.141 | 3.84 *** |
| | lnPURCHASE | 0.001 | 0.44 | -0.002 | -0.46 | 0.00005 | 0.14 | 0.002 | 0.32 |
| | SCORE | -0.001 | -1.41 | 0.009 | 3.77 *** | 0.000 | 1.91 * | -0.008 | -3.55 *** |
| | INVENTORY_SR | -0.091 | -1.9 * | -0.267 | -2.18 ** | -0.019 | -1.01 | 0.377 | 3.09 *** |
| | SALSESCOST_SR | 0.114 | 3.07 *** | -0.373 | -3.64 *** | -0.005 | -0.44 | 0.264 | 2.52 ** |
| Controls: | lnS_EMP_NUM | 0.014 | 4.91 *** | -0.001 | -0.11 | 0.004 | 3.09 *** | -0.017 | -1.94 * |
| Characteristics of the | S_RELATION1 | 0.054 | 1.67 * | 0.028 | 0.41 | 0.000 | -0.04 | -0.081 | -1.17 |
| main supplier | S_RELATION3 | 0.003 | 0.19 | 0.033 | 0.65 | -0.004 | -1.4 | -0.032 | -0.63 |
| | S_RELATION4 | 0.059 | 3.76 *** | -0.043 | -1.31 | 0.000 | -0.11 | -0.015 | -0.47 |
| Industry dummies | | yes | | | | | | | |
| Supplier's industry dummies | | yes | | | | | | | |
| NOB | | 1770 | | | | | | | |
| LR chi2 | | 656.28 | | | | | | | |
| Prob > chi2 | | 0 | | | | | | | |
| Pseudo R2 | | 0.1889 | | | | | | | |
| Log likelihood | | -1408.547 | | | | | | | |

## Table 8. Determinants of trade credit use: With vs. without late payment penalty

This table shows the multinomial logit estimation results for the determinants of trade credit use. The dependent variable, the multinomial variable STATUS that is the dependent variable in Table 4, is further divided based on whether there is a provision for a late payment penalty (PENALTY=1) or not (PENALTY=0) in the case of bank transfer. ***, **, or * means that the coefficient is statistically significant at the 1%, 5%, or 10% level, respectively.

Dependant variable: STATUS
Multinomial logit. Base outcome: NON_TC(STATUS=0)

| Independent variables | | NON_TC(STATUS=0) | | TC_BKTRANS(STATUS=1) (a) PENALTY=0 | | TC_BKTRANS(STATUS=1) (b) PENALTY=1 | | TC_BILLS(STATUS=2) | |
|---|---|---|---|---|---|---|---|---|---|
| | | Marginal effect | z | Marginal effect | z | Marginal effect | z | Marginal effect | z |
| Transaction costs | NOD_CHK | -0.002 | -1.72 * | -0.002 | -0.68 | -0.001 | -1.82 * | 0.004 | 1.84 * |
| Information production | lnS_DURATION | 0.003 | 0.48 | -0.140 | -6.3 *** | -0.001 | -0.22 | 0.138 | 5.94 *** |
| | KNOW1_S | 0.002 | 0.37 | -0.036 | -2.34 ** | 0.004 | 1.23 | 0.029 | 1.89 * |
| | KNOW4_S | -0.001 | -0.32 | 0.016 | 1.19 | -0.002 | -0.79 | -0.012 | -0.91 |
| | lnB1_DURATION | -0.010 | -1.66 * | -0.020 | -0.91 | -0.004 | -0.85 | 0.034 | 1.48 |
| Goods characteristics | DGOODS | -0.025 | -1.67 * | -0.200 | -3.93 *** | -0.038 | -3.2 *** | 0.262 | 4.99 *** |
| | RGOODS | -0.035 | -2.9 *** | -0.156 | -3.08 *** | -0.025 | -3.25 *** | 0.215 | 4.07 *** |
| | SUBSTITUTE | 0.026 | 1.76 * | 0.069 | 1.8 * | 0.018 | 1.71 * | -0.113 | -2.92 *** |
| | S_SUBSTITUTE | -0.010 | -0.7 | 0.013 | 0.2 | -0.004 | -0.25 | 0.001 | 0.01 |
| Controls: | lnEMP | -0.011 | -2.72 *** | 0.021 | 1.58 | 0.002 | 0.85 | -0.013 | -0.91 |
| Firm characteristics | lnAGE | 0.000 | -0.01 | -0.128 | -3.64 *** | -0.008 | -1.16 | 0.137 | 3.73 *** |
| | lnPURCHASE | 0.001 | 0.46 | -0.003 | -0.53 | 0.000 | 0.31 | 0.002 | 0.34 |
| | SCORE | -0.001 | -1.46 | 0.009 | 3.85 *** | 0.001 | 1.54 | -0.009 | -3.69 *** |
| | INVENTORY_SR | -0.091 | -1.89 * | -0.230 | -1.91 * | -0.062 | -1.53 | 0.383 | 3.14 *** |
| | SALSESCOST_SR | 0.113 | 3.06 *** | -0.366 | -3.67 *** | -0.008 | -0.43 | 0.260 | 2.48 ** |
| Controls: | lnS_EMP_NUM | 0.014 | 4.91 *** | -0.005 | -0.58 | 0.008 | 3.88 *** | -0.017 | -2.02 ** |
| Characteristics of the | S_RELATION1 | 0.051 | 1.63 | 0.049 | 0.72 | -0.011 | -1.48 | -0.090 | -1.29 |
| main supplier | S_RELATION3 | 0.004 | 0.27 | 0.024 | 0.48 | -0.001 | -0.13 | -0.027 | -0.53 |
| | S_RELATION4 | 0.059 | 3.75 *** | -0.045 | -1.39 | 0.001 | 0.15 | -0.015 | -0.47 |
| Industry dummies | | yes | | | | | | | |
| Supplier's industry dummies | | yes | | | | | | | |
| NOB | | 1770 | | | | | | | |
| LR chi2 | | 645.28 | | | | | | | |
| Prob > chi2 | | 0 | | | | | | | |
| Pseudo R2 | | 0.1767 | | | | | | | |
| Log likelihood | | -1502.933 | | | | | | | |

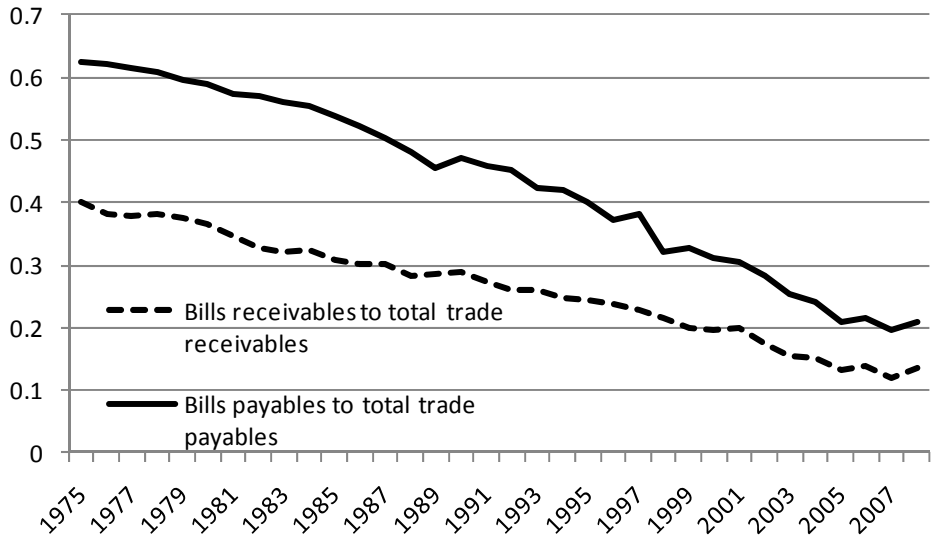
## Table 9. Determinants of trade credit use: With vs. without collateral

This table shows the multinomial logit estimation results for the determinants of trade credit use. The dependent variable, the multinomial variable STATUS that is the dependent variable in Table 4, is further divided based on whether there is a provision for collateral (S_COLL=1) or not (S_COLL=0) in both cases of trade credit use. ***, **, or * means that the coefficient is statistically significant at the 1%, 5%, or 10% level, respectively.

Dependant variable: STATUS
Multinomial logit. Base outcome: NON_TC(STATUS=0)

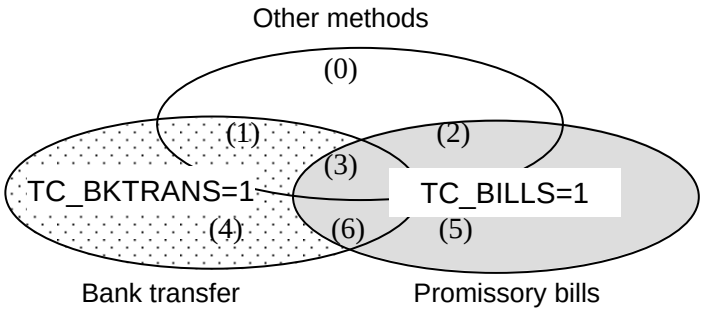
| Independent variables | | NON_TC(STATUS=0) | | TC_BKTRANS(STATUS=1) (a) S_COLL=0 | | TC_BKTRANS(STATUS=1) (b) S_COLL=1 | | TC_BILLS(STATUS=2) (c) S_COLL=0 | | TC_BILLS(STATUS=2) (d) S_COLL=1 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Marginal effect | z | Marginal effect | z | Marginal effect | z | Marginal effect | z | Marginal effect | z |
| Transaction costs | NOD_CHK | -0.002 | -1.78 * | -0.001 | -0.65 | -0.001 | -1.32 | 0.006 | 2.68 *** | -0.002 | -1.66 * |
| Information production | lnS_DURATION | 0.007 | 0.88 | -0.148 | -6.7 *** | 0.008 | 0.89 | 0.069 | 2.92 *** | 0.065 | 5.57 *** |
| | KNOW1_S | 0.003 | 0.65 | -0.040 | -2.57 *** | 0.009 | 1.61 | 0.0090 | 0.57 | 0.018 | 2.85 *** |
| | KNOW4_S | -0.002 | -0.4 | 0.021 | 1.51 | -0.004 | -0.93 | -0.014 | -1.04 | 0.000 | -0.04 |
| | lnB1_DURATION | -0.011 | -1.66 * | -0.029 | -1.26 | -0.001 | -0.11 | 0.048 | 2.03 ** | -0.008 | -1.02 |
| Goods characteristics | DGOODS | -0.032 | -1.94 * | -0.181 | -3.43 *** | -0.071 | -3.56 *** | 0.285 | 5.07 *** | -0.001 | -0.07 |
| | RGOODS | -0.041 | -3.15 *** | -0.144 | -2.74 *** | -0.053 | -3.83 *** | 0.246 | 4.14 *** | -0.008 | -0.4 |
| | SUBSTITUTE | 0.026 | 1.7 * | 0.099 | 2.51 ** | 0.008 | 0.58 | -0.147 | -3.88 *** | 0.014 | 0.92 |
| Controls: | lnEMP | -0.014 | -3.1 *** | 0.033 | 2.4 ** | -0.010 | -2.11 ** | 0.008 | 0.56 | -0.017 | -3.27 *** |
| Firm characteristics | lnAGE | 0.002 | 0.15 | -0.117 | -3.28 *** | -0.014 | -1.11 | 0.124 | 3.26 *** | 0.006 | 0.39 |
| | SCORE | -0.001 | -1.63 | 0.009 | 3.87 *** | 0.0008 | 1.03 | -0.007 | -3.14 *** | -0.001 | -1.52 |
| | INVENTORY_SR | -0.102 | -1.93 * | -0.202 | -1.65 * | -0.087 | -1.41 | 0.407 | 3.39 *** | -0.016 | -0.31 |
| | SALSESCOST_SR | 0.130 | 3.19 *** | -0.396 | -3.99 *** | 0.035 | 0.86 | 0.144 | 1.34 | 0.089 | 1.85 * |
| Controls: | lnS_EMP_NUM | 0.016 | 5.11 *** | -0.013 | -1.58 | 0.018 | 5.19 *** | -0.034 | -3.94 *** | 0.013 | 3.7 *** |
| Characteristics of the | S_RELATION1 | 0.045 | 1.46 | 0.009 | 0.13 | -0.005 | -0.28 | -0.013 | -0.18 | -0.036 | -2.96 *** |
| main supplier | S_RELATION3 | 0.005 | 0.28 | 0.018 | 0.36 | 0.009 | 0.52 | -0.036 | -0.67 | 0.003 | 0.18 |
| | S_RELATION4 | 0.064 | 3.77 *** | -0.079 | -2.43 ** | 0.020 | 1.5 | -0.007 | -0.21 | 0.001 | 0.09 |
| Industry dummies | | yes | | | | | | | | | |
| Supplier's industry dummies | | yes | | | | | | | | | |
| NOB | | 1770 | | | | | | | | | |
| LR chi2 | | 983.93 | | | | | | | | | |
| Prob > chi2 | | 0 | | | | | | | | | |
| Pseudo R2 | | 0.2095 | | | | | | | | | |
| Log likelihood | | -1856.154 | | | | | | | | | |

**Figure 1. Ratio of bills payables (receivables) to total trade payables (receivables)**




Source: *Financial Statement Statistics of Corporations by Industry*, Ministry of Finance.

**Figure 2. Methods of payment and dependent variables**




Note: Other methods = Cash or check at the time of delivery, cancelling out with accounts receivables and/or endorsement of promissory bills received from other firms