A Comparison of the Lending Technologies between Private and Public Banks

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Abstract

Using very unique data on loan screening by a large public bank and private banks in Japan, this paper empirically compares the lending technologies used for lending to small- and medium-sized enterprises between the two types of banks. We find that the public bank uses financial statement lending, but does not extensively use relationship lending or lending based on collateral or guarantee. These findings are in sharp contrast with those for private banks that extensively use all three types of lending technologies. We also find less frequent visits by loan officers at the public bank to, and the bank's greater geographic distance from, its borrowers, which may contribute to the public bank's less extensive screening. However, we also find uniqueness in the public bank's loan screening in the form of its greater emphasis on borrowers' business plans and on-site visits to borrowers' establishments.

Keywords: Public banks, Private banks, Lending technology, Screening
JEL classification codes: H81, G21

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1. Introduction

Public ownership of banks is large and pervasive around the world (La Porta et al. 2002). Publically owned banks, or public banks in short, have long been a subject of controversy. For example, the "development" view for public banks argues that in countries with poor private financial institutions, public banks can contribute to their economic growth. However, the "political" view argues that governments may acquire banks as a means for politicians to provide benefits to their supporters (La Porta et al. 2002). On the other hand, public banks can play an important role in providing funds in economic downturns where private banks shrink their loan supply. However, private banks often criticize public banks as strong competitors with favorable treatment from the government in the form of subsidies and tax treatments, for example.

Although these views have conflicting implications for the role of public banks, they are common in the sense that they all implicitly assume that loans from public and private financial institutions are close substitutes to each other. This is indeed a reasonable assumption because from a borrowers' viewpoint, funds are funds irrespective of who provide them. However, the studies on *lending technologies* suggest that even among private banks, different banks may have different lending processes and make decisions differently (e.g., Berger and Udell 2002, 2006), and there are some empirical support for this prediction.[1] Thus, we can well expect that there are similar, or more extensive, differences in lending technologies used by public and private banks, which may make the two types of lenders imperfect substitutes. However, to the best of the author's knowledge, there have been no study on the lending technologies for public banks, much less on the comparison of lending technologies used by public and private banks.[2]

The aim of this paper is to empirically investigate this difference in the lending technologies used by public and private banks. We use very unique data from a corporate survey conducted

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[1] The approach to lending technologies categorizes loans based on a combination of information to use, screening and decision procedures, loan contract structure, and monitoring of debt (Berger and Udell 2006). See Section 2 for the literature review including empirical studies on lending technologies used by private banks.

[2] There is only one study that makes a small reference on the predicted use of lending technologies by public banks (Berger and Udell 2006). It argues that because of their similar (large) size, public banks use a lending technology that is similar to what large private banks use.

in Japan. The target of the survey are small- and medium-sized enterprises (SME) that are potential borrowers of one of the most important public banks in Japan, the Small and Medium Enterprise Unit of the Japan Finance Corporation (hereafter JFC-SME), which provides long-term loans to SMEs for policy objectives.[3] In the survey, responding firms (SMEs) answer questions on the extent to which their lenders – the JFC-SME and private banks – focus on (or emphasize) different firm characteristics when they underwrite their loans. We mainly use this information to identify the lending technologies used by these banks.

Our analysis consists of two stages.[4] At the first stage, we focus on each of the different firm characteristics that the public and private banks emphasize. We start by describing the actual emphasis by the public bank and private banks, and then make a comparison between them. To control for differences in firm characteristics between borrowers of the JFC-SME and those of private banks, the comparison is made *within firms* by limiting the sample to those borrowing from *both* the public and private banks. At the second stage of our analysis, we more elaborately identify lending technologies used by the two types of banks by focusing on simultaneous emphasis on similar (multiple) firm characteristics as the theory on lending technology predicts. In this vein, we conduct factor analysis on the characteristics that lenders emphasize. Using the measures of lending technologies identified by the factor analysis, we also run multivariate regressions to examine what determines the use of the lending technologies.

The findings of this study can be summarized as follows. First, from the first stage of our analysis, we find that the public bank (JFC-SME) puts more emphasis on borrowers' business plans, profitability (e.g., profit to sales ratio), soundness (e.g., capital ratio), and the voluntary disclosure of financial statements. This finding suggests that the public bank uses financial statement lending that is based primarily on information from financial statements. We also find that the public bank puts some emphasis on soft (qualitative and non-quantifiable) information or on collateral, which is consistent with the use of relationship lending or fixed-asset lending.

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[3] See Section 3 for institutional details of JFC-SME.
[4] In some analysis, we use the same methodology as that in existing studies (Uchida et al. 2008, Uchida 2011, and Bartoli et al. 2013), but they all focus on private banks, and we also add new analysis to compare lending technologies between the public and private banks.

Second, the first stage analysis on private banks reveals that they put much emphasis on profitability and soundness, suggesting that they also use financial statement lending. However, we also find that private banks' emphasize other characteristics that the JFC-SME does not focus: borrowers' business basis (e.g., customers and products); capabilities or talent of the CEOs; collateral; and firms' wealth (including CEO's); their main-bank status; and trust between the firm and the bank's loan officer. These findings suggest that private banks also use relationship lending and lending based on collateral or guarantee.

Third, from the within-firm comparison between public and private banks, we find that private banks put greater emphasis on a larger number of firm characteristics than the public bank does. Consistent with this finding, we also find that loan officers at the public bank make less frequent contact with, and the bank has a longer distance from, as compared with private banks, which is probably because the JFC-SME has a significantly smaller number of branch offices than private banks does. However, we instead find that the public bank puts greater emphasis on business plans and on-site inspection of borrowers' establishments than their private counterparts do. These results imply that due to the resource constraint that stems from a small number of branches, the public bank deeply focus on a limited number of screening factors that are most relevant to the type of loans they provide, i.e., long-term loans for SMEs.

Fourth, from the analysis at the second stage, we identify three lending technologies – financial statement lending, relationship lending, and lending based on collateral and guarantee – for both the public and the private banks, in the sense that they simultaneously emphasize multiple firm characteristics that are relevant to the respective technologies. However when we also take into account the results from the first stage for the JFC-SME, the characteristics that are related to the latter two lending technologies are not emphasized by the public bank, and so we can conclude that the JFC-SME does not extensively use relationship lending or lending based on collateral and guarantee.

Fifth and finally, the regression results from the second stage of our analysis reveal that private banks do not differently use the three lending technologies depending on firm characteristics, suggesting that these technologies are ubiquitously used. However, we find that depending on specific firm characteristics, the JFC-SME uses the lending technologies that it

does not commonly use, e.g., relationship lending for firms with older CEO, and lending based on collateral and guarantee for smaller firms.

The main contribution of this paper is to examine, for the first time, lending technologies used by a public bank, and to compare them with those used by private banks. Our findings suggest that the loan screening by the public bank is indeed distinctive, and so the public and private banks may make different loan-granting decisions for the same firm. In this sense, the two types of banks may not be perfect substitutes, and the public bank may not be an almighty competitor for private banks.

This paper also suggests that the loan screening by this public bank reflects the type of loans that this bank provides as an institution for a policy operation, i.e., long-term loans to SMEs. Note that there are many types of "public" banks around the world, e.g., from the banks that are mostly similar to private banks except for public ownership, to the ones with full commitment to policy objectives like financing for economic development or SME lending. Our findings suggest that loan screening and loan granting decisions are likely to differ depending on the type of the public bank, so our findings call for further analysis on different types of "public" banks other than those focusing on SME lending like the JFC-SME.

This paper is organized as follows. Section 2 reviews the literature on lending technology. Section 3 explains the institutional background behind the JFC-SME and public banks in Japan. Section 4 describes the data and Section 5 analyzes the importance of screening policies by examining individual firm characteristics that the public and private banks focus on. Section 6 performs factor analysis to better identify lending technologies, and regression analysis to examine determinants of the lending technologies. Section 7 concludes the paper.

2. Lending technology

The theoretical framework of lending technology, first proposed by Berger and Udell (2002), is to categorize a variety of loans from financial institutions to firms based on differences in several dimensions of the loan characteristics, e.g., information used in loan screening, and the use/non-use of collateral or guarantee. Lending technologies are categorized into two broad types: transactions(-based) lending and relationship lending (Berger and Udell 2002, 2006). *Transactions lending* is a lending that is based primarily on quantitative information or

information on financial figures called *hard information* that can easily be verified to third parties. Figures on financial statements and the value of the firms' assets or CEO's personal wealth are typical examples of hard information.

Transactions lending are further categorized into several lending technologies. First, *financial statement lending* is lending that relies on figures on firms' financial statements. Second, fixed assets lending is lending based on fixed-assets (immovable assets, real estates) as collateral. Third, asset-based lending (ABL) is lending based on the collateral value of movable assets such as accounts receivable or inventories. Fourth, credit scoring is lending primarily based on a score automatically calculated from a model based on information on the firm or its CEO. Other types of transaction lending include factoring where a lender called factor purchases accounts receivable of a borrower, and leasing where a lender known as a lessor purchases fixed assets and lends physical assets rather than money to the borrower.

The other broad type of lending technology is *relationship lending*, lending based primarily on *soft information*, i.e., qualitative information which is difficult to measure. Soft information is difficult to observe and to transmit to others. Examples of soft information include CEO's skills or integrity, and future prospect of the firms' market.

Does this framework of lending technology have empirical relevance? There have been many empirical studies that have tried to answer this question using data for private banks. One strand of the literature focuses on specific lending technologies and examine when they are used (e.g., Jiménez et al. 2009 for fixed-asset lending and Garcia-Appendini 2011 for relationship lending). Some strand of the literature examine whether multiple lending technologies are actually used by using survey information on banks' examination policy, loan contract terms, or borrower characteristics (de la Torre et al. 2010 and Berger and Black 2011). These studies are also interested in whether relationship lending is the only technology for SME lending.

The other strand of the literature, which is most closely related to the present paper, uses information from corporate surveys that directly ask firm characteristics that banks focus in lending to the responding firms (Uchida et al. 2008, Uchida 2011, and Bartoli et al. 2013). Uchida et al. (2008) and Bartoli et al. (2013) focus on complementarities or substitutability of

different lending technologies. [5] Uchida (2011) descriptively examines individual firm characteristics and also conduct factor analysis to identify lending technologies.

However, these studies focus on lending technologies used by private banks. To the best of the author's knowledge, there has been no study on lending technologies used by public banks. The main contribution of the present paper is to examine, for the first time, lending technologies used by a public bank by using data on the JFC-SME, a large public bank in Japan. Methodologically, the approach in this paper is similar to that in Uchida (2011), but this paper applies the approach for both the public and private banks. Furthermore, this paper also compares lending technologies of public and private banks by comparing the results within firms that borrow from both the public and private banks.

3. Institutional background[6]

3.1 Japan Finance Corporation (JFC)

The Japan Finance Corporation (JFC) is a public corporation wholly owned by the Japanese government. As one of the government-affiliated financial institutions in Japan, the JFC "aims to complement financial activities carried out by private financial institutions and contributes to the improvement in the living standards of Japanese people" (cited from the JFC homepage). Although there are many "public banks" around the world, and many of them are similar to private banks except for public ownership, the JFC fully commits to providing loans for policy purposes, and do not take deposits.

The JFC was established in 2008 after the merger of the four government-affiliated financial institutions: the Agriculture Forestry and Fisheries Finance Corporation (AFFFC), which provided loans to firms in agriculture, fishery, and food industries; the National Life Finance Corporation (NLFC), which provided loans to micro businesses; the Japan Finance Corporation for Small and Medium Enterprises (JASME), which provided long-term loans to SMEs for policy purposes; and the Japan Bank for International Cooperation (JBIC), which provided support for the government's foreign economic policy initiatives and economic

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[5] Bartoli et al. (2013) also examine the relation between the use of transaction/relation lending and the banks' production of soft information

[6] See, for example, Uchida and Udell (2014, Sec. 36.2.2.8) for more detailed account for public banks in Japan.

cooperation programs.[7] Even after the merger, the businesses and the accounting of the predecessor banks are separated inside the JFC. The JFC currently has three units: The Agriculture, Forestry, Fisheries and Food Business Unit (JFC-AFFFB) that succeeded the AFFFC; the Micro Business and Individual Unit (JFC-MBI) that succeeded the NLFC; and the Small and Medium Enterprise Unit (JFC-SME) that succeeded the JASME.

The JFC does not compete with private banks in deposit markets, because it does not accept deposits. The funds that the JFC (and the JFC-SME) uses for its loans are raised mostly through the Fiscal Investment Loan Program (FILP), the program by the government to provide long-term low interest loans and investments to achieve policy objectives. More specifically, the JFC relies on the funds that the government raises by issuing special government bonds (FILP bonds) for the purpose of raising funds for the FILP program.

3.2 Small and Medium Enterprise Unit of JFC (JFC-SME)

The JFC-SME, which we focus in this paper, provides long-term loans to SMEs as a public bank and so it competes with private banks in the long-term SME loan market in Japan. The loans by the JFC-SME are program-based, and borrowers apply for different loan programs that the JFC-SME offers. The programs are designed to provide funds to SMEs for different policy-purposes. Safety-net Loans, Loans for Enhancing Corporate Vitality, and New Business Development Loans are examples of the JFC-SME's loan programs.

The terms of the program loans are predetermined, but vary depending on internal rating that the JFC-SME assigns to borrowers. The JFC-SME screens loan applications to determine whether or not to grant loans, and what internal rating to assign.[8]

The JFC-SME has 63 branches (as of January 2016) in their nationwide operations. However, this number is significantly smaller than those for private banks. For example, if we calculate the total number of private banks' branches by bank types as of March 2015 (from the Japan Bankers' Association's homepage), 5 city banks that operate nationwide have 2,037 branches, 64 regional banks that operate mainly around one of the 47 prefectures in Japan have 6,781

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[7] Later in 2012, the JBIC was made an independent institution again.
[8] Note that an ex-banker at the JFC-SME tells that they do not change the intensity of their loan screening depending on the extent to which other lenders (especially private banks) actively involve in lending relationships with the borrower, or on the borrower's industry.

branches, and 41 second regional banks that operate mostly within one prefecture have 2,895 branches.[9]

There are also other public banks in Japan that provide business loans. The first is the JFC-MBI, another JFC unit, but there is segregation between the JFC-MBI and the JFC-SME depending on firm size: the former targets micro businesses and the latter targets larger SMEs. Second, Shoko Chukin Bank (SCB) also provides loans to SMEs. The targets of the SCB and the JFC-MBI or the JFC-SME overlap, but the SCB is more privatized than JFC-SME. The SCB raises most of its funds through deposits and its own bonds, provides short- as well as long-term loans, and does not provide loans on the program basis. Thus, the bank is more similar to private banks than the JFC-SME does. Finally, the Development Bank of Japan (DBJ) also provide business loans, but the main target of the bank is large companies, and the DBJ also focus on a provision of sophisticated financial products, e.g., structured finance and derivatives.

4. Data

4.1 Data source and original sample

The source of the data used in this paper is the Survey on SME's Attitude toward Banks, which was conducted from February to March 2013. The survey was designed by a group of researchers to obtain information on lending relationship between firms and their banks (both public as well as private) and on firms' behavior after the so-called Lehman shock in Japan in September 2008.[10] The survey was outsourced to the Tokyo Shoko Research, Ltd. (hereafter TSR), one of the two largest credit reporting agencies in Japan.

The targets of the survey are 15,000 SMEs in Japan that are chosen to include borrowers of

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[9] City banks are the largest banks in Japan with nationwide and overseas operations. Trust banks can provide trust services in addition to banking services and also operate nationwide, but have a small number of branches. Regional banks are mid-sized regional financial institutions that typically operate in areas around one of the 47 prefectures in Japan. Second-regional banks also operate regionally but in areas smaller than regional banks'. Shinkin banks and credit cooperatives are not-for-profit cooperative banks that operate inside a prefecture. Shinkin banks are larger than credit cooperatives. See Uchida and Udell (2014, section 36.2.2) for types of banks in Japan.

[10] The failure of Lehman Brothers was the landmark event for the Japanese Economy and called the "Lehman shock," because the worldwide financial crisis triggered by the turmoil in the U.S. subprime residential mortgage market spread in the Japanese economy after the Lehman's failure (see Uchida and Udell 2014, Section 36.3.3.4).

public banks, with borrowers of the JFC-SME as the main targets, and to also include borrowers of private banks with comparable characteristics. As for borrowers of the public banks, we selected from the JFC-SME's database firms that meet the following three criteria: (1) firms that are recorded as borrowers of the JFC-SME at the end of September 2012, that did not go into bankruptcy afterwards, and that had more than 20 employees[11]; (2) firms that are not associated companies of larger companies (the criterion to focus on non-affiliated firms); and (3) firms on which accounting information is available from 2007 to 2011 (the criterion for different analysis using financial information, which is irrelevant to the present study where no accounting information is used). There are 17,910 firms in the JFC-SME's database that meet these criteria, and from these firms, we randomly choose 7,500 firms (one-half of the whole targets) on a pro-rata basis in terms of industry and region.

The remaining half of the sample firms (another 7,500 firms) are chosen from the TSR database as control firms that do not borrow from the JFC-SME. More specifically, we select firms that belong to the industries that are targets of the JFC-SME's loan programs and that meet the above three criteria for the treatment firms. However, we relax criterion (3) and allow for missing accounting information for one year, because not doing so reduces the number of candidate control firms smaller than 7,500. From 61,085 firms that meet these criteria, we randomly pick 7,500 firms on a pro-rata basis in terms of industry and region.

After distributing the survey questionnaire by hard mail to the 15,000 target firms, we receive responses from 4,635 firms. Among these firms, 2,289 are from the 7,500 treatment firms (potential borrowers of the JFC-SME) and 2,346 are from the 7,500 control firms. After eliminating responses that do not contain meaningful answers, 4,379 firms remain (the effective response rate is 29.2%), which makes our original sample.

The questionnaire of the Survey on SME's Attitude toward Banks (in Japanese) is composed of five parts: "1. Your company"; "2. Transactions with financial institutions"; "3. Business conditions pre- and post-Lehman shock in September 2008"; "4. Transactions with financial institutions pre- and post-Lehman shock"; and "5. Others." The questions on lending

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[11] The final criterion on the number of employees was chosen because more than 80% of the JFC-SME's customers have 20 or more employees (based on information from the JFC-SME's internal database).

technologies are in the fifth part, and we mainly use this information for our analysis. We also use information on firms' transactions with private and with public banks, which is obtained from the questions in the second part, and on firm characteristics, which is obtained from the questions in the first part.

4.2 Sample selection for borrowers of the JFC-SME

The survey first asks the responding firm the amounts of borrowing from the four public banks: the three units of the JFC (JFC-AFFFB, JFC-MBI, and JFC-SME) and from Shoko Chukin Bank (SCB). Because the SCB provides not only long-term but also short-term loans, the survey separately asks the amount of short-term and long-term loans for the SCB. The survey subsequently asks questions on details of the firm' transactions with the public bank that lends the most to them (among the above four banks or among the three (excluding the SCB), depending on the questions).

Among the 4,379 effective responses, 2,716 firms have a positive amount of loans from at least one public bank (33 firms from the JFC-AFFFB, 418 firms from the JFC-MBI, 2,020 firms from the JFC-SME, and 1,495 and 636 firms from the SCB for long- and short-term loans, respectively). The largest public lender is, the JFC-AFFB for 4 firms, the JFC-MBI for 48 firms, the JFC-SME for 726 firms, the SCB (long-term loans) for 280 firms, and the SCB (short-term loans) for 72 firms. If we exclude the SCB, the largest public lender is the JFC-AFFB for 8 firms, the JFC-MBI for 63 firms, and the JFC-SME for 1,088 firms. We thus use the sample of 726 firms, with respect to the questions on the largest public bank among the four, or 1,088 firms, with respect to those among the three, for the analysis on the JFC-SME.[12] However, due to missing answers on each question, the number of observation is smaller depending on the analysis.

4.3 Sample selection for borrowers of private banks

As for the analysis on private banks, we first choose, from the sample firms, those respond to

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[12] It is technically possible to conduct similar analysis for the other three public banks, i.e., the JFC-AFFFB, the JFC-MBI, and the SCB. However, the number of observations for the two other units of the JFC is too small. The analysis on the SCB is impossible, because we cannot identify whether responding firms answer subsequent questions with respect to its short- or long-term loans.

any of the questions on their private lending banks. More specifically, the survey first asks attributes (including identity) of the firm's "main bank" that is identified by the firm itself as the private bank with the closest relationships in terms of deposits, loans, etc., and then asks questions on detailed transactions with the main bank. We selected firms that respond to these questions.

However, we find that some firms answer as "the main bank" a financial institution that is not apparently a private bank. We thus eliminate firms that answer, as the type of their main banks, "others" or "with no main bank" instead of "city or trust banks," "regional or second-regional banks," "Shinkin banks," or "credit cooperatives." We also eliminate firms that answer as the name of their main banks names of public banks, agricultural cooperatives, non-bank lenders, non-financial institutions, or multiple names. As a result, among 4,277 firms that answer the type or the name of the main banks, 244 firms are eliminated. The remaining 4,033 firms constitute our sample for the analysis on private banks, although the number of the observations may be smaller depending on the availability of the variables to use. Below, we sometimes present results by bank types, but we do not present ones for credit cooperatives because of the small sample.

5. Analysis of screening items

5.1 Methodology

5.1.1 Screening criteria and lending technology

To identify lending technologies, we use information in the survey on loan screening by the largest public bank and by the private main bank. The survey asks responding firms to grade the extent to which the relevant bank emphasize (or focus on) specific borrower characteristics when underwriting their loans. There are 18 candidate criteria (borrower characteristics) as shown in Table 1, and for each criterion, the responding firms grade their main banks on a 1-5 scale (categorical).

The 18 criteria capture different dimensions of borrowers that the relevant bank may evaluate in their screening process. We categorize these criteria based on theoretical prediction on lending technologies. First, criteria 2 (size), 6 (profitability), and 7 (soundness) represent quantitative information from financial statements (hard information). A finding of emphasis

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on these criteria means that financial statement lending is an important lending technology. Second, criteria 8 (collateral), 9 (guarantee), 10 (public guarantee) and 12 (wealth) represent the emphasis on collateral/guarantee. A finding of emphasis on criterion 8 alone indicate the importance of fixed-asset lending, and a finding of emphasis on these criteria as a whole means that lending based on collateral and guarantee is important. Finally, criteria 11 (CEO's capabilities and talent), 13 (main bank status), 14 (relationship length) and 16 (trust with loan officers) capture creditworthiness information that is difficult to quantify, or the strength of the SME-Bank relationship. Thus, these criteria are related to relationship lending.

To measure the emphasis on these criteria, we generate for each criterion a categorical variable that takes the value of 5 if the firm responds that the importance of the criterion is "very much," 4 if "important," 3 if "neither important nor unimportant," 2 if "rarely important," and 1 if "never important." We label the relevant variables for the JFC-SME *char_pb1* to *char_pb18*, and those for private banks *char_bk1* to *char_bk18*. We examine these variables individually in this section, while we apply factor analysis on these variables in the next section to examine simultaneous emphasis on multiple criteria.

Note that these responses are based on the subjective evaluation from the borrowers' viewpoint, and so may not adequately capture emphasis that lenders actually make. However, it is very difficult to obtain confidential information on loan screening from banks. Thus, being able to use information on loan screening at firm levels sufficiently compensate this shortcoming as far as we interpret the results carefully. Also, in the analysis on the comparison of the lending technologies between the public and private banks, we will control for firm fixed effects by comparing them within firms.

5.1.2 The strength of relationships

Although we mainly focus on the variables above when examining lending technologies, we also use other pieces of information when we identify relationship lending. First, we take into account the distance between the branch of the public or private banks and the borrower. The survey directly asks the distance, where the responding firms choose from the six options: "a. 500 m or less," "b. 1 km or less" (and more than 500m), "c. 10 km or less" (and more than 1 km), "d. 30 km or less" (and more than 10 km), "e. 50 km or less" (and more than 30 km), and

"f. more than 50 km." We create variables *JFCdist* (for the JFC-SME) and *maindist* (for the private main bank) that takes the median value of the interval of the chosen option.[13] Theory predicts that when banks use relationship lending, more soft information is accumulated as the geographic distance becomes smaller (see e.g., Petersen and Rajan 2002); thus, we expect that the smaller values for these variables are associated with more focus on relationship lending.

Second, we measure the frequency of visits of the bank's loan officer to the borrower, based on firms' answer to the relevant question. The option to choose are: (1) every day; (2) once a week; (3) once a month; (4) once in half a year; (5) once a year; (6) no meeting in the previous one year. The variable *JFCfreq* (for the JFC-SME) and *mainfreq* (for the private main bank) indicate the frequency of visits per year, taking the value of 365 if the answer is (1), 52 if (2), 12 if (3), 2 if (4), 1 if (5), and 0 if (6). Theory of relationship lending predicts that a lender can obtain a larger amount of soft information as the lender visits the borrower more frequently (see e.g., Boot 2000 for theory and Berger et al. 2005 for an empirical analysis). We thus expect that this variable is large when relationship lending is used.

Third, we consider the actual length of lending relationships between the SME and the bank, although the relevant information is available for the private main bank only. As a question on an attribute of the private main banks, the survey directly asks the length (years) of the relationships with the bank. Based on the answer, we generate the variable *mainlength*. Theory of relationship lending also predicts that banks can accumulate more soft information as the relationship becomes longer (see e.g., Boot 2000 for theory and Berger et al. 2005 for an empirical analysis). Thus, the larger value of this variable is consistent with the use of relationship lending.

5.2 Univariate results
5.2.1 Result for the JFC-SME

Table 2 presents the summary statistics for the variables *char_pb1* to *char_pb18* that measure the emphasis on the 18 criteria by the JFC-SME. The boldface figures in the table mean that the mean (average) of the relevant variable exceeds the value of 3.5 that is between

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[13] More specifically, these variables take the value of 0.25, 0.75, 5, 20, 40, or 100 (km), if the firm chooses options 1, 2, 3, 4, 5, or 6 respectively.

"important" and "neither important nor unimportant." This is to indicate that the variable is emphasized, although the cutoff value of 3.5 is set arbitrarily.

The results show that the means of many variables take the value larger than 3. In particular, the means for criteria 4 (business plan), 6 (profitability), and 7 (soundness) are larger than 4 (meaning "important"), the mean for criterion 15 (active disclosure) is close to 4, and the mean for criteria 3 (business basis), 8 (collateral), and 11 (CEO's capabilities/talent) exceed 3.5. The finding for criteria 6, 7, and 15 indicate emphasis on financial statement lending, the findings for criteria 3 and 11 implies that relationship lending is important, and the finding for criterion 8 indicates that fixed-asset lending is also important.

However, the findings that the means are smaller than 3 for criteria 10 (public credit guarantee), 13 (main bank status), and 18 (tax accountant/CPA) suggest that the JFC-SME does not put much emphasis on these criteria in its loan screening. Note that the finding for criterion 10 is consistent with the fact that loans from the JFC-SME cannot obtain public credit guarantee. Also, the finding for criterion 13 suggests that the main bank status is not important for public banks.

Table 2 also shows the summary statistics for the two variables for relationship lending. The average distance between a branch of the JFC-SME and its borrower is 33km, and the average frequency of visit of JFC-SME's loan officer is five per year (once in 2.4 months).

5.2.2 Results for private banks

Table 3 presents the results for private banks. Panel A reports the results for the whole sample (private banks as a whole), Panel B for the case where the main banks are city or trust banks, Panel C for regional/second-regional banks 2, and Panel D for Shinkin Banks. Similar to Table 2, boldface figures indicate the means larger than the value of 3.5.

As for the variables from *char_bk1* to *char_bk18*, the four panels show similar findings. The criterion that is emphasized the most is 6 (profitability), which is followed by criterion 7 (soundness), both of which have the means larger than 4. These findings indicate that private banks put much emphasis on financial ratios. The criteria that follow are criterion 3 (business basis) and 15 (active disclosure), which are then followed by 4 (business plans) and 11 (capabilities/talent of CEO), 2 (firm size), 8 (collateral), 12 (wealth), 13 (main bank status), 16

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(trust with loan officers), and 17 (attitude of other banks). Compared with the findings for the JFC-SME (Table 2), we find that private banks emphasize criteria that the JFC-SME does not, e.g., criteria 2, 12, 13, 16, and 17.

Turning to the criteria that are not emphasized by private banks, we find that criterion 18 (tax accountant/CPA) has a mean smaller than 3. When compared with the JFC-SME, there are three criteria with means smaller than 3 in Table 2, so private banks emphasize a larger number of screening criteria than the JFC-SME.

When we focus on the results for the final three variables for relationship lending, we find that the average length of bank-firm relationships (*mainlength*) is 36 years for the whole banks, 34 years for city/trust banks, 38 years for regional/second-regional banks, and 34 years for Shinkin banks. Although there are some differences by bank types, the length is on balance long. The firm-bank distance (*maindist*) is on average 7.1 km for the whole sample, but is shorter for smaller bank types, e.g., 5.2 km for Shinkin banks. Similarly, the frequency of visits (*mainfreq*) is 49 times a year for the whole sample, and is higher for smaller bank types, e.g., 90 times a year for Shinkin banks. Compared with the JFC-SME, private banks have branches that are located far closer to their borrowers, and visit the borrowers very frequently. These findings are consistent with the fact that the JFC-SME has a significantly smaller number of branches than private banks.

5.3 Comparison between the JFC-SME and private banks

The analysis in the previous subsection examined screening by the JFC-SME and by private banks independently. Although we find some intriguing differences in the results, we should take into account the fact that the sample firms for Tables 2 and 3 are different, and so the differences may simply be an artifact of different sample characteristics.

To make a more adequate comparison, this subsection focuses on firms that answer questions for both the JFC-SME and private banks. For those firms, we can examine the differences in the variables for the 18 screening criteria. More specifically, we generate 18 new variables, *char_dif1* to *char_ dif18*, that are defined as "*char_pb1 - char_bk1*" to "*char_pb18 - char_bk18*" respectively. We also compute the difference in the bank-borrower distance, *dist_dif*, and in meeting frequency, *freq_dif*, in a similar manner.

Table 4 presents the summary statistics for these difference variables. This table shows the differences between the JFC-SME and the private main banks as a whole in Panel (A), and between the JFC-SME and each type of private main banks in Panels (B)–(D). In each panel, we also report the results (*p*-value) for the test of differences in means. The *p*-values with asterisks ***, **, and * respectively indicate that the null hypothesis of the difference being zero is rejected at 1%, 5%, and 10% level of the statistical significance.

As for the whole sample (Panel A), we find that the emphasis on screening criteria differs significantly between the JFC-SME and private banks for all but three criteria (1, 8, and 15) at the 1% level of significance. Most of the differences are negative, meaning that private banks put more emphasis on these criteria. Also, consistent with the finding in subsection 5.2, we find that the branch-firm distance is larger and the frequency of visit is lower for the JFC-SME than for private banks. These findings suggest that loan officers at the JFC-SME cannot directly visit borrowers frequently because they are located afar, which results in smaller emphasis on many screening criteria.

However, we also find intriguing results with respect to criteria 4 (business plan) and 5 (on-site inspection). The JFC-SME puts more emphasis on these criteria than private banks do, although these criteria area also important for private banks. Especially, the finding of greater emphasis on on-site examination by the JFC-SME than by private banks is interesting because it is private banks that are located closer to, and have more frequent contact with, borrowers. The finding suggests that, due to the constraint that stems from a small number of branches, the JFC-SME puts its resources to extensively screen a limited number of screening factors that are most relevant to the types of loans they provide, i.e., long-term loans for SMEs.[14] The finding also implies that private banks may visit borrowers for purposes other than loan screening, e.g., for collecting deposits or for selling financial products such as mutual funds or insurance.

As for analysis by bank types (Panels (B) – (D)), the results are qualitatively similar to those for the whole sample, but there are also some differences. First, the results for city/trust banks

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[14] Consistent with this view, an ex-loan officer at the JFC-SME tells that the public bank attaches particular importance on on-site inspection, and takes care for its bankers to make decisions based on their own direct inspections.

(Panel (B)) show that the statistical significances of the differences in emphasis with the JFC-SME is smaller with respect to criteria 5, 14, and 16. We also find no significant difference for criterion 18. Second, as for regional/second-regional banks (Panel (C)), different from the results in Panel (A), we find significant differences even for criteria 1 and 15. These findings imply that regional/second-regional banks emphasize a larger number of screening criteria, and in this sense the JFC-SME is more similar to large banks (city or trust banks), which is consistent with the prediction in Berger and Udell (2006). However, even compared with regional/second-regional banks, the JFC-SME puts more emphasis on criteria 4 and 5. Third, compared with Shinkin banks (Panel (D)), we find a smaller number of significant differences. This finding implies that Shinkin banks do not focus on many screening criteria. However, because typical borrowers of the JFC-SME are larger than those of Shinkin banks, the finding may be an artifact of Shinkin banks' exerting less effort in costly screening for creditworthy borrowers. We should also take into account the smaller number of observations for Panel (D).

6. Factor analysis

6.1 Identification of lending technologies

6.1.1 Methodology

In the previous section, we individually focus on each of the screening criteria. However, the original idea of lending technology focuses on combined or simultaneous emphasis on screening criteria of similar kinds rather than on individual criterion. For example, in relationship lending, lenders take advantage of long-term relationships (criterion 14) to accumulate soft information such as CEO's capabilities or talent (criteria 11) through their loan officers' trustable relationship with the borrowers (criterion 16). Thus, the use of relationship lending should result in simultaneous emphasis on these criteria.

A statistical approach that is suitable in this vein is factor analysis. Factor analysis assumes that for observations of multiple variables, there are a small number of unobservable (latent) variables called *common factor* that produces the variations in the observed variables. Under this assumption, factor analysis derives the common factors using data of the observed

variables.[15] In this paper, we assume that there are some common factors that explain the observed values of the 18 loan screening criteria for the JFC-SME (i.e., *char_pb1* through *char_pb18*), as represented by the following equation:

$$\begin{cases} char\_pb1_i = a_1^1 F_{1i} + a_2^1 F_{2i} + \cdots + a_m^1 F_{mi} + e_{mi}^1, \\ \qquad\qquad \ldots\ , \\ char\_pb18_i = a_1^{18} F_{1i} + a_2^{18} F_{2i} + \cdots + a_m^{18} F_{mi} + e_{mi}^{18}, \end{cases}$$

where $char\_pbj_i$ is the value of *j*-th screening criterion (*char_pbj*) for firm *i* (=1, ..., *n*), and *n* is the number of observations. F_k (*k* = 1, ..., m) are the common factors, which are m unobservable variables that determine the value of $char\_pbj_i$, and they take different values for different firms (i.e., for different *i*). Thus, F_{ki} are variables on their own, and called *factor scores*. The parameters a_m^j represent the effect of the common factors on $char\_pbj_i$, and are called *factor loadings*. A larger factor loading means that the larger part of the left-hand-side variable is explained by the relevant common factor. The final terms e_{mi} are called *unique factor*s and capture variations of $char\_pbj_i$ that cannot be explained by the common factors.

In factor analysis, we only use the observations of the right-hand-side variables to determine the values of the unobservable variables/parameters in the left-hand side (i.e., the common factors, the factor loadings, and the unique factors). From a mathematical viewpoint, there exist an uncountable number of combinations of a_m^j, F_{ki}, and e_{mi} that satisfy the equation above. Among them, factor analysis determines their values so that they replicate the correlation of the left-hand-side variables as good as possible. There are alternative approaches to obtain such "good" replication, but in every approach, factor scores are standardized to have zero mean and unit standard deviation.

After obtaining the values for a_m^j, F_{ki}, and e_{mi}, researchers give economic meanings (or label) to the obtained common factors, because the values are obtained as a mere outcome of mathematical calculus, and have no real-world relevance by themselves. The economic meaning of a common factor is given based on the values of their factor loading, or which

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[15] See Harmann (1976) for factor analysis. Our approach using factor analysis is similar to that in Uchida (2011).

left-hand-side variables the relevant common factor strongly affects. In this manner, factor analysis is an approach to "let the data tell." However, what meaning to give may more or less depend on the researchers' subjectivity, which is often pointed out as a shortcoming of factor analysis.

In this paper, we refer to common factors F_k lending technology factors, because in our context, common factors determine the extent to which different lending technologies are used. That is, we give to the obtained common factors meanings based on theory of lending technologies, with an assumption that the underlying lending technologies determine to what extent the 18 lending criteria are emphasized.

We also conduct the same analysis for private banks. In this case, we simply replace $char\_pbj_i$ with $char\_bkj_i$ in the above equation. As in Uchida (2011), we do not split the sample depending on bank types when obtaining a_m^j, F_{ki}, and e_{mi}. Rather, we compare the obtained lending technology factors among different bank types when we conduct regression analysis in subsection 6.2.

The specific approach that we follow when obtaining the results reported below is as follows. We first set the number of common factors to 3 based on a standard that is conventionally used. The first five eigenvalues of the correlation matrix of *char_pb1* through *char_pb18* are 4.92, 1.81, 1.67, 1.21, and 1.04, and we have significant drop between the third and the fourth eigenvalues. The choice of the three common factors are also justified by the Scree test (see Harmann 1976), because on a plot of the eigenvalues, we find a gentler slope after from the fourth eigenvalue. On the other hand, the eigenvalues for private banks are 5.31, 1.78, 1.46, 1.21, and 0.99, and so there is less clear difference between the third and the forth eigenvalues. However, to keep consistency with the analysis on the public bank, we adopt 3 common factors. For the three common factors, we obtain the initial solution using the iterated principal factor method. The results below are qualitatively unchanged even if we obtain the solution by the maximum likelihood method, but there are some differences, which will be reported below. Finally, we rotate the initial solution using the Promax method.

6.1.2 Results for the public bank

Table 5 reports the results for the factor analysis for the JFC-SME. In this table, the three

columns in the middle ("Factor1" through "Factor3") report the factor loadings (a_1^j, a_2^j and a_3^j, j=1, ..., 18) of the three lending technology factors (common factors) for each screening criterion (j). For example, the value of 0.409 for the factor loading of Factor 1 on *char_pb1* means that when the first common factor increases by one unit, which is equal to one standard deviation, the value of the first loan screening factor (*char_pb1*) increases by 0.409. The final column shows the values of the unique factors (i.e., e_{mi}), which indicate the fraction of the emphasis on the relevant screening criterion (i.e., *char_pbj*) that is not explained by the three lending technology factors. For example, the value of 0.783 on the top raw indicates that 21.7% (= (1-0.783)*100) of the variation in *char_pb1* is not explained by the three lending technology factors. To interpret the results, we focus on the variables that the three lending technology factors better explain, or on what variables the factors have larger factor loadings. To facilitate the interpretation, we indicate the loadings larger than 0.5, which is one possible (but ad hoc) threshold, in bold figures.

Table 5 shows that the first lending technology factor (*Factor1*) have significant impact on criteria 13 (main bank status), 16 (trust), 17 (attitude of other banks), and 18 (reputation of tax accountant/CPA). Because these are criteria that represent the importance of relationship lending, we can label this factor the *relationship lending factor*. However, when interpreting the findings here, we need to take into account the findings in subsection 5.2 as well. More specifically, we already find in subsection 5.2 (Table 2) that the values of *char_pb13, 16, 17, 18* are not so large, and so the JFC-SME does not emphasize these criteria very much. Taken together, although the larger value of the first (relationship lending) factor simultaneously increases the emphasis on these screening criteria that are related to relationship lending, the level of the emphasis is low even after the increase. Thus, on balance, we can conclude that relationship lending is not a very important lending technology for the JFC-SME.

Turning to the second lending technology factor (Factor2), it has a large positive impact on screening criteria 3 (customer basis), 6 (profitability), and 7 (soundness). When we use the maximum likelihood method to obtain the initial solution, the factor loading for criterion 3 becomes smaller (0.358). Because criteria 6 and 7 are focus on financial ratios, we can call the second factor the financial statement lending factor. Because we find in subsection 5.2 that criteria 6 and 7 are most emphasized by the JFC-SME, we can conclude that the financial

statement lending is a very important lending technology for the JFC-SME.

Finally, the third lending technology factor (Factor3) has a large positive impact on criteria 9 (guarantee) and 12 (wealth). We can thus call this factor the collateral/guarantee factor. However, this factor does not have a significantly large impact on criteria 8 (collateral) and 10 (public credit guarantee) that are also the factors related to lending based on collateral or guarantee. Also, we already find in subsection 5.2 that criteria 9 and 12 are not emphasized by the JFC-SME, although criterion 8 is emphasized. Thus, our findings suggest that the JFC-SME does not emphasize guarantee, and focus on collateral only. This finding is consistent with the use of fixed asset lending.

On balance, we find the three lending technology factors for the JFC-SME: the relationship lending factor, the financial statement lending factor, and collateral/guarantee factor. These findings are consistent with those in Uchida (2011) for private banks. However, by taking into account the findings in the previous section, we can conclude that the JFC-SME puts less emphasis on the factors other than the financial statement lending factor. Rather, we find in the previous section that criteria 4 (business plan), 15 (active disclosure), 3 (business basis), and 8 (collateral) are independently emphasized. Thus, financial statement lending is the main lending technology that the JFC-SME uses, and the bank may not extensively emphasize relationship lending or lending based on collateral or guarantee.

6.1.3 Results for private banks

The results from the factor analysis for private banks are shown in Table 6. The structure of the table is the same as that of table 5. The first lending technology factor has a positive and significant impact on screening criteria 13 (main bank status), 14 (relationship length), 16 (trust), 18 (reputation of tax accountant/CPA). Thus, we can call this factor the relationship lending factor.[16] Different from the case for the JFC-SME, relationship lending is important for private banks, because criteria 13 and 16 are important even when we examine each criterion individually (see subsection 5.2). Thus relationship lending is an important lending

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[16] When we use the maximum likelihood method to obtain the initial solution, the factor loading of this factor becomes larger than 0.5 for criterion 15, but smaller than that for criterion 18. When we use the cutoff of 0.4, instead of 0.5, regardless of the method to use, criteria 5, 11, and 13-18 have high loadings.

technology for private banks. Compared to the relationship lending factor of a public bank, the factor loading of private banks is larger for criterion 14 and is smaller for criterion 17.

As for the second lending technology factor, we find that it has a large factor loadings for criterion items 6 (profitability) and 7 (soundness), so this factor can be called the financial statement lending factor. The finding of these impacts for private banks is similar to that for the public bank. We already find in subsection 5.2 that private banks focus on these factors (as the JFC-SME does), so the financial statement lending is an important lending technology for private banks.

Finally, regarding the third lending technology factor, its factor loading is large for criteria 8 (collateral), 9 (guarantee), 10 (public credit guarantee), and 12 (wealth). We can thus label this factor the collateral/guarantee factor. Because criterion 8 and 12 are individually emphasized by private banks (see subsection 5.2), we find that credit prediction is important for private banks. Compared to the collateral/guarantee factor for the JFC-SME, private banks focus not only criteria 9 and 12 but also 8 and 10, although the JFC-SME does not emphasize collateral or guarantee.

On balance, we find three lending technology factors for private banks: the relationship lending factor, the financial statement lending factor, and the collateral/guarantee factor. These findings are consistent with our findings for the JFC-SME, and the findings in Uchida (2011) for private banks. However, the number of the screening criteria that each lending technology factor affects is larger, and the absolute level of the emphasized screening criteria are higher, in the case of private banks than in the case of the JFC-SME. Thus, the main difference between the JFC-SME and private banks is the use of all the three lending technologies by private banks.

6.2 Regression analysis for the determinants of lending technology
6.2.1 Methodology

In this section, we perform regression analysis where the dependent variable is the factor scores (F_{ki}) obtained in the factor analysis in the previous section for the three lending technology factors: relationship lending factor; financial statement lending factor; and collateral/guarantee factor. The independent variables are different variables to indicate

borrowers' and lenders' characteristics. Factor scores of a lending technology factors indicate the importance of the relevant lending technologies for the relevant borrower. Thus, this regression analysis examines the determinants of the different use in lending technologies depending on borrower or lender characteristics. A finding of no statistically significant impact of a variable means that whether to use the relevant lending technology does not depend on the firm/bank characteristics represented by the variable. Note that such a finding of no significance does not mean that the relevant *lending technology* is unimportant, because, as we already examined in the previous section, the importance (or emphasis) is measured by the level of the screening criteria variable (i.e., *char_pbj*) that the lending technology factor has a large impact. The variables we use are listed in Table 7 (for the analysis of the JFC-SME) and Table 8 (for the analysis of private banks) together with their summary statistics. The definitions of these variables are explained below. We run the regressions by Ordinary Least Squares (OLS).

The dependent variables in this analysis are the three factor scores. As a method to obtain the scores, we use the Bartlett method and the regression method, but as the results are qualitatively similar, we mainly report the results using the Bartlett method, and report the results using the regression method when we find significant differences.

As for the analysis on the JFC-SME, we only use the factor score of the financial statement lending factor, which we label *fin_pb*, as the dependent variable. We do not use the two other lending technology factors for the JFC-SME, because the lending criteria that are closely related to these two factors are not emphasized by the JFC-SME (see subsection 5.2.1). As for the analysis on private banks, we use the factor scores of all the three identified screening factors: *fin_bk*, the financial statement lending factor; *col_bk*, the collateral/guarantee factor; and *rel_bk*, the relationship lending factor. Note that in factor analysis, factor scores are standardized to have zero mean and unit standard deviation.

We use many variables for independent variables. First, we use variables to represent firm characteristics that are available from the survey. The variable *employee* is the number of employees, which is a proxy for firm size. The variable *firmage* is the age of a firm defined as the difference between the survey year and the year of firms' foundation. As shown in Table 7, the average firm hires 76 employees and is 57 years old. The variable *founder* is a dummy

variable that takes the value of one if the current CEO of the firm is a founder, and zero otherwise. We also use *CEOgender*, the dummy variable for the gender of the current CEO that takes the value of one if the current CEO is female, and *CEOage*, the age of the CEO. In our sample, 15.6% of our sample firms have a founder-CEO, 3.2% of them have a female CEO, and the average age of the CEOs is 58 years old.

As performance measures of the firm, we also use different variables. First, *sales_inc* and *sales_dec* are dummy variables that take the value of one if the firm's sales respectively increase and decrease in the most recent accounting year. As shown in Table 7, *sales_inc* = 1 for 39.4% of the sample firms, and *sales_dec* = 1 for 32.4% of them. We also use dummy variables to indicate the firm's net profit in the previous two years: *prof_ds* indicating a change in the net profit from deficit to surplus; *prof_sd* indicating its change from surplus to deficit; *prof_dd* indicating two consecutive deficits, where the default is the firms with two consecutive surpluses. In our sample, 11.9% of them experience an increase in net profit, 8.5% experience a decrease, 9.8% experience consecutive deficits, and the reminder (around 70%) has surpluses for two consecutive accounting periods.

We also use variables for characteristics of the firms' main banks: as for the type of the firms' main bank (private banks), *mainbk_reg* indicates that the main bank is a regional or second regional bank, *mainbk_shi* indicates a Shinkin Bank, and *mainbk_coo* indicates a credit cooperative. The default is the firms with a city or trust bank as their main banks. In our sample, the main bank is a regional/second regional bank for 57.6% of the sample firms, a Shinkin bank for 12.4%, and a credit cooperative for 1.1%, with a city or trust bank for 29%.

Finally, we also use variables for the bank-firm relationships that we focused above: *mainlength* is the length of the relationships between the borrower and its private main bank; *JFCdist* and *maindist* measure the bank-firm distance, and *JFCfreq* and *mainfreq* measure the frequency of contact between the firm and the bank's loan officer. To take into account non-linear impact of these variables, we use the natural logarithm of these variables (i.e., *ln_JFCdist*, *ln_JFCfreq*, *ln_maindist*, and *ln_mainfreq*).

6.2.2 Results for the public bank

Table 9 reports the regression results for the JFC-SME's financial statement lending factor

(*fin_pb*). We find few significant independent variables. This finding suggests that the JFC-SME does not differently use the financial statement lending depending on the characteristics of the firm or its private main bank. We already find in the previous section that the financial statement lending is a key lending technology of the JFC-SME. On balance, our findings suggest that the public bank ubiquitously uses financial statement lending.

There are however two variables that have significant and significant effect on *fin_pb*, i.e., *ln_JFCdist* and *ln_JFCfreq*. The finding for *ln_JFCdist* implies that the public bank is more likely to use financial statement lending for distant borrowers. The finding for *ln_JFCfreq*, on the other hand, implies that the public bank is more likely to use financial statement lending as its loan officer visits the firm more frequently. This finding is inconsistent with a prediction of relationship lending theory that banks make frequent contact to obtain soft information (or for relationship lending). Rather the finding here might imply that the public bank tries to obtain soft information in addition to financial statement information for borrowers with a specific characteristic such as those with deteriorating creditworthiness.

6.2.3 Results for private banks

The regressions results for private banks are reported in Table 10. The format of this table is the same as that of Table 8. First, in Panel (A) where we report the results for financial statement lending, we find no statistically significant variables except for *prof_sd* and *ln_JFCfreq*. For many firm/bank characteristics, private banks do not change the use of financial statement lending depending on many firm/bank characteristics. Note, however, that the results in the previous section show that private banks do emphasize financial statement lending. The findings for *prof_sd* and *ln_JFCfreq* are difficult to interpret, but when the factor score is calculated by the regression method, *prof_sd* has no statistically significant coefficient.

Second, in Panel (B), the results for lending based on collateral/guarantee show that the number of employees, *employee*, has a negative impact on its use. Similar to the case of JFC-SME, private banks also focus on credit protection for smaller borrowers. We also find that the dummy variable to indicate a decrease in net profit has a positive and statistically significant coefficient. This finding may imply that private banks focus on collateral/guarantee when firm performance deteriorates, but the finding is not robust because we find no

statistically significant impact for this variable when we use scores calculated by the regression method. When using the scores by the regression method, we also find a positive and significant impact for *CEOage* (10% level), suggesting that the collateral/guarantee is important for an older CEO.

We also find in Panel (B) that lending based on collateral or guarantee is important for Shinkin Banks and credit cooperatives, with a larger impact for the latter. These findings suggest that small banks put more emphasis on collateral or guarantee. Finally, collateral or guarantee is less important for borrowers when private banks' loan officers have frequent contact with the borrower (*ln_mainfreq*). This finding suggests that lending based on collateral/guarantee and relationship lending are substitutes rather than complements.

Turning finally to Panel (C), we find two variables that have significant impact on the use of relationship lending: *mainlength* and *ln_JFCfreq*. The finding for *mainlength* suggests that as theoretically predicted, relationship lending is important as the length of firm-bank relationship is longer and more soft information is accumulated. The finding for *ln_JFCfreq* means that private banks are more likely to use relationship lending when the JFC-SME frequently visits the borrower, although it is difficult to interpret this finding. Finally, no significance for the other variables implies that private banks do not differently use relationship lending depending on those factors, although private banks put much emphasis on relationship lending (see subsection 5.2).[17]

As for private banks, similar regression analysis is also conducted in Uchida (2011) using similar information obtained from a corporate survey. After identifying the same three lending technology factors, Uchida (2011) also generate factor scores in a similar manner. On balance, Uchida (2011) reports a larger number of significant variables than this paper does, and so the results in the two paper are inconsistent with each other. However, we cannot directly compare the two results because the independent variables are different, and the sample characteristics are also different. Most importantly, the size of the sample firms for Uchida (2011) is larger with larger variation in the size.[18] This lack of heterogeneity in the sample firms may

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[17] When we use the factor score based on the regression method, we find that *CEOage* has a positive and statistically significant (10%) impact, as it does for the JFC-SME.

[18] The summary statistics for the number of employee reported in Uchida (2011) are: the mean of 156.8; the standard deviation of 895.3; the minimum of 1; and the maximum of 22,724. Thus, our

contribute to the many insignificant results in Table 10. However, note again that both papers consistently find the three lending technology factors

7. Conclusion

Focusing on the JFC-SME, a large public bank that play an important role in providing loans to SMEs, we examined its loan screening from the viewpoint of lending technology, and find intriguing results on lending technologies that the JFC-SME uses. First, the public bank emphasizes quantitative information in financial statements, such as borrowers' profitability and soundness, which suggests that the bank uses financial statement lending. Because the emphasis on this technology does not differ depending on borrower characteristics, it is the technology that is ubiquitously used in the JFC-SME. However, we do not find evidence that the JFC-SME extensively use relationship lending that is based on soft (qualitative) information or of lending based on collateral/guarantee.

Second, compared with these results for the public bank, we find that private banks put more emphasis on a larger number of screening criteria, and use relationship lending and lending based on collateral/guarantee in addition to financial statement lending. Consistent with the limited emphasis on financial statement lending by the JFC-SME, we also find that loan officers at private banks make more frequent contact with, and the banks have a shorter distance from, their borrowers than the public bank does.

Third, however, as uniqueness in loan screening by the JFC-SME, we find that the public bank put significant emphasis on business plan of the borrowers, and on on-site inspection of borrowers' establishments. These findings imply that the JFC-SME inputs its limited resources to a limited number of screening criteria.

On balance, our findings suggest that the loan screening by the public bank is distinctive, and so the public and private banks may make different loan-granting decisions for the same firm. In this sense, the two types of banks may not be perfect substitutes, and the public bank may not be an almighty competitor for private banks. Also, our findings suggest that the loan screening by the public bank may reflect the type of loans, i.e., long-term loans to SMEs for

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sample firms (see Table 9) are smaller on average, with a smaller number of very small and very large firms.

policy purposes. There are many types of "public" banks around the world, and loan screening and loan granting decisions may differ depending on the types. Examining differences in loan screening among different types of "public" banks is an intriguing topic for future studies.

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Tables

Table 1   Characteristics banks emphasize in their loan screening process

1. SME's industry
2. SME's size
3. SME's business basis (e.g., customers and products)
4. SME's business plan
5. Bank's on-site inspection of SME's establishments (e.g., plant and stores)
6. SME's profitability (e.g., profit to sales ratio)
7. SME's soundness (e.g., capital ratio)
8. SME's collateral
9. Solvency of SME's personal guarantor
10. Availability of public credit guarantee
11. CEO's capabilities or talent
12. SME's wealth (including CEO's personal wealth)
13. Banks' main bank status (whether the bank is the main bank or not)
14. Length (years) of the SME-Bank relationship
15. SME's active disclosure (e.g., accounting information) to Bank
16. SME's trust with Bank's loan officers
17. [Lending] attitude of other financial institutions
18. Reputation of SME's licensed tax accountant or CPA

Table 2 Emphasis on screening criteria by the JFC-SME

Variables	Number of obs.	Mean	Standard deviation	Minimum	Maximum
char_pb1	676	3.297	0.867	1	5
char_pb2	672	3.363	0.783	1	5
char_pb3	677	**3.795**	0.768	1	5
char_pb4	675	**4.027**	0.822	1	5
char_pb5	663	3.179	0.931	1	5
char_pb6	682	**4.155**	0.727	1	5
char_pb7	681	**4.041**	0.777	1	5
char_pb8	674	**3.739**	0.960	1	5
char_pb9	674	3.258	0.948	1	5
char_pb10	658	2.540	1.069	1	5
char_pb11	679	**3.729**	0.806	1	5
char_pb12	673	3.342	0.857	1	5
char_pb13	665	2.722	0.918	1	5
char_pb14	675	3.089	0.879	1	5
char_pb15	677	**3.938**	0.812	1	5
char_pb16	674	3.393	0.809	1	5
char_pb17	669	3.129	0.880	1	5
char_pb18	672	2.635	0.907	1	5
JFCdist	996	32.693	36.025	0.25	100
JFCfreq	1078	5.010	12.225	0	365

Table 3 Emphasis on screening criteria by private banks

Variables	Number of obs.	Mean	Std. dev.	Min.	Max.	Number of obs.	Mean	Std. dev.	Min.	Max.	Number of obs.	Mean	Std. dev.	Min.	Max.	Number of obs.	Mean	Std. dev.	Min.	Max.
char_bk1	3,433	3.386	0.904	1	5	1,071	3.360	0.901	1	5	1,897	3.400	0.898	1	5	434	3.376	0.927	1	5
char_bk2	3,433	**3.527**	0.838	1	5	1,072	**3.537**	0.796	1	5	1,900	**3.541**	0.841	1	5	430	3.442	0.903	1	5
char_bk3	3,446	**3.938**	0.790	1	5	1,078	**3.925**	0.779	1	5	1,898	**3.929**	0.784	1	5	439	**3.991**	0.855	1	5
char_bk4	3,458	**3.850**	0.877	1	5	1,080	**3.804**	0.880	1	5	1,913	**3.878**	0.868	1	5	433	**3.818**	0.909	1	5
char_bk5	3,380	3.047	0.949	1	5	1,048	2.962	0.978	1	5	1,876	3.060	0.932	1	5	425	3.169	0.946	1	5
char_bk6	3,508	**4.288**	0.721	1	5	1,097	**4.301**	0.714	1	5	1,940	**4.285**	0.720	1	5	440	**4.255**	0.748	1	5
char_bk7	3,485	**4.165**	0.753	1	5	1,089	**4.189**	0.762	1	5	1,926	**4.165**	0.739	1	5	438	**4.096**	0.798	1	5
char_bk8	3,455	**3.649**	1.021	1	5	1,079	**3.622**	1.043	1	5	1,905	**3.634**	1.018	1	5	440	**3.723**	0.978	1	5
char_bk9	3,421	3.328	1.007	1	5	1,062	3.270	1.016	1	5	1,892	3.312	1.010	1	5	436	3.489	0.946	1	5
char_bk10	3,399	3.159	1.168	1	5	1,048	3.023	1.169	1	5	1,884	3.181	1.163	1	5	436	3.362	1.149	1	5
char_bk11	3,471	**3.820**	0.846	1	5	1,083	**3.743**	0.835	1	5	1,922	**3.828**	0.851	1	5	434	**3.947**	0.835	1	5
char_bk12	3,433	**3.604**	0.876	1	5	1,068	**3.606**	0.857	1	5	1,900	**3.580**	0.881	1	5	435	**3.674**	0.890	1	5
char_bk13	3,427	**3.647**	0.950	1	5	1,068	**3.595**	0.957	1	5	1,894	**3.674**	0.927	1	5	433	**3.647**	1.010	1	5
char_bk14	3,447	3.401	0.915	1	5	1,073	3.346	0.893	1	5	1,909	3.401	0.911	1	5	434	**3.525**	0.969	1	5
char_bk15	3,487	**3.984**	0.821	1	5	1,090	**3.943**	0.827	1	5	1,927	**4.004**	0.814	1	5	439	**3.993**	0.837	1	5
char_bk16	3,455	**3.584**	0.842	1	5	1,081	**3.528**	0.831	1	5	1,906	**3.593**	0.839	1	5	436	**3.665**	0.867	1	5
char_bk17	3,439	**3.567**	0.843	1	5	1,073	**3.541**	0.847	1	5	1,902	**3.569**	0.841	1	5	433	**3.610**	0.849	1	5
char_bk18	3,438	2.834	0.913	1	5	1,071	2.688	0.903	1	5	1,903	2.878	0.914	1	5	432	2.977	0.890	1	5
mainlength	3,723	36.328	18.687	1	200	1,140	34.304	18.851	1	130	2,063	37.873	19.118	1	200	485	34.470	15.902	1	80
maindist	3,917	7.09	12.44	0.25	100	1,231	9.42	17.31	0.25	100	2,149	6.25	9.53	0.25	100	501	5.15	7.95	0.25	100
mainfreq	3,907	49.12	86.60	0	365	1,228	24.71	45.07	0	365	2,146	51.99	87.19	0	365	498	89.97	124.52	1	365

Table 4 Public-private differences in emphasis on screening criteria

Variables	Number of obs.	Mean	Std. dev.	Min.	Max.	*p*- value		Number of obs.	Mean	Std. dev.	Min.	Max.	*p*- value	
char_dif1	637	-0.046	0.762	-3	4	0.132		203	-0.049	0.782	-3	3	0.370	
char_dif2	631	-0.143	0.772	-4	4	0.000	***	201	-0.219	0.769	-4	2	0.000	***
char_dif3	635	-0.153	0.688	-3	4	0.000	***	203	-0.148	0.743	-3	2	0.005	***
char_dif4	634	0.170	0.743	-2	3	0.000	***	202	0.193	0.771	-2	3	0.000	***
char_dif5	623	0.100	0.829	-3	4	0.003	***	196	0.148	0.843	-3	3	0.015	**
char_dif6	642	-0.156	0.605	-3	4	0.000	***	204	-0.206	0.584	-3	1	0.000	***
char_dif7	639	-0.139	0.646	-3	4	0.000	***	204	-0.191	0.657	-3	2	0.000	***
char_dif8	633	-0.058	1.100	-4	4	0.182		203	-0.049	1.181	-4	4	0.553	
char_dif9	635	-0.121	0.784	-3	4	0.000	***	204	-0.152	0.763	-3	4	0.005	***
char_dif10	620	-0.690	1.237	-4	3	0.000	***	194	-0.753	1.276	-4	3	0.000	***
char_dif11	641	-0.126	0.628	-4	4	0.000	***	205	-0.117	0.615	-4	2	0.007	***
char_dif12	634	-0.285	0.715	-3	4	0.000	***	202	-0.327	0.685	-3	2	0.000	***
char_dif13	627	-0.860	1.187	-4	4	0.000	***	199	-0.894	1.203	-4	3	0.000	***
char_dif14	637	-0.248	0.889	-4	4	0.000	***	204	-0.142	0.879	-3	3	0.022	**
char_dif15	638	-0.041	0.652	-3	3	0.115		202	-0.010	0.646	-3	3	0.828	
char_dif16	635	-0.170	0.699	-3	4	0.000	***	204	-0.093	0.699	-3	2	0.058	*
char_dif17	631	-0.474	1.023	-4	4	0.000	***	202	-0.490	1.103	-4	2	0.000	***
char_dif18	633	-0.073	0.504	-3	2	0.000	***	202	-0.010	0.478	-3	2	0.769	
dist_dif	923	26.775	35.891	-60	99.8	0.000	***	316	7.511	16.630	-20	99.8	0.000	***
freq_dif	1000	-42.889	83.997	-365	353	0.000	***	337	-23.697	48.474	-363	10	0.000	***

Variables	(C) JFC-SME versus regional/second-regional banks						(D) JFC-SME versus Shinkin banks					
	Number of obs.	Mean	Std. dev.	Min.	Max.	p-value	Number of obs.	Mean	Std. dev.	Min.	Max.	p-value
char_dif1	348	-0.069	0.760	-3	4	0.091 *	80	0.050	0.727	-2	4	0.540
char_dif2	345	-0.122	0.764	-2	4	0.003 ***	79	-0.051	0.815	-3	4	0.582
char_dif3	345	-0.159	0.678	-2	4	0.000 ***	81	-0.160	0.580	-2	1	0.015 **
char_dif4	345	0.078	0.692	-2	3	0.036 **	81	0.481	0.808	-1	3	0.000 ***
char_dif5	341	0.088	0.828	-3	4	0.051 *	80	0.000	0.779	-2	3	1.000
char_dif6	351	-0.134	0.616	-2	4	0.000 ***	81	-0.148	0.615	-2	1	0.033 **
char_dif7	349	-0.149	0.639	-3	4	0.000 ***	80	0.013	0.646	-2	2	0.863
char_dif8	345	-0.041	1.039	-4	4	0.469	79	-0.114	1.155	-4	3	0.383
char_dif9	346	-0.095	0.776	-3	4	0.023 **	79	-0.152	0.893	-3	3	0.135
char_dif10	344	-0.651	1.200	-4	2	0.000 ***	76	-0.697	1.296	-4	2	0.000 ***
char_dif11	350	-0.126	0.616	-2	4	0.000 ***	80	-0.150	0.731	-3	3	0.070 *
char_dif12	348	-0.241	0.708	-2	4	0.000 ***	79	-0.354	0.817	-3	3	0.000 ***
char_dif13	345	-0.832	1.213	-4	4	0.000 ***	77	-0.896	1.033	-4	1	0.000 ***
char_dif14	347	-0.265	0.870	-4	4	0.000 ***	80	-0.475	0.941	-3	2	0.000 ***
char_dif15	349	-0.103	0.617	-2	2	0.002 ***	81	0.136	0.720	-2	2	0.094 *
char_dif16	346	-0.208	0.700	-3	4	0.000 ***	79	-0.190	0.642	-3	1	0.010 **
char_dif17	344	-0.483	0.972	-4	4	0.000 ***	79	-0.405	1.019	-3	3	0.001 ***
char_dif18	346	-0.104	0.523	-3	2	0.000 ***	79	-0.076	0.417	-2	1	0.109
dist_dif	488	37.276	38.958	-15	99.8	0.000 ***	112	33.855	38.976	-60	99.8	0.000 ***
freq_dif	534	-44.648	86.138	-365	353	0.000 ***	122	-84.025	120.913	-365	0	0.000 ***

Table 5 Result from factor analysis: JFC-SME

Variables	Factor1	Factor2	Factor3	Uniqueness
char_pb1	0.409	0.120	-0.065	0.783
char_pb2	0.312	0.243	-0.046	0.779
char_pb3	0.179	**0.588**	-0.161	0.546
char_pb4	0.175	0.446	-0.010	0.696
char_pb5	0.408	0.147	0.013	0.748
char_pb6	-0.152	**0.720**	0.172	0.502
char_pb7	-0.195	**0.772**	0.223	0.420
char_pb8	-0.078	0.244	0.426	0.748
char_pb9	0.002	0.115	**0.714**	0.442
char_pb10	0.241	-0.146	0.485	0.686
char_pb11	0.208	0.386	0.137	0.672
char_pb12	0.024	0.209	**0.587**	0.548
char_pb13	**0.560**	-0.173	0.282	0.608
char_pb14	0.377	0.092	0.209	0.721
char_pb15	0.142	0.479	-0.091	0.698
char_pb16	**0.620**	0.128	-0.182	0.559
char_pb17	**0.529**	0.067	0.011	0.677
char_pb18	**0.708**	-0.258	0.175	0.535

Table 6 Results from factor analysis: private banks

Variables	Factor1	Factor2	Factor3	Uniqueness
char_bk1	0.346	0.152	0.001	0.799
char_bk2	0.289	0.269	0.006	0.756
char_bk3	0.337	0.445	-0.151	0.602
char_bk4	0.343	0.318	0.029	0.643
char_bk5	0.472	0.008	0.050	0.750
char_bk6	-0.106	**0.847**	0.004	0.368
char_bk7	-0.131	**0.757**	0.095	0.461
char_bk8	-0.074	0.098	**0.680**	0.519
char_bk9	-0.040	-0.034	**0.841**	0.343
char_bk10	0.046	-0.054	**0.545**	0.704
char_bk11	0.431	0.161	0.122	0.633
char_bk12	0.039	0.121	**0.535**	0.619
char_bk13	**0.642**	-0.058	-0.007	0.629
char_bk14	**0.665**	-0.154	-0.010	0.652
char_bk15	0.487	0.204	-0.024	0.626
char_bk16	**0.767**	-0.092	-0.089	0.527
char_bk17	0.438	0.092	0.025	0.743
char_bk18	**0.520**	-0.226	0.149	0.747

Table 7   Summary statistics for regression variables: public bank

Variables	Number of obs.	Mean	Std. dev.	Min.	Max.
fin_pb	469	-0.016	1.142	-4.586	2.395
employee	469	75.994	84.548	13	954
firmage	469	56.953	31.802	10	415
founder	469	0.156 NA		0	1
CEOgender	469	0.032 NA		0	1
CEOage	469	57.776	10.677	29	93
sales_inc	469	0.394 NA		0	1
sales_dec	469	0.324 NA		0	1
prof_ds	469	0.119 NA		0	1
prof_sd	469	0.085 NA		0	1
prof_dd	469	0.098 NA		0	1
mainbk_reg	469	0.576 NA		0	1
mainbk_shi	469	0.124 NA		0	1
mainbk_coo	469	0.011 NA		0	1
mainlength	469	37.247	18.255	2	110
ln_maindist	469	1.620	0.841	0.223	3.714
ln_mainfreq	469	3.195	1.051	0.693	5.903
ln_JFCdist	469	2.983	1.196	0.223	4.615
ln_JFCfreq	469	1.415	0.736	0.000	3.970

Table 8 Summary statistics for regression variables: private banks

Variables	Number of obs.	Mean	Std. dev.	Min.	Max.
fin_bk	742	0.057	1.016	-4.042	3.033
col_bk	742	0.116	1.038	-5.892	2.220
rel_bk	742	0.038	1.173	-3.638	2.651
employee	742	91.027	141.148	9	2850
firmage	742	56.887	29.985	9	415
founder	742	0.162	NA	0	1
CEOgender	742	0.027	NA	0	1
CEOage	742	57.616	10.529	29	93
sales_inc	742	0.407	NA	0	1
sales_dec	742	0.313	NA	0	1
prof_ds	742	0.113	NA	0	1
prof_sd	742	0.092	NA	0	1
prof_dd	742	0.081	NA	0	1
mainbk_reg	742	0.538	NA	0	1
mainbk_shi	742	0.125	NA	0	1
mainbk_coo	742	0.008	NA	0	1
mainlength	742	37.557	18.816	1	132
ln_maindist	742	1.652	0.861	0.223	4.615
ln_mainfreq	742	3.225	1.049	0.693	5.903
ln_koukodist	742	2.960	1.168	0.223	4.615
ln_koukofreq	742	1.407	0.732	0.000	3.970

Table 9 Regression results: public bank

Financial statement lending factor
(dependent variable = *fin_pb*)

	Coef.	Std. Err.	t	P>t	
employee	0.000	0.001	-0.190	0.851	
firmage	0.002	0.002	0.950	0.343	
founder	0.212	0.168	1.260	0.210	
CEOgender	0.219	0.306	0.710	0.475	
CEOage	0.002	0.005	0.280	0.779	
sales_inc	-0.038	0.133	-0.290	0.774	
sales_dec	-0.133	0.139	-0.960	0.340	
prof_ds	-0.244	0.171	-1.420	0.155	
prof_sd	-0.219	0.198	-1.110	0.268	
prof_dd	-0.096	0.186	-0.520	0.606	
mainbk_reg	-0.073	0.131	-0.550	0.581	
mainbk_shi	0.150	0.193	0.780	0.439	
mainbk_coo	0.575	0.531	1.080	0.279	
mainlength	0.001	0.003	0.380	0.704	
ln_maindist	0.108	0.066	1.640	0.103	
ln_mainfreq	-0.012	0.054	-0.230	0.822	
ln_JFCdist	0.083	0.050	1.660	0.097	*
ln_JFCfreq	0.237	0.075	3.180	0.002	***
(intercept)	-0.867	0.400	-2.170	0.031	**
No. of obs.		469			
F (18, 450)		1.48			
Prob > *F*		0.092			
Adj *R* -squared		0.018			

Table 10 Regression result: private banks

	(A) Financial statement lending factor (dependent variable = *fin_bk*)			(B) Collateral/guarantee factor (dependent variable = *col_bk*)			(C) Relationship lending factor (dependent variable = *rel_bk*)		
	Coef.	Std. err.	p-value	Coef.	Std. err.	p-value	Coef.	Std. err.	p-value
employee	0.000	0.000	0.303	-0.001	0.000	0.000 ***	0.000	0.000	0.946
firmage	0.002	0.001	0.273	0.001	0.002	0.385	-0.002	0.001	0.139
founder	0.126	0.121	0.299	0.073	0.134	0.585	0.030	0.118	0.801
CEOgender	-0.139	0.239	0.561	0.055	0.265	0.837	-0.060	0.234	0.796
CEOage	0.002	0.004	0.582	0.007	0.004	0.108	0.006	0.004	0.103
sales_inc	-0.036	0.095	0.708	-0.087	0.105	0.408	0.011	0.093	0.905
sales_dec	0.002	0.103	0.988	-0.111	0.114	0.330	-0.111	0.101	0.272
prof_ds	-0.152	0.125	0.224	0.200	0.138	0.148	-0.192	0.122	0.116
prof_sd	-0.284	0.139	0.042 **	0.296	0.155	0.056 *	-0.062	0.136	0.647
prof_dd	-0.090	0.145	0.538	0.221	0.161	0.171	0.010	0.142	0.944
mainbk_reg	0.004	0.093	0.968	0.134	0.103	0.194	0.080	0.091	0.380
mainbk_shi	-0.178	0.136	0.191	0.282	0.151	0.062 *	0.136	0.133	0.308
mainbk_coo	-0.166	0.436	0.704	1.078	0.483	0.026 **	-0.157	0.425	0.711
mainlength	-0.001	0.002	0.776	0.002	0.003	0.475	0.005	0.002	0.023 **
ln_maindist	-0.039	0.047	0.412	0.061	0.052	0.243	0.064	0.046	0.163
ln_mainfreq	0.003	0.039	0.939	-0.091	0.043	0.035 **	0.024	0.038	0.520
ln_koukodist	0.041	0.037	0.271	0.038	0.041	0.348	0.031	0.036	0.392
ln_koukofreq	0.122	0.053	0.023 **	-0.037	0.059	0.535	0.098	0.052	0.060 *
(intercept)	-0.269	0.296	0.363	-0.398	0.328	0.225	-0.795	0.289	0.006 ***
No. of obs.	742			742			742		
F (18, 723)	1.18			2.78			1.42		
Prob > *F*	0.270			0.000			0.116		
Adj *R*-squared	0.004			0.041			0.010		