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Does Geographical Proximity Matter in Small Business Lending? Evidence from Changes in Main Bank Relationships[†]

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Abstract

Using a unique and massive firm-bank matched panel dataset, this paper examines the causal link between the geographical distance between a firm and its main bank and the probably that a firm will switch its main bank. Utilizing the exogenous change in firm-main bank distances brought about by bank mergers and bank branch consolidations in Japan during 2000–2010, the analysis – the first of its kind – finds the following. First, an increase in lending distance positively affected switching of firm-main bank relationships. Second, the average lending distance for firms that switched to new main banks significantly decreased afterwards. Third, the lending distance of new firm-main bank relationships after the switch did not have a significant impact on firms' probability of ex-post default, suggesting that larger lending distance does not necessarily result in a deterioration in the quality of soft information.

JEL classifications: G21, R12

Keywords: lending distance, firm-bank relationships, bank mergers, main bank

1. Introduction

Loans to small businesses have traditionally been extended by local lenders that have a physical presence – such as their headquarters or a branch – in the vicinity of their borrowers. Previous theoretical and empirical studies have argued that distance matters for firm-bank relationships for the following two reasons. First, smaller distances increase the precision of soft information, such as information on how motivated a firm's owner and its employees are and on the owner's management ability, that is employed by banks when extending loans to informationally opaque firms (see, e.g., Agarwal and Hauswald 2010). Second, smaller distances reduce transportation costs incurred by firms when using bank services as well as banks' cost of monitoring a borrower (see, e.g., Degryse and Ongena 2005). Not only the distance of incumbent firm-bank relationships but also the distance between firms and rival banks matter, since whether a firm and its bank continue to transact with each other is also affected by the degree of competition in the local loan market (see, e.g., Shaffer 1998). In sum, all of these studies predict that a smaller firm-bank distance increases the likelihood that an existing firm-bank relationship survives.

However, while there is an abundant literature on how distance affects loan availability and loan conditions (e.g., Agarwal and Hauswald 2010, Degryse and Ongena 2005, Petersen and Rajan 1994), there is little empirical evidence on the impact of firm-bank distance on the continuation or termination of firm-bank relationships. Against this background, the present study is the first to empirically examine the link between firm-bank distance and firm-bank relationship survival, using a

unique and massive firm-bank matched panel dataset and exploiting exogenous changes in firm-bank distances brought about by bank branch consolidations. More specifically, focusing on changes in firm-main bank relationships in Japan during the period 2000–2010, we conduct the following three exercises. First, we examine whether lending distance affects the likelihood that a firm-main bank relationship is terminated. In order to deal with possible biases caused by reverse causality and/or omitted variables, which have often been neglected in previous studies examining the effects of firm-bank distance, we utilize the exogenous change in firm-main bank distances brought about by changes in the bank branches that firms transacted with as a result of the massive consolidation of bank branch networks and bank mergers in Japan during the 2000s.

Second, we compare the "old" lending distance and the "new" distance when firms terminate their existing main bank relationship and switch to a new main bank. If a longer distance between a firm and its main bank branch is a major reason for switching to a new main bank, we should observe distances to the new main bank to be shorter. On the other hand, if distance plays a relatively minor role compared to other factors that affect firm-main bank relationships, we should observe no significant differences after the switch. In other words, this exercise assesses how switching of the main bank affects the physical distances between firms and their banks. Examining the lending distance after the formation of new main bank relationships also sheds light on the relevance of geographical proximity between firms and banks in an age of improving information technology and the growing use of techniques such as small business credit scoring, which rely less

on soft information (e.g., DeYoung, Glennon, and Nigro 2008, DeYoung, Frame, and Glennon 2011, Ono et al. 2014).

Third, we focus on the effect of lending distances on firms' ex-post default and examine whether the precision of soft information or transaction cost (e.g., transportation cost and monitoring cost) savings play a more important role in whether there is a switch in firm-main bank relationships. If shorter lending distance results in more accurate soft information, then banks that forge new relationships at a shorter distance will have more accurate information on borrower firms' quality and presumably face a smaller probability of borrower firm default (Agarwal and Hauswald 2010, DeYoung, Glennon, and Nigro 2008). On the other hand, if shorter distances in firm-bank relationships are driven mainly by the desire to reduce transaction costs (e.g., Carling and Lundberg 2005), we would expect to find no link between lending distance and firms' ex-post default probability. Because empirical research has yet to reach firm conclusions, we revisit this issue by investigating the probability of default for firms that switched their main banks.

The major findings of this study are as follows. First, we find that exogenous changes in geographical distance positively affect the probability that a firm switches its main bank.[1] The impact of changes in lending distance is both statistically and economically significant. Based on our estimation results, a marginal one-unit increase in the log difference of the lending distance,

[1] It should be noted that because the regression model used for the analysis (equation (1) below) is in reduced form, we cannot tell whether it was a firm or a bank that initiated the termination of a main bank relationship. Therefore, although for convenience we talk about firms terminating a main bank relationship, switching their main bank, etc., strictly speaking all we can say is that a main bank relationship came to an end, since it is also possible that a bank may have reduced its loan exposure to a firm, so that it is no longer the firm's main bank.

which corresponds to 5.0km (5.3km) for a median borrower-main bank distance of about 1.6km (1.8km), raises the probability that a firm switches its main bank by 8.2 (6.0) percentage points during the period 2000–2005 (2005–2010). Splitting our observations into a subsample of firm-main bank pairs whose geographical distance increased and one of firm-main bank pairs whose distance decreased, we find that the impact of distance on the main bank switch probability is non-linear, i.e., a decrease does not lower the probability as much as an increase raises the probability. We also find that the probability that a firm will switch its main bank is negatively correlated to the distance between the firm and alternative banks. All of these findings indicate that lending distance does indeed matter for firm-main bank relationships.

Second, regarding the termination of existing and switch to new firm-main bank relationships, we find that the average distance of the new relationships is significantly shorter than if there had been no switches. This provides evidence that distance affects firm-bank relationships and complements the first finding: changes in lending distance not only can be a reason for the termination of main bank relationships but also play an important role in the formation of new firm-main bank relationships.

Third, we find that there is no significant correlation between the lending distance of new firm-main bank relationships after a switch and firms' ex-post default probability. This finding is inconsistent with the argument that geographical proximity improves the quality of soft information and suggests that proximity instead is motivated by the desire to reduce transaction costs.

The contribution of our study to the literature is threefold. First, it contributes to the literature focusing on the impact of geographical proximity among borrowers, their lenders, and other rival potential lenders on loan terms and loan availability (Agarwal and Hauswald 2010, Bellucci et al. 2013, Degryse and Ongena 2005, Knyazeva and Knyazeva 2012, Petersen and Rajan 1994) as well as on loan default (Agarwal and Hauswald 2010, Carling and Lundberg 2005, DeYoung, Glennon, and Nigro 2008). Our study adds to this literature by examining the link between physical distance and the likelihood that a firm-main bank relationship is terminated, an issue on which, as far as we are aware, no previous studies provide any detailed evidence. Another contribution of our study to this literature is that, by making use of the exogenous variation in changes in firm-bank distances, it provides a way to control for the possible bias caused by reverse causality and/or omitted variables. While geographical distance between a firm and its lender bank may well be determined endogenously, very few existing studies have addressed the potential bias arising from such endogeneity.[2] For instance, in the context of our study, it is conceivable that the closeness of a firm-main bank relationship (in terms of their business dealings) may affect the geographical distance between the two (reverse causality) and/or that other unobservable factors (e.g., banks' lending technology) affect both the relationship and the distance (omitted variable bias). Using the exogenous variation in changes in firm-bank distances allows us to control for such potential biases.

Second, we examine why lending distance seems to matter – an issue on which preceding

[2] One of the few exceptions is the study by Knyazeva and Knyazeva (2012), which uses the state and industry median of firm-bank distances and bank density as instruments for individual firm-bank distances.

studies have produced mixed results. While Agarwal and Hauswald (2010) and DeYoung, Glennon, and Nigro (2008) find evidence suggesting that a shorter distance is an important determinant of the precision of soft information, other studies, including Bellucci et al. (2013), Carling and Lundberg (2005), Degryse and Ongena (2005), and Knyazeva and Knyazeva (2012), find evidence that is inconsistent with the soft information hypothesis and suggest instead that lending distance matters because of its impact on transaction costs. Against this background, our analysis of the link between physical distance and the likelihood of ex-post default of firms that switched their main bank may provide new insights on how the conflicting evidence of the preceding studies should be interpreted.

Third, our study also contributes to the literature on the duration and switching of firm-bank relationships. Existing studies mostly focus on the measurement of switching costs (Ioannidou and Ongena 2010) and firm and bank attributes that affect the duration and switching of relationships (Farinha and Santos 2002, Gopalan et al. 2011, Ongena and Smith 2001). Our research adds to these studies by closely examining the impact of physical distance.

The remainder of the paper is organized as follows. The next section explains our dataset. Section 3 then provides summary statistics of the geographical distance between firms and their main banks and the distance between firms and rival banks for the period from 2000 to 2010, on which this study focuses. Next, Section 4 presents univariate analyses on how borrower-lender distance affects the probability that firms terminate the relationship with their main bank, followed by a probit model estimation that also controls for various characteristics of firms and their main banks. Section 5 then

examines the ex-post lending distances of firms that switched their main bank, while Section 6 presents a probit model estimation that examines the link between lending distance and the probability of ex-post firm default. Finally, Section 7 concludes.

2. Data

We constructed our dataset from the following sources. First, we employ the firm-level credit database provided by Teikoku Databank Ltd. (TDB), a leading credit research firm that compiles information on more than 2 million firms in Japan. It also provides information on firms' primary characteristics such as firm age, number of employees, ownership structure, industry, location, credit score, and the identity of banks and bank branches the firm transacts with. Since, according to the "2012 Economic Census for Business Activity" by the Ministry of Internal Affairs and Communications and the Ministry of Economy, Trade and Industry, the total number of firms in Japan in 2012 including proprietorships was 4.1 million and the number of incorporations was about 1.6 million, the coverage of the TDB database, which mainly comprises incorporations, is quite high. From the TDB database, we use information on firms' characteristics such as their address, basic accounting information, and the names of the banks from which firms have borrowed, including details of the branches with which they transact. For each firm, the TDB database provides a list of up to ten banks with which the firm transacts, and – following conventions – we define the bank at the top of each firm's list as the firm's main bank, based on the assumption that banks in the TDB

database are listed in order of importance to the firm.

Second, to identify the location of the main bank branch that a firm transacts with, we use the *Nihon Kinyu Meikan* (Almanac of Financial Institutions in Japan) provided by Nihon Kinyu Tsushinsha (The Japan Financial News Co., Ltd.). This provides information on the addresses of all bank branches in Japan as well as basic characteristics of banks and branches. To construct variables that represent the characteristics of main banks for our regression analyses, we also use the Nikkei Financial Quest database, the *Zenkoku Shinyo-kinko Zaimushohyo* (Financial Statements of Shinkin Banks) and the *Zenkoku Shinyo-kumiai Zaimushohyo* (Financial Statements of Credit Cooperatives) provided by *Kinyu Tosho Consultantsha*.

Third, we use the *Ginko Hensenshi Database* (Bank History Database) provided by the Japanese Bankers Association to identify all mergers and acquisitions (M&As) of financial institutions during 2000–2010. For M&As of Shinkin banks and credit cooperatives, we use the *Zenkoku Shinyo-kinko Zaimushohyo* and *Zenkoku Shinyo-kumiai Zaimushohyo*. We need this information in order to identify cases in which the name of the main bank branch changed due to a merger or acquisition while the physical addresses remained unchanged.

Using all the sources outlined above, we construct our dataset containing information on borrower-main bank relationships, their geographical distances, borrower firm characteristics, and lender (main bank) characteristics in the years 2000, 2005, and 2010. As our main research interest lies in the distance between firms and their main bank and the switching of main banks, the unit of

observation for most variables is a firm-main bank pair. The following section provides definitions of key variables.

3. Lending distance in Japan

The main variable of interest in this study is the borrower-lender distance. For every firm in the TDB dataset, we calculate the Euclidian (straight-line) geographical distance between a firm's headquarters and the main bank branch that the firm transacts with. As noted above, we define the main bank as the bank listed at the top in the TDB database. In order to identify the geographical location (latitude and longitude) of a firm and its main bank, we geocode their address data using the CSV Address Matching Service provided by the Center for Spatial Information Science, University of Tokyo.

Table 1 provides summary statistics of borrower-lender distances, labeled DISTANCE, in the years 2000, 2005, and 2010, using the unbalanced panel dataset described in the previous section. For all three years together, we find that the mean and median distance between firms and their main bank are 5.51km and 1.61km, respectively, which is substantially shorter than the distance between firms and transaction partners for goods and services, such as suppliers and customers (Nakajima et al. 2012).[3] This finding suggests that, in Japan, geographical proximity is more important for firm-bank transactions than for other types of transactions. During our observation period, the mean (median)

[3] Using a dataset of manufacturing firms in Japan, Nakajima et al. (2012) report that the mean (median) of physical distances for interfirm transaction relationships is 153 km (39km).

distance increased from 4.97 km (1.51 km) in 2000 to 5.99 km (1.72 km) in 2010.

Table 1 also reports summary statistics of the distance between firms and potential rival banks for the main bank, DISTANCE_COMP. We define a potential rival bank as the bank with a branch office located at the shortest distance from the firm except for the main bank branch with which a firm transacts. Table 1 shows that the physical distance between firms and rival banks is much shorter than the firm-main bank distance: the mean (median) of DISTANCE_COMP during 2000–2010 is 1.03 km (0.48 km). This finding suggests that firms and banks take not only geographical proximity but also other factors into account when forming main bank relationships. During the observation period, the mean (median) value of DISTANCE_COMP increased from 0.92 km (0.41 km) in 2000 to 1.10 km (0.53 km) in 2010.

4. Lending distance and firm-main bank relationships

4.1. Identification strategy

In order to correctly identify whether the geographical distance between firms and their main banks is an important determinant of relationships, and whether lending distance plays a role in the termination of relationships in particular, we need to single out an exogenous variation in the distance which is orthogonal to the disturbance that affects firm-main bank relationships. Note, however, that in some cases the assumption of orthogonality may not hold if we simply use the lending distance between firms and their banks. For example, banks that employ transaction-based lending technologies (e.g.,

credit scoring) may establish main bank relationships with firms located far from them. Because such transaction relationships are likely to be arm's length and not based on soft information that is proprietary to the bank, the probability that a main bank relationship is terminated is higher. In such cases, we would find a spurious positive relationship between firm-main bank distances and the termination of main bank relationships.

In order to address this issue, we employ changes in distances as a result of banks' closing branch offices. Since each branch office of a bank has a large number of customer firms, the characteristics of individual firms that a bank transacts with will have only a miniscule impact on the bank's decision whether to close a particular branch. During the observation period of 2000–2010, there were a large number of branch closures as a result of the consolidation of branch networks triggered either as a result of bank mergers or simply to reduce costs. (Figure 1). In most cases, the primary objective of branch network consolidation – typically consisting of the closure of branches – in Japan during this period was to cut costs to deal with the massive non-performing loans problem rather than to strategically reorganize branch networks. Moreover, when branch networks are consolidated in the wake of a bank merger, it is often mainly branches of the acquired bank that are closed, so that branch closures do not necessarily occur from the perspective of branch network optimization but more likely reflect the relative bargaining power of the acquired and the acquiring bank.[4]

[4] For example, in the case of the merger of Bank of Tokyo Mitsubishi and UFJ Bank in 2005 – the largest merger in the world in terms of assets at that time – 83 branches that were closed within three years of the merger. Out of these 83 branches, 69 were branches of the acquired bank (UFJ), while only 14 were

Specifically, in our analysis we focus on the subset of firms whose main bank branch disappeared between *t-1* and *t*, likely as a result of branch network consolidation, which, in turn, may or may not be the result of a merger. In this case, if a firm wanted to maintain its relationship with the bank, it had to transact with another branch of the same main bank located somewhere else. Typically, when a bank closes a branch, the bank will transfer the staff of the branch, customers' loan balances, and deposit accounts to the "succeeding" branch it chooses and ask customer firms to continue transacting with that branch. We assume that this alternative succeeding branch is the one geographically closest to the branch with which the firm did transact and that disappeared. We then calculate the geographical distance between a firm's headquarters and the alternative branch and take the difference with the lending distance associated with the old branch at time *t-1* ($DIFF\_DISTANCE_t$). On average, the distance between the firm and the alternative main bank branch is greater than the distance between the firm and the branch the firm used to transact with, implying that $DIFF\_DISTANCE_t$ takes positive values. The change in lending distance calculated in this manner is likely to be exogenous to the decision at time *t* to terminate a main bank relationship, since it is unlikely that bank mergers and branch closures are affected by individual firm-bank relationships.

4.2. Univariate analysis

In this subsection, we conduct a univariate analysis of the interaction between distance and firm-main

branches of the acquiring bank (Bank of Tokyo Mitsubishi).

bank relationships, followed by a multivariate analysis controlling for other factors in the next subsection. We divide our sample of firm-main bank pairs into quintiles based on the change in the firm-main bank log distance between time *t-1* and *t* (DIFF_lnDISTANCE$_t$) and calculate the average frequency of the termination of firm-main bank relationships for each quintile at time *t* (SWITCH$_t$). Firms in the first quintile are those that experienced the smallest change in the distance with the main bank (DIFF_lnDISTANCE), while those in the fifth quintile experienced the largest change. Following previous studies, we use the log of one plus the distance to take account of the skewed distribution of distances and the likely nonlinearity of the economic impact of distance on the switching probability.

As explained in the previous subsection, DIFF_lnDISTANCE$_t$ measures the difference between the log value of the distance between a firm and the alternative branch of the same main bank and the log value of the distance between a firm and the old main bank branch that disappeared between time *t-1* and *t*.

SWITCH$_t$ is a dummy variable that indicates whether a firm-main bank relationship at time *t-1* breaks up by time *t*. Note that SWITCH=1 includes the following two cases: (1) a firm and its former main bank terminated all transactions; (2) a firm and its former main bank continue to transact, but the bank is no longer the firm's main bank. Note that if a firm simply changes the branch of the same main bank that it transacts with, SWITCH takes a value of zero.[5]

[5] Because of the mergers and acquisitions in the banking sector especially during the first half of the 2000s, this happened quite frequently in our dataset.

Because we have observations for the years 2000, 2005, and 2010, the time interval for subscript *t* is 5 years and we use observations for *t*=2005 or 2010. That is, we examine how changes in lending distance during the periods 2000–2005 and 2005–2010 affect firms' switching probability during the same period.

The results of the univariate analysis are shown in Figure 2. The top panel of Figure 2 indicates that there is a positive correlation between changes in lending distances ($DIFF\_lnDISTANCE_t$) and switching probabilities ($SWITCH_t$) during both 2000–2005 and 2005–2010. Next, the second and third panels of Figure 2 examine how firm main bank distance ($DISTANCE_{t-1}$) and firm-rival bank distance ($DISTANCE\_COMP_{t-1}$) affect the probability that a firm switches its main bank ($SWITCH_t$). The figure indicates that $SWITCH_t$ is positively correlated to $DISTANCE_{t-1}$ and negatively correlated to $DISTANCE\_COMP_{t-1}$.

4.3. Multivariate analysis

4.3.1. Empirical strategy

To control for other factors that potentially affect whether firms switch their main bank, we estimate the following reduced form probit regression model:

$$\begin{aligned}&\Pr(\mathrm{SWITCH}_{ij,t} \mid X_{ij,t-1}) \\ &= \Psi(\beta_0 + \beta_1 \mathrm{DIFF\_lnDISTANCE}_{ij,t} + \beta_2 \ln \mathrm{DISTANCE}_{ij,t-1} + \beta_3 \ln \mathrm{DISTANCE\_COMP}_{ij',t-1} \\ &\quad + \beta_4 FIRM_{i,t-1} + \beta_5 BANK_{j,t-1} + \beta_6 MARKET_{i,t-1})\end{aligned} \quad (1)$$

The unit of observation is firm-main bank pairs, with firms represented by subscript *i* and banks by

subscript *j*, and we estimate equation (1) separately for the periods 2000–2005 (*t*=2005) and 2005-2010 (*t*=2010). Table 2 presents summary statistics of the variables used in the estimation, which are explained below.

The key variable of interest is DIFF_lnDISTANCE$_t$, that is, the difference between the distance between firm *i* and the nearest alternative branch of its main bank *j* and the actual lending distance between the firm and the branch it transacts with at time *t-1*. To control for the possibility that a firm whose main bank branch at time *t-1* is farther away than the branch of a rival bank is more likely to switch, we also include the (log of the) actual distance to the main bank branch and the closest branch of a rival bank, lnDISTANCE$_{t-1}$ and lnDISTANCE_COMP$_{t-1}$.

Next, the effect of geographical distance on the switching probability may depend on whether the lending distance increases or decreases as a result of the branch closure. To take into account the possibility that the effect may differ, we split observations into those for which DIFF_lnDISTANCE was positive and those for which it was negative and then run separate probit regressions for them.

The literature suggests that firm characteristics are important determinants of the likelihood that firms will switch their main bank. For instance, as firms grow and become more mature and transparent, they are more likely to terminate their old relationships with banks, partly due to lower switching costs and partly due to the limited capacity of some of those banks to meet the growing credit needs and demand for other capital market services of these growing firms (Gopalan et al.

2011). To control for such firm characteristics at time *t-1* (represented by $FIRM_{i,t-1}$ in equation (1)) that can affect the probability that a firm switches its main bank, we use a variety of variables. The first of these is firms' TDB score (F_SCORE), which represents their creditworthiness. The TDB score assesses firms based on their business history, capital structure, size, profitability, funding status, CEO, and vitality. The score takes an integer value on a scale from 1 to 100, with a higher score representing greater creditworthiness. However, because there are many missing observations for F_SCORE in the year 2000, we use the current profits to sales ratio (F_PROFIT) instead when estimating the switching probability between 2000 and 2005. In addition, theory predicts that competition among banks to establish relationships with informationally opaque firms will be hampered by concerns about information asymmetry (Rajan 1992). This means that more transparent firms likely will find it easier to switch banks. As a proxy for firms' transparency (opaqueness), we use a dummy variable indicating whether a firm's financial records are collected by TDB (F_RECORD). We also control for firm size, represented by the logarithm of the number of employees (F_lnEMP) and firm age (in logarithm, F_lnAGE). Industry dummies (F_IND) are also included in the regressions.

Next, it is likely that the probability that a firm will switch its main bank also depends on the bank's characteristics at time *t-1* ($BANK_{j,t-1}$). The literature suggests that switching costs may also be linked to banks' lending technology. If a bank primarily relies on soft information in assessing the creditworthiness of small businesses, it may be less likely for the relationship between that bank and

its borrower firm to be terminated than if the bank relied on hard information because of the higher switching costs associated with lending based on soft information. To take the type of lending technology adopted into account, we use two variables, B_LOAN_EMP_RATIO and B_lnDISTANCE_MEAN. B_LOAN_EMP_RATIO is the loan amount per employee. Following Petersen and Rajan (2002), we assume that banks that rely more on hard information in their loan originations will have a higher B_LOAN_EMP_RATIO due to higher productivity. B_lnDISTANCE_MEAN measures the mean of lending distances (in logarithm) that a bank has with its client firms, and we assume that banks that rely more on hard information in their loan originations have a longer average lending distance. We expect both of these variables to have positive coefficients. Other than these variables, $BANK_{j,t-1}$ includes the logarithm of the number of employees at the main bank branch that the firm transacted with (B_lnEMP_BR) and the logarithm of the total number of employees of the main bank (B_lnEMP_ALL). The former variable is a proxy for the capacity of the branch to provide a variety of services to customer firms, while the latter variable is a proxy for bank size. We also include a dummy variable, B_MA, which indicates whether a firm's main bank at time *t-1* was involved in a merger or acquisition between *t-1* and *t*, and a number of bank type dummies, B_TYPE_i, where i=CITY, TRUST&LCB, REG&REG2, SHINKIN, and CREDIT-COOP, representing whether the main bank is a city bank, a trust bank or long-term credit bank, a regional bank (including second-tier regional banks), a Shinkin bank, or a credit cooperative.[6]

[6] For details on bank types in Japan, see Uchida and Udell (2010).

The characteristics of the market in which a firm is located, $MARKET_{i,t-1}$, may also be important. Specifically, firms may be more likely to switch their main bank in more competitive loan markets. As a proxy for the degree of competition in the loan market, we construct the variable MESH1, which represents the number of bank branches within a 1km-radius of a firm's headquarters.

4.3.2. Main results

The results of the probit model estimations are presented in Table 3(a) for the period 2000–2005 and 3(b) for the period 2005–2010. In each table, column (A) reports the result using all observations, while columns (B) and (C) report the results using the subsamples of firm-main bank pairs with a positive and a negative DIFF_lnDISTANCE, respectively. We use heteroscedasticity-robust standard errors to gauge the statistical significance of coefficients.

As for the variable of interest, we find that, after controlling for other factors, DIFF_lnDISTANCE does indeed have a positive impact on the probability that a firm switches its main bank (column (A)). The marginal effect of an increase in DIFF_lnDISTANCE on the probability of switching is 8.2 percentage points during 2000–2005 and 6.0 percentage points during 2005–2010, respectively, and both are statistically significant at the 1 percent level. For a borrower-main bank pair with a median distance of about 1.6km (1.8km) during 2000–2005 (2005–2010), a one point increase in DIFF_lnDISTANCE corresponds to an increase in lending distance

from 1.9km (2.1km) to 6.9km (7.4km). Given that the average switching probability during the 2000-2005 subperiod was 13.8 percent, a marginal effect of 8.2 percentage points is economically significant. Similarly, the average switching probability in 2005-2010 was 8.6 percent, so that again a marginal effect of 6.0 percentage points is economically significant.

Comparing the coefficients on DIFF_lnDISTANCE in columns (B) and (C) in Tables 3(a) and (b), we find that the effect of lending distance on firm-main bank relationships is stronger when the changes in lending distance are positive (column (B)) than when they are negative (column (C)). For example, in Table 3(a), the marginal effect of an increase in lending distance is 9.9 percentage points, while that of a decrease in lending distance is 2.5 percentage points. These results suggest that the marginal effect of lending distance on firm-main bank relationships is non-linear: firms and banks downgrade the value of maintaining a main bank relationship when they become geographically more remote after the closure of the main bank branch, but do not appreciate the value of a shorter distance in maintaining the relationship to the same extent.

The relevance of geographical proximity is further evidenced by the coefficients on lnDISTANCE, the firm-main bank distance before the closure of the main bank branch at *t-1*, and that on lnDISTANCE_COMP, the firm-rival bank distance. The coefficient on the former is significantly positive while that on the latter is significantly negative, implying that firms are more likely to switch their main bank the farther away a main bank is located and the closer a competing bank is located. Regarding firm characteristics, we find significant negative correlations between the variable

representing firms' creditworthiness (F_PROFIT for 2000–2005 and F_SCORE for 2005–2010) and the switching probability in most estimations. The results suggest that more creditworthy firms are less likely to change their main bank, which is inconsistent with the story that more creditworthy firms face lower switching costs and therefore are more likely to terminate the relationship with their main bank. The marginal effect of transparency, F_RECORD, is positive, indicating that informationally opaque firms for which no detailed financial data are available in the TDB database face higher switching costs and thus are less likely to terminate the relationship with their main bank. Next, the marginal effect of F_lnEMP is significantly positive, indicating that larger firms are more likely to switch, while firm age (F_AGE) has a negative marginal effect, indicating that older firms are less likely to switch.

Turning to the main bank characteristics, the coefficients on B_LOAN_EMP_RATIO are significantly negative in column (A) in Tables 3(a) and (b), implying that main bank relationships are less likely to be terminated when the main bank exhibits higher labor productivity, which likely rely more on lending technologies such as credit scoring. This result is inconsistent with our prediction presented in the previous subsection. In contrast, the coefficient on B_lnDISTANCE_MEAN is significantly positive in the 2000–2005 period, which is consistent with our prediction, while it is insignificant in the 2005–2010 period. In sum, with regard to the effect of banks' lending technology on the switching probability of firm-main bank relationships, the results are mixed. Turning to other bank covariates, the bank merger dummy variable (B_MA) is significantly positive in all estimations.

This implies that firm-main bank relationships are more likely to be terminated if a firm's main bank was involved in a merger or acquisition. Next, there is a negative correlation between the number of employees at the branch that a firm transacts with (B_lnEMP_BR) and the switching probability. This result suggests that branches with a larger number of loan officers have greater capacity to provide a variety of services to firms and firms are therefore less likely to terminate their main bank relationship. On the other hand, the marginal effect of the number of employees at the bank level (B_lnEMP_ALL) is insignificant in most estimations. Finally, the proxy for the degree of market competition, MESH1, has insignificant coefficients in all estimations.

5. Comparison of lending distances between old and new main banks

The results of the probit model estimations in the previous section suggest that the geographical proximity is an important determinant of whether firms and banks form a main bank relationship. This section reexamines the issue by focusing on a separate but related aspect of firm-main bank distance: whether the average lending distance between firms and their new main bank is shorter than the distance between firms and the old main bank with which they terminated their main bank relationship. If geographical distance really matters in firm-main bank relationships, firms would not only terminate their relationship with a main bank that is far away but would ensure that any new main bank is located in geographical proximity. On the other hand, if lending distance plays a relatively minor role compared to other factors that determine whether a firm terminates a main bank

relationship and switches to a new bank, there should be no significant difference in lending distance – or distances might even be longer – after a firm switches its main bank.

To examine whether distance indeed plays a role in firms' main bank choice, we focus on firms whose main bank branch was closed and that changed their main bank. Specifically, we compare the distance between firms' headquarters and the closest alternative branch of their original main bank and the distance between firms' headquarters and their new main bank. As mentioned in Section 4.1, as the succeeding branch, we focus on the branch that is nearest to the branch that was closed.

The results of the comparison are shown in Table 4, which provides information on lending distances in three separate rows. The first row, labeled (a), presents information on the actual distances between firms and the main bank branch they used to transact with and that was closed down. The second row, labeled (b), shows the distance to the nearest alternative branch of the same main bank, and the third row, labeled (c), shows the actual distance to the new main bank. Finally, the fourth row, labeled (c)-(b), shows the difference between (c) and (b).

Looking at the results, Table 4 shows that for 2000–2005, the mean distance between a firm's headquarters and the nearest alternative branch of the original main bank was 11.21km, while the mean distance to the new main bank was 6.44km, implying that the average lending distance between a firm and its new main bank was 4.77km shorter than the old lending, and the t-test indicates that the difference is statistically significant at the 1 percent level. The difference in the

median, which is -1.11km, is also statistically significant at the 1 percent level based on the Wilcoxon signed-rank test. Using observations for the period 2005–2010 yields qualitatively similar results. The average lending distance between firms and their new main bank is shorter than that to their old main bank.

Another interesting finding is that the difference between rows (b) and (a), which corresponds to DIFF_DISTANCE$_t$ in Section 4.1, is also substantial. For example, for the period 2000–2005, the difference is 2.57km (=11.21-8.64). For comparison, we compute the same statistics for firms that did not change their main bank even though the branch their transacted with was closed. We find that the average difference in distance in the 2000-2005 period is only 0.40km (=5.49-5.09). This result is consistent with the probit estimation results in Table 3 that DIFF_lnDISTANCE is a significant determinant of whether a firm terminates its main bank relationship.

Overall, the results in Table 4 indicate that, on average, lending distances after firms switched to a new main bank were shorter than they would have been had they switched to the nearest alternative branch of their old main bank, suggesting that distance is not only an economically significant determinant of whether firms terminated a main bank relationship but also plays an important role in the establishment of new firm-main bank relationships.

6. Lending distance and firms' ex-post default

Our empirical results in the previous sections provide strong indication that geographical proximity is

an important determinant of whether a firm continues or terminates its main bank relationship. The literature suggests that borrower-lender distance is important because it improves the precision of soft information collected by the lender and/or because it reduces transaction costs incurred by the borrower and the lender. In order to examine which of these two possible factors plays a greater role in explaining whether firms switch their main bank relationships, we examine the correlation between lending distance and firm ex-post default. If the precision of soft information decreases with lending distance, the distribution of borrower firms' quality will be more dispersed if banks extend loans to firms that are farther away, which, in turn, means that we should observe a higher rate of default among such firms.

To examine the relationship between lending distance and the probability of firm default, we focus on firms that switched to a new main bank during the period 2000–2005 and check whether they defaulted during the next period from 2005 to 2010. The reason for doing so is that this provides a more accurate assessment of the relationship between lending distance and the precision of soft information than if firms that did not switch their main bank were included in the sample, since the amount of soft information gathered by main banks is likely more similar across new firm-main bank pairs than across long-established pairs. In other words, focusing on firm-main bank pairs that formed new main bank relationships in the same period (2000–2005), we assume that the amount of soft information gathered by the main banks is limited and similar across firm-main bank pairs. We expect that if the precision of soft information decreases with lending distance, greater lending

distance should go hand-in-hand with a higher rate of default.

Table 5 presents the results of the probit model estimation for firm default. The coefficient on lnDISTANCE is positive but insignificant. The average lending distance of new main banks, B_lnDISTANCE_MEAN, does not have a significant impact on the default probability either. In sum, Table 5 does not provide evidence for the hypothesis that geographical proximity improves the quality of soft information.

7. Conclusion

The banking literature suggests that borrower-lender distance is important, since a shorter lending distance potentially improves the quality of soft information lenders collect about borrowers, deters rival lenders from competing aggressively, and/or reduces transaction costs between lenders and borrowers. Using a unique large-scale firm-bank matched dataset, this paper examined the effect of lending distance on firm-main bank relationships. Our results suggest that distance indeed is an important determinant of firm-main bank relationships. Not only does an exogenous increase in lending distance increase the probability that a firm will switch its main bank, but firms will chose a new main bank based on its proximity. On the other hand, we do not find evidence for the hypothesis that a shorter lending distance improves the quality of soft information. The results of our empirical investigation therefore suggest that lending distance is important because a shorter distance reduces the transaction costs incurred by firms and their main bank.

Our dataset allows us to conduct a number of additional analyses, which should further deepen our understanding of the role of lending distance. First, while Table 1 showed developments in lending distance during the period 2000–2010, we did not discuss what factors contributed to these developments. In principle, it would be possible to decompose the developments into the contribution of various factors: the contribution of bank branch closures, the contribution of firms relocating their headquarters, and the contribution of firm entries and exits. Such a decomposition would help us to better understand how lending distance matters for firms' loan availability and banks' management of credit risk. A second issue we could examine is how the loan terms and conditions changed of firms whose main bank branch closed and that therefore saw an increase in lending distance. As noted in the Introduction, while there are a number of studies that examine this issue to find whether a shorter distance is an important determinant of the precision of soft information, they produced mixed results. It should also be noted that these studies do not properly deal with the issue of potential bias due to reverse causality and/or omitted variables. Making use of the exogenous changes in lending distance brought about by bank mergers and bank branch consolidation may shed new light on unresolved issues including the one above.

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Table 1: Developments in lending distance from 2000 to 2010

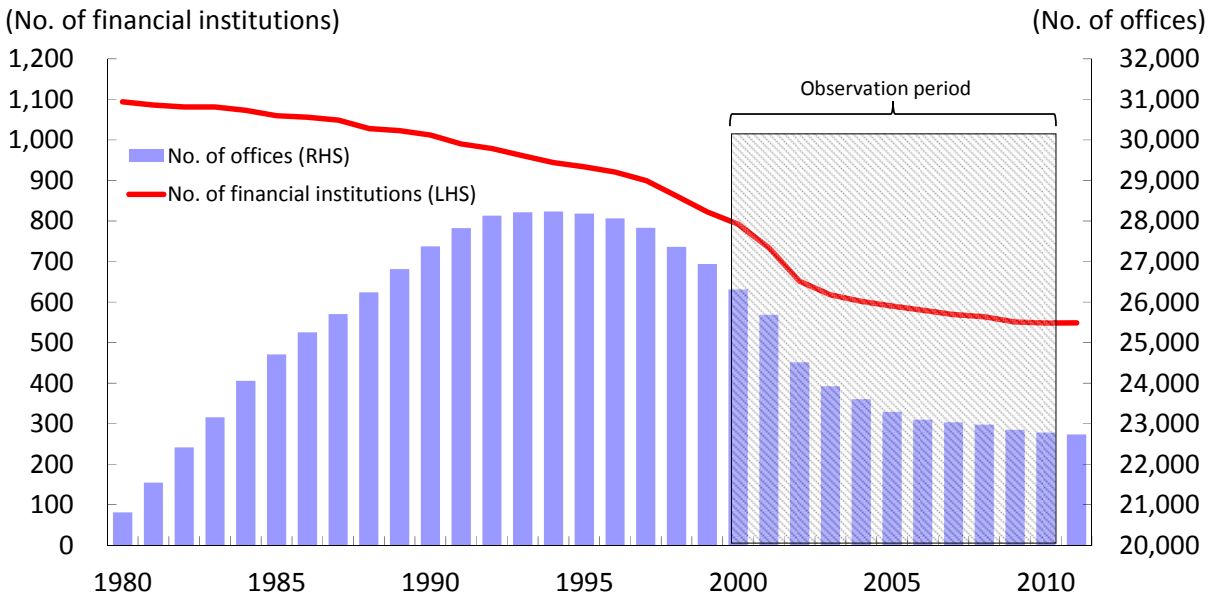
This table presents summary statistics of the physical distance between a firm and its main bank (DISTANCE) and between a firm and the closest rival bank (DISTANCE_COMP), both in kilometers.

Year	NOB	Mean	Median	Std. dev.	Min	Max
DISTANCE						
2000	1,075,885	4.97	1.51	30.97	0.00	2394.37
2005	1,195,676	5.47	1.66	34.26	0.00	2394.28
2010	1,319,848	5.99	1.72	38.61	0.00	2390.24
Total	3,591,409	5.51	1.64	35.02	0.00	2394.37
DISTANCE_COMP						
2000	1,075,884	0.92	0.41	1.96	0.00	584.31
2005	1,195,676	1.05	0.50	2.00	0.00	128.94
2010	1,319,162	1.10	0.53	2.22	0.00	584.31
Total	3,590,722	1.03	0.48	2.08	0.00	584.31

Unit: kilometers.

Figure 1: Number of financial institutions and offices in Japan

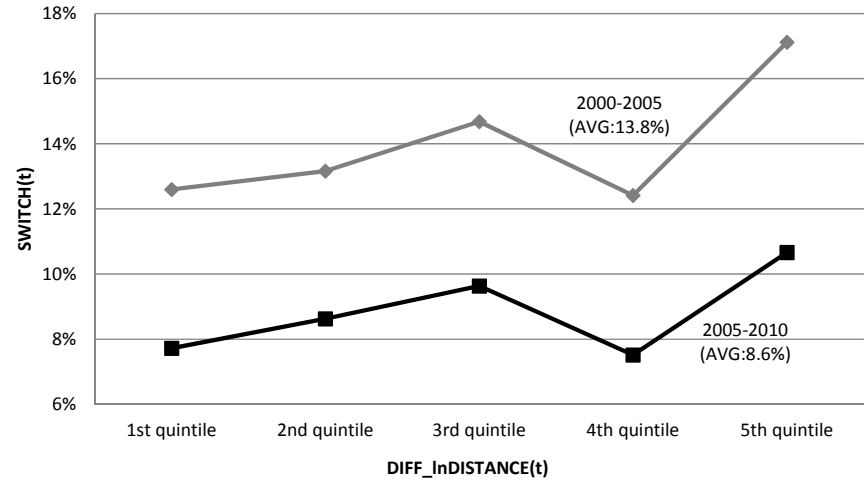
This figure presents the aggregated number of financial institutions and their offices (headquarters and branches) in Japan.

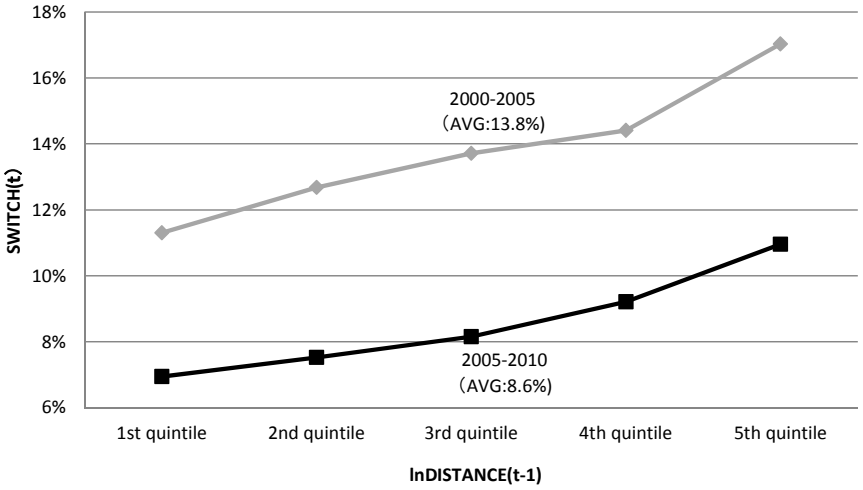


Source: Bank of Japan, "Financial and Economic Statistics," The Center for Financial Industry Information Systems, "White Paper on Financial Industry Information Systems."

Figure 2: Firm-main bank distance and the likelihood that a firm-main bank relationship is terminated: univariate analysis

The top panel presents the link between differences in firm-main bank log distances between time *t-1* and *t*, denoted as DIFF_lnDISTANCE(t), and the likelihood that a firm-main bank relationship is terminated between *t-1* and *t*, denoted as SWITCH(t). The gray line represents [t-1, t] = [2000, 2005], while the black line represents [t-1, t] = [2005, 2010]. The second and third panels present the link between the firm-main bank log distance at time *t-1* (lnDISTANCE(t-1)) and SWITCH (t) and between the firm-rival bank log distance (lnDISTANCE_COMP(t-1)) and SWITCH(t).





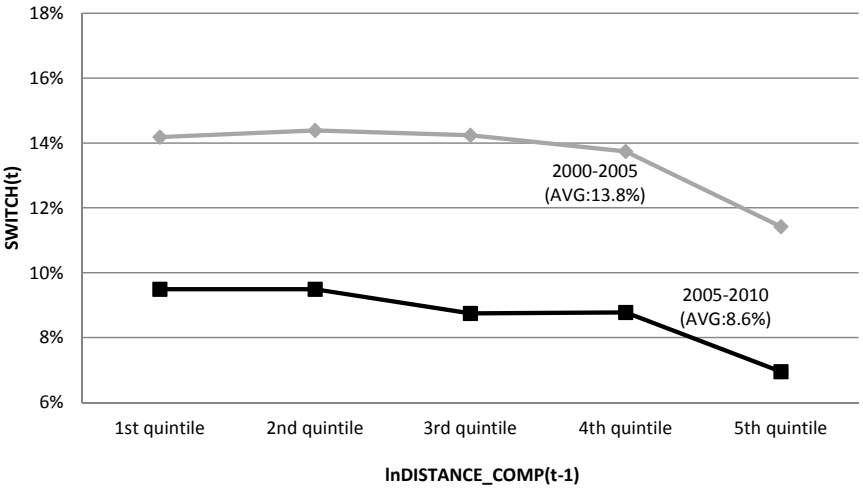


Table 2: Summary statistics

This table presents summary statistics of variables used in the probit model estimations (Table 3). Definitions of variables are provided in the text.

	(1) 2000-2005				(2) 2005-2010			
Variable	NOB	Mean	Std. dev.	Median	NOB	Mean	Std. dev.	Median
Dependent variable								
SWITCH	111,775	0.138	0.345	0	76,224	0.086	0.281	0
Borrower-lender distance								
DIFF_lnDISTANCE	111,775	0.101	0.407	0.000	76,224	0.106	0.461	0.007
lnDISTANCE	111,775	1.136	0.860	0.960	76,224	1.186	0.858	1.025
lnDISTANCE_COMP	111,775	0.432	0.417	0.301	76,224	0.568	0.529	0.404
Firm characteristics								
F_lnAGE	111,775	3.097	0.659	3.219	76,224	3.193	0.638	3.296
F_lnEMP	111,775	2.283	1.325	2.079	76,224	1.949	1.263	1.792
F_PROFIT	111,775	0.736	5.068	0.185				
F_SCORE					76,224	46.007	9.309	46.000
F_RECORD	111,775	0.194	0.396	0	76,224	0.172	0.378	0
Main bank characteristics								
B_lnEMP_BR	111,775	3.005	0.710	2.944	76,224	2.826	0.708	2.833
B_lnEMP_ALL	111,775	7.654	1.363	7.933	76,224	7.284	1.473	7.274
B_LOAN_EMP_RATIO	111,775	6.986	0.672	6.962	76,224	6.866	0.620	6.871
B_lnDISTANCE_MEAN	111,775	1.125	0.162	1.154	76,224	1.141	0.138	1.154
B_MA	111,775	0.657	0.475	1	76,224	0.152	0.360	0
B_TYPE_CITY	111,775	0.411	0.492	0	76,224	0.235	0.424	0
B_TYPE_TRUST&LCB	111,775	0.012	0.108	0	76,224	0.001	0.024	0
B_TYPE_REG&REG2	111,775	0.346	0.476	0	76,224	0.477	0.499	0
B_TYPE_SHINKIN	111,775	0.197	0.398	0	76,224	0.248	0.432	0
B_TYPE_CREDIT-COOP	111,775	0.035	0.183	0	76,224	0.040	0.195	0
Degree of market competition								
MESH1	111,775	16.527	29.808	6	76,224	10.795	23.009	3
Cf. Distance measures in raw numbers								
DIFF_DISTANCE	111,775	0.700	6.996	0.000	76,224	0.846	8.611	0.031
DISTANCE	111,775	5.581	34.301	1.612	76,224	5.857	36.596	1.788
DISTANCE_COMP	111,775	0.746	2.243	0.351	76,224	1.130	1.939	0.497
B_DISTANCE_MEAN	111,775	5.895	4.162	4.999	76,224	5.309	3.026	4.287

Table 3: Probit estimation of likelihood that a firm-main bank relationship is terminated

This table presents the results of the probit estimation examining the determinants of the likelihood that a firm will switch its main bank (SWITCH). The column labeled dF/dx presents the average marginal effect of each variable. ***, **, * indicate statistical significance at the 1, 5, and 10% level, respectively. Heteroscedasticity-robust standard errors are reported.

(a) 2000–2005

Estimation method: probit	(1) 2000-2005					
	(A) All		(B) DIFF_lnDISTANCE>=0		(C) DIFF_lnDISTANCE<0	
Dependent variable: SWITCH	dF/dx	Robust std. err.	dF/dx	Robust std. err.	dF/dx	Robust std. err.
Borrower-lender distance						
DIFF_lnDISTANCE	0.0821 ***	0.0023	0.0990 ***	0.0027	0.0248 ***	0.0080
lnDISTANCE	0.0355 ***	0.0012	0.0379 ***	0.0015	0.0280 ***	0.0022
lnDISTANCE_COMP	-0.0533 ***	0.0029	-0.0555 ***	0.0036	-0.0441 ***	0.0050
Firm characteristics						
F_lnAGE	-0.0210 ***	0.0016	-0.0223 ***	0.0019	-0.0192 ***	0.0029
F_lnEMP	0.0055 ***	0.0009	0.0050 ***	0.0010	0.0070 ***	0.0016
F_PROFIT	-0.0008 ***	0.0002	-0.0007 ***	0.0002	-0.0010 ***	0.0003
F_RECORD	0.0312 ***	0.0030	0.0327 ***	0.0036	0.0278 ***	0.0054
Main bank characteristics						
B_lnEMP_BR	-0.0273 ***	0.0017	-0.0287 ***	0.0020	-0.0136 ***	0.0035
B_lnEMP_ALL	-0.0001	0.0022	0.0028	0.0027	-0.0150 ***	0.0042
B_LOAN_EMP_RATIO	-0.00004 ***	0.0000	-0.00004 ***	0.0000	-0.00003 ***	0.0000
B_lnDISTANCE_MEAN	0.0433 ***	0.0088	0.0432 ***	0.0101	0.0280	0.0186
B_MA	0.0642 ***	0.0027	0.0672 ***	0.0032	0.0745 ***	0.0052
Degree of market competition						
MESH1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001
Industry dummies (F_IND)	YES		YES		YES	
Bank type dummies (B_TYPE)	YES		YES		YES	
Number of observations	111775		80194		31581	
Wald chi-sq	4756.89		3799.44		1208.93	
Prob > chi2	0		0		0	
Pseudo R2	0.0568		0.0621		0.0517	
Log pseudo likelihood	-42324.37		-30639.44		-11565.79	

(b) 2005-2010

Estimation method: probit	(2) 2005-2010					
	(A) All		(B) DIFF_lnDISTANCE>=0		(C) DIFF_lnDISTANCE<0	
Dependent variable: SWITCH	dF/dx	Robust std. err.	dF/dx	Robust std. err.	dF/dx	Robust std. err.
Borrower-lender distance						
DIFF_lnDISTANCE	0.0598 ***	0.0019	0.0705 ***	0.0022	0.0155 **	0.0064
lnDISTANCE	0.0264 ***	0.0011	0.0322 ***	0.0015	0.0184 ***	0.0018
lnDISTANCE_COMP	-0.0366 ***	0.0022	-0.0428 ***	0.0028	-0.0259 ***	0.0036
Firm characteristics						
F_lnAGE	-0.0182 ***	0.0015	-0.0195 ***	0.0020	-0.0171 ***	0.0024
F_lnEMP	0.0073 ***	0.0009	0.0081 ***	0.0012	0.0062 ***	0.0013
F_SCORE	-0.0002 **	0.0001	-0.0002	0.0001	-0.0003	0.0002
F_RECORD	0.0317 ***	0.0033	0.0360 ***	0.0044	0.0258 ***	0.0050
Main bank characteristics						
B_lnEMP_BR	-0.0073 ***	0.0017	-0.0075 ***	0.0022	-0.0060 **	0.0027
B_lnEMP_ALL	0.0023	0.0019	0.0012	0.0025	0.0029	0.0030
B_LOAN_EMP_RATIO	-0.00001 ***	0.0000	-0.00001 **	0.0000	-0.00001	0.0000
B_lnDISTANCE_MEAN	-0.0080	0.0100	0.0032	0.0133	-0.0225	0.0167
B_MA	0.0211 ***	0.0037	0.0199 ***	0.0045	0.0320 ***	0.0070
Degree of market competition						
MESH1	0.0001	0.0000	0.0000	0.0001	0.0001	0.0001
Industry dummies (F_IND)	YES		YES		YES	
Bank type dummies (B_TYPE)	YES		YES		YES	
Number of observations	76224		46171		30053	
Wald chi-sq	2065.95		1707.86		503.62	
Prob > chi2	0		0		0	
Pseudo R2	0.0475		0.0641		0.0278	
Log pseudo likelihood	-21365.53		-13089.7		-8201.064	

Table 4: Comparison of lending distances for firms that switched their main bank

Using the subsample of firms that switched their main bank between *t-1* and *t* (SWITCH=1), this table presents summary statistics for three types of firm-main bank distances (in kilometers): (a) to the actual old main bank branch, (b) to the nearest alternative branch of the old main bank, and (c) to the new main bank. The nearest alternative branch of the old main bank is defined as that nearest to the old bank branch. *** indicates that the difference in the mean or median is significant at the 1 percent level.

Subsample: SWITCH=1

Type of distance		NOB	Mean	Std. dev.	Median
Actual old main bank branch (2000)	(a)	15,435	8.64	50.20	1.96
Alternative old main bank branch (2000-2005)	(b)	15,435	11.21	52.28	2.55
New main bank branch (2005)	(c)	15,435	6.44	42.95	1.43
Difference	(c)-(b)		**-4.77** ***		**-1.11** ***
Actual old main bank branch (2005)	(a)	6,591	8.97	52.50	2.29
Alternative old main bank branch (2005-2010)	(b)	6,591	13.77	57.43	3.02
New main bank branch (2010)	(c)	6,591	7.18	44.98	1.64
Difference	(c)-(b)		**-6.59** ***		**-1.38** ***

Cf. Subsample: SWITCH=0

Type of distance		NOB	Mean	Std. dev.	Median
Actual old main bank branch (2000)	(a)	96,340	5.09	30.98	1.56
Alternative old main bank branch (2000-2005)	(b)	96,340	5.49	31.13	1.80
Actual old main bank branch (2005)	(a)	69,633	5.56	34.70	1.75
Alternative old main bank branch (2005-2010)	(b)	69,633	6.03	34.98	2.04

Unit: kilometers.

Table 5: Probit estimation of firms' default probability

This table presents the probit estimation examining the determinants of the likelihood that a firm defaulted (DEFAULT) between 2005 and 2010. The sample consists of firms that switched their main bank between 2000 and 2005. The column labeled dF/dx presents the average marginal effect of each variable. ***, **, * indicate statistical significance at the 1, 5, and 10% level, respectively. Heteroscedasticity-robust standard errors are reported.

Estimation method: probit			
Dependent variable: DEFAULT	dF/dx		Robust std. err.
Borrower-lender distance			
lnDISTANCE	0.0010		0.0026
lnDISTANCE_COMP	0.0017		0.0065
Firm characteristics			
F_lnAGE	-0.0184	***	0.0043
F_lnEMP	0.0035	*	0.0019
F_PROFIT	-0.0020	***	0.0003
F_RECORD	0.0086	*	0.0050
Main bank characteristics			
B_lnEMP_BR	-0.0061		0.0042
B_lnEMP_ALL	0.0019		0.0041
B_LOAN_EMP_RATIO	0.00001	**	0.0000
B_lnDISTANCE_MEAN	0.0009		0.0239
B_MA	-0.0001		0.0093
Degree of market competition			
MESH1	0.00002		0.0001
Industry dummies (F_IND)			
Bank type dummies (B_TYPE)			
Number of observations	10517		
Wald chi-sq	102.57		
Prob>chi-sq	0		
Pseudo R-sq	0.02		
Log pseudo likelihood	-2207.843		