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The Effects of a Megabank Merger on Firm-Bank Relationships and Borrowing Costs *

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Abstract

Using a unique dataset of non-listed firms that identifies the banks the firms transact with, we examine the effects of the largest-ever bank merger in Japan, that between Bank of Tokyo-Mitsubishi (BTM) and UFJ Bank (UFJ) in 2005. We focus on how the merger affected firms through their firm-bank relationships. Specifically, we examine whether there are any differences in how the availability of loans evolved over time for firms that prior to the merger transacted with both of the merged banks, with one of the merged banks, or with none of them. We find the following: (1) Firms that had transacted with both BTM and UFJ saw their borrowing costs increase by 40bp relative to those that had transacted with neither of them. (2) Firms that transacted with one of the two banks saw their borrowing costs increase by a smaller but still significant margin of 20bp relative to those that had transacted with neither of them. And (3) we do not find a significant difference in the extent that borrowing costs increased between firms that transacted with the acquiring bank (BTM) and those that transacted with the acquired bank (UFJ). These results suggest that the bank merger increased firms' borrowing costs partly through the exogenous decrease in the number of firm-bank relationships and partly through changes in the organizational structure of the merged bank, including a consolidation of the branch network.

Keywords: Firm-bank relationships; Interest rates; Switching costs

JEL classification: G21; G34

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1 Introduction

Japan, like other developed countries, has seen a wave of bank mergers in the past 20 years. Mainly as a result of these mergers, the number of banks has decreased substantially over this period, falling from 1,069 in 1990 to 595 in 2010. Especially the number of so-called city banks - banks that operate nation-wide and across national borders has declined significantly, dropping from 13 in 1990 to only 4 in 2010.

Policymakers have been concerned about the implications of these bank mergers. Since bank consolidation changes the market structure for loans and firm-bank relationships, a particular focus of such concerns is whether efficiency gains from mergers are passed on to borrowers or are appropriated by the merged banks. Studies seeking to address these issues empirically, such as Sapienza (2002) and Erel (2011), have typically focused on the availability and the price of loans provided by the merged banks. The present study follows this approach, using micro-level data to investigate how the availability of loans and the interest rates that firms have to pay develop after a major merger.

For our analysis, we use the merger of two major city banks, Bank of Tokyo-Mitsubishi (BTM) and UFJ Bank (UFJ), in 2005. The merger of these banks, which took place toward the end of the bank merger wave in Japan, had a sizable impact on the domestic loan market. The combined amount of loans outstanding of the two banks in 2004 stood at 70 trillion yen (700 billion US dollar at the exchange rate at the time), equivalent to 18% of total loans outstanding extended by financial institutions in Japan, making the newly-formed entity, the Bank of Tokyo-Mitsubishi UFJ (BTMU), the largest financial institution in the country.

As pointed out by Williamson (1968) in his theoretical analysis, horizontal mergers in general are likely to increase market power, raise prices for goods and services, and decrease the surplus of firms or consumers demanding the goods and services in the market. This expected negative effect of mergers has been the focus of many previous studies on bank mergers. Conducting a comprehensive review of over 250 studies, Berger, Demsetz, and Strahan (1999) find that the empirical evidence suggests that some types of consolidation indeed result in an increase in market power.

However, in the market for bank loans, the interactions among market power, market structure, and transaction conditions are complicated by the fact that transactions between banks and borrowers often are not at arm's length but involve some sort of relationship. Suppose, for example, that information on the viability of borrower firms is produced through bank-firm relationships and cannot be transferred to potential new lenders. In this case, it is unlikely that all lenders, both incumbents and potential new lenders, can exercise market power and set loan conditions in a similar manner. Instead, bank-firm relationships or, in Sapienza's (2002) terminology, "information-based market power" come to play an important role in determining loan conditions, including interest rates.

Against this background, the primary focus of our study is to examine how a bank merger affects firm-bank relationships and changes the availability of loans after the merger. By focusing on the merger of two megabanks, each with a large number of borrower firms, we are able to classify firms into three categories: firms that transacted with both banks at the time of the merger (BTM and UFJ in the case we are examining); those that transacted with one of the two banks; and firms that transacted with neither of these banks. Classifying firms in this manner, we examine how a bank merger affects the availability of loans through firm-bank relationships.

Specifically, we focus on the following issues. First, for firms in the first category, the merger automatically reduces their number of firm-bank relationships by one, which is likely to have an impact on the loan conditions they face. Studies such as those by Petersen and Rajan (1994) and Harhoff and Körting (1998) regard the number of firm-bank relationships as a proxy for the switching costs a firm faces (the larger the number of relationships, the smaller the switching costs) and examine the link between the number of relationships and the availability of credit. The BTM-UFJ merger provides an excellent opportunity to examine the impact of an exogenous reduction in the number of relationships on loan availability and borrowing costs.

Second, the bank merger is likely to have had a greater impact on firms in the first two categories (firms that transacted with both or one of the merged banks) than those in the third category (firms that transacted with neither) due to changes in organizational structure and the reallocation of resources to increase managerial efficiency at the newly merged bank. Potential organizational changes as a result of the bank merger include the consolidation of branches, directly affecting firms that had a relationship with one or both of the merged banks and maintained a relationship with the merged entity. In the case of the BTM- UFJ merger, an extensive consolidation of the branch network followed, providing an excellent case study to examine this issue.

Third, within the second category of firms, there may well be a difference in the way loans are provided between borrower firms that transacted with the acquiring bank and those that transacted with the acquired bank. As pointed out by Peek and Rosengren (1998), the lending behaviour of a newly merged bank usually mirrors that of the acquiring bank. Hence, firms that transacted with the acquired bank may face more stringent loan conditions following the merger than those that transacted with the acquiring bank. Indirect evidence of such differences in loan conditions depending on whether a firm transacted with the acquiring or acquired bank is provided by Karceski, Ongena, and Smith (2005), who used share price data of listed firms in Norway. Here, we examine the same issue using our database. Since the firms that we focus on, non-listed firms, are weaker in loan negotiations than the listed firms examined by Karceski, Ongena, and Smith (2005), one would expect the impact to be more pronounced, and we use more direct measures than the share prices to examine the impact on loan conditions.

Further, we consider the results of these examinations in the context of the literature on the "inefficient" Japanese banking sector in the late 1990s and early 2000s. Peek and Rosengren (2005) and Caballero, Hoshi, and Kashyap (2008), for example, reported that financial institutions had perverse incentives to postpone the realization of loan-losses caused by non-performing loans. The measures adopted to this end by financial institutions include forbearance lending and accepting reduced loan repayments. As a result, as shown by Smith (2003), the interest rate charged by Japanese financial institutions did not necessarily reflect the credit risk of a borrower firm. Under these circumstances, it is worth examining if the bank merger not only changed the level of borrowing costs but also changed the risk-interest rate relationship in the Japanese loan market.

For the analysis, we employ a unique firm-level panel dataset for the years 2004-2008 of about 11,000 non-listed firms that mostly depend on bank loans for external finance. The dataset not only contains balance-sheet information, which we use for generating our variables on loan availability and firm performance, but also provides the names of up to ten banks and their branches that a firm transacts with and that we use for identifying firms' relationship with BTM and UFJ. To measure the effect of the merger of the two banks on firms, we employ the propensity score matching difference-in-differences estimator (PSM-DID). Since there are multiple ways in which the bank merger affects firms' configuration of bank relationships, we follow the procedure proposed by Lechner (2002) and allow for multiple treatments.

Our findings can be summarized as follows. First, firms that transacted with both BTM and UFJ prior to the merger saw their borrowing costs increase by 40 basis points (bp) relative to firms that had no such transaction relationships. Second, firms that transacted with one of the two banks saw their borrowing costs increase by a smaller but still significant margin of 20bp. Third, we do not find a significant difference in the extent that borrowing costs increased between firms that transacted with the acquiring bank (BTM) and those that transacted with the acquired bank (UFJ). Overall, these results indicate that the bank merger increased firms' borrowing costs partly through the exogenous decrease in the number of firm-bank relationships and partly through changes in organizational structure at the merged bank. Finally, the treatment effect does not significantly differ depending on firms' riskiness, meaning that our results provide no evidence that the interest rate that a firm is charged better reflects firms' credit risk than before the merger.

The remainder of the paper is organized as follows. Section 2 provides an overview of previous studies and presents the empirical hypotheses. Section 3 then presents details on the merger of BTM and UFJ and its background. Next, Sections 4 and 5 respectively outline the dataset used for the analysis and the empirical approach. Section 6 provides summary statistics and the estimation results followed by a further discussion in Section 7. Section 8 concludes.

2 Previous Studies and Empirical Hypotheses

There are a considerable number of studies examining the impact of bank mergers on firms' borrowing conditions, such as Sapienza (2002) and Erel (2011), who focus on the increasing market concentration in the loan market following a merger. An increase in market concentration through a merger not only results in an increase in market power of the merged banks (through the increase in the market share of loans outstanding) but also of all other banks operating in the market, allowing them to impose more stringent loan conditions and extracting larger rent than before the merger.

At the same time, however, the interactions among market structure, the degree of competition, and transaction conditions are not straightforward due to the role of bank-borrower relationships. The literature on financial intermediation suggests that banks produce valuable information on the viability of borrowers through bank-borrower relationships (Diamond 1984). If such information is not transferable to potential new lenders, borrowers will incur switching costs when terminating a relationship with an existing lender and finding a new lender (Rajan 1992; Sharpe 1990). Firm-bank relationships can be found in most advanced economies, although their duration and importance tends to vary. Reviewing a number of empirical studies on a range of countries, Degryse, Kim, and Ongena (2008) suggest that the average duration of firm-bank relationships ranges from 8 years in Belgium (Degryse and Van Cayseele 2000) and 7 to 11 years in the United States (Petersen and Rajan 1994) to 13 years in Germany (Harhoff and Körting 1998), 14 years in Italy (Angelini, Di Salvo, and Ferri 1998), and 15 to 18 years in Norway (Ongena and Smith 2001). Meanwhile, studies on Japan suggest that the average duration is over 20 years (e.g., Horiuchi, Packer, and Fukuda 1988; Uchida, Udell, and Watanabe 2006), suggesting that particularly in Japan, firm-bank relationships appear to play a key role in the loan market and that, consequently, it is important to focus on such relationships when examining the terms and conditions of loan contracts in Japan.

Changes in firm-bank relationships following a merger have three characteristics which can be directly linked to empirical hypotheses. First, a bank merger results in an exogenous decrease in the number of firm-bank relationships. For firms that used to transact with both of the merging banks, the number of banks they transact with automatically declines by one after the merger. In contrast, the number of unique borrower firms for the merged banks remains the same after the merger.

Regarding the effect of the number of relationships, many studies, such as those by Petersen and Rajan (1994) and Harhoff and Körting (1998), examine the hypothesis that a smaller number of firm-bank relationships means that switching costs for borrowers are higher, endowing banks with "information-based market power" and resulting in more stringent loan conditions such as higher borrowing costs. However, these studies do not focus on the effects of bank mergers. Moreover, they often fail to control for the fact that the number of relationships may be endogenously determined. Further, the results reported in these studies are sometimes the opposite of what theory predicts, but we cannot tell whether this is due to the possible endogeneity of the number of relationships or whether the theoretical predictions are wrong. In contrast, by using the event of a bank merger, the present study can measure the effect of a change in the number of relationships that is clearly exogenous. Thus, we can posit the following hypothesis for firms that used to transact with both of the merged banks:

Hypothesis 1: Firms that used to transact with both of the merged banks experience an exogenous decrease in the number of relationships with banks and face more stringent loan conditions, including higher borrowing costs, following the merger.

Second, as highlighted by Berger, Demsetz, and Strahan (1999) in their comprehensive survey, bank mergers result in a change in the organizational structures and operational procedures of the merged banks, which affects firms through their bank relationships. Firms that had established a relationship with at least one of the merged banks are affected by such changes. On the negative side for borrower firms, the newly merged bank may be too big and organizationally too multi-layered to extend loans to relatively small borrowers. In addition, there may be a loss of soft information by the bank when it consolidates its branches and reallocates loan officers somewhere unrelated to old borrowers. The possible result is more stringent loan conditions for borrowers. On the positive side, the newly merged bank may successfully reduce operating costs and increase its managerial efficiency. This improvement could potentially result in more favorable transaction terms for borrowers. To summarize, we have the following hypothesis:

Hypothesis 2: Firms that used to transact with one of the merged banks also face more stringent loan conditions due to organizational changes or the loss of soft information at the bank. Alternatively, they face more favorable conditions if they receive rents created by improved managerial efficiency at the merged bank.

Third, as shown by Karceski, Ongena, and Smith (2005), bank mergers may have an asymmetric effect on firm-bank relationships depending on whether a firm used to transact with the acquiring bank or the acquired bank. In the case they examined, listed firms in Norway that transacted with acquired banks saw a decrease in their stock price following the bank merger. Our setting here allows us to examine similarly whether the effects of the bank merger are asymmetric, depending on whether a firm used to transact with the acquired (UFJ) or the acquiring bank (BTM).

Hypothesis 3: Firms that used to transact with the acquired bank face more stringent loan conditions than firms that transacted with the acquiring bank.

We are going to examine each of these three hypotheses using our firm-level panel dataset and employing a propensity score matching estimator. Details of the procedure are provided in Sections 5 and 6.

3 The BTM-UFJ Merger

3.1 Japan's banking system and merger activity

This section provides a brief description of the structure of, and developments in, Japan's banking sector in the past few decades, including merger and acquisition activity. Roughly speaking, banks in Japan are categorized into two groups based on the nature of their activities: major banks that operate nation-wide and often across national borders, and regional financial institutions that operate in relatively limited geographical areas.[1] The major banks were traditionally further divided into city banks, trust banks, and long-term credit banks, although the latter type no longer exists.[2] The city banks are legally categorized as regular commercial banks and are the largest in terms of the size of their assets. They extend loans not only to large firms but also to small businesses and individuals. The trust banks extend loans mainly to large firms and provide trustee services to customers. The long-term credit banks provided long-term loans to large firms while issuing long-term debentures in order to collect funds from the public.

[1] There exist other types of banks in Japan, including agricultural/fishery cooperatives, government-affiliated financial institutions, and de novo banks. However, we do not include these types of institutions in our brief overview since they are of little relevance to the issues considered here.

[2] There used to be three long-term credit banks; however, two of them failed around the turn of the millennium, while the third merged with two city banks and thus became a regular commercial bank.

Regional financial institutions comprise of regional banks, second-tier regional banks, *shinkin* banks, and credit cooperatives. The regional banks are regular commercial banks and the largest in size among the regional financial institutions. In most cases, however, they focus on local loan markets at the prefecture level. The second-tier regional banks, which used to be mutual banks, primarily lend to small businesses. In 1989, they converted themselves into regular commercial banks and started to be labelled as second-tier regional banks. They usually operate in one or a few adjoining prefectures. Both the *shinkin* banks and the credit cooperatives are non-profit cooperatives composed of members living and working in a defined geographical area. They extend loans mainly to their members, including small businesses.

Until the 1990s, bank mergers were very rare in any of these bank categories. The number of city banks remained unchanged at 13 until 1990. Mergers among regional and second-tier regional banks were also rare. Only three of the second-tier banks were acquired during the 1970s and 1980s. The number of mergers involving *shinkin* banks and credit cooperatives was also limited until the 1990s.

This stability in the number of banks to a considerable extent was the result of the so-called "convoy system," in which competition among banks was limited due to government restrictions on the opening of new branches; competition between banks and other categories of financial businesses, such as security houses and insurance firms, was also strictly prohibited; and, against the background of these policies, the government arm-twisted larger healthy banks into acquiring failing banks in exchange for the permission to open new branches. As a consequence, most bank mergers during the 1970s and 1980s were initiated at the request of the government in order to bail out weaker banks.

However, Japan's stable banking system became increasingly fragile in the 1990s. This was partly due to the prolonged decline in asset prices during this period and partly due to the financial liberalization undertaken in the 1980s. Yet another factor was the introduction of the Basel Accord, which stipulated risk-based capital requirements and led relatively weak banks to consolidate. As a consequence, there were two mergers among city banks and three mergers among regional banks in the early 1990s.

3.2 A wave of bank mergers

However, starting in 1997, Japan experienced a financial crisis that set off a veritable wave of bank mergers. As a consequence of the crisis, triggered by non-performing loans, the Japanese government was forced to inject large sums into the banking system, resulting in quasi-nationalization that provided the impetus for wide-ranging consolidation in the financial sector. Major mergers during this phase included those between two city banks and one long-term credit bank, Dai-ichi Kangyo Bank, Fuji Bank, and the Industrial Bank of Japan, to form Mizuho Financial Group in 2000, and between Sakura and Sumitomo banks to form the Sumitomo Mitsui Banking Corporation in 2001. The merger between BTM and UFJ did not follow until 2005.

3.3 The BTM-UFJ merger

The Bank of Tokyo-Mitsubishi (BTM), which acquired UFJ Bank, was itself the product of a merger between Mitsubishi Bank, one of the largest city banks, and the Bank of Tokyo in 1996. In contrast with most other city banks, BTM had remained relatively healthy throughout the financial crisis. UFJ, on the other hand, resulted from the merger in 2001 of Sanwa Bank and Tokai Bank and had massive amounts of non-performing loans to several ailing large firms without sufficient reserves for loan losses, although this fact had not been made public at the time. Following a severe dispute with the Financial Services Agency (FSA) on the treatment of these loans, UFJ was forced to report huge loan losses in its financial statement in May 2004, meaning that its capital level was critically low. Desperately in need of cash to shore up its balance sheet and ensure a sufficient level of capital, UFJ agreed with BTM to merge, with the announcement being made in July 2004 and the merger itself becoming effective as of 2005. Bringing together the second-largest (BTM) and the fourth-largest (UFJ) bank in Japan, the merger created the largest financial institution not only in Japan but also in the world, outstripping Citigroup Incorporated in terms of assets.

Several remarks concerning the merger are in order. First, the interval between the disclosure of UFJ's massive loan losses (May 2004) and the announcement of the merger (July 2004) was short. Until the disclosure of those losses, most UFJ officials as well as borrower firms and other customers did not appear to have expected any radical changes in UFJ's management.

Moreover, even after UFJ had been forced to disclose its losses, it initially did not intend to merge with BTM. Instead, it tried to sell one of its operating arms, UFJ Trust Bank, to another financial group, Sumitomo Trust Bank. Therefore, it seems fair to say that the behaviour of neither UFJ nor borrowers was affected by the expectation of a merger until the merger was formally announced.

Second, the merger between BTM and UFJ was almost the last in the merger wave in the Japanese banking sector. There has been no merger involving a city bank since 2005. Even in terms of smaller mergers, there were only one second-tier bank merger and a few *shinkin* bank mergers in the year 2005, while since then, only 34 regional, second-tier regional, and *shinkin* banks have been involved in mergers.[3] Thus, focusing on the merger between BTM and UFJ allows us to examine the effects of a bank merger without confounding factors caused by other big mergers.

The third remark is that the loan losses that triggered the merger were due to non-performing loans to a small number of large firms that were considered to be "too big to fail." The average ex-ante performance of UFJ's small business borrowers, on the other hand, was not significantly worse in our sample than that of BTM's small business borrowers. Thus, it is unlikely that UFJ's balance sheet problems and subsequent merger with BTM were caused by the ex-ante under-performance of UFJ's small business borrowers.

4 Data

4.1 Data sources

The data used in this study are taken from the database of Tokyo Shoko Research (hereafter TSR database), a business database company. The TSR database covers more than 1.2 million firms in Japan and provides information on firms' primary characteristics such as firm age, number of employees, ownership structure, industry, location, and the identity of banks and bank branches the firm transacts with. For a sizable subset of firms, the database also has information on financial statements, including the outstanding amount of assets, interest payments, the outstanding amount of short- and long-term loans, business profits, and the outstanding amount

[3]Specifically, one regional bank, two second-tier regional banks, 19 *shinkin* banks, and 12 credit cooperatives have been involved.

of capital. The sample we use for analysis comprises 18,888 firms that had responded to previous government surveys implemented annually in 2001-2003 by the Small and Medium Enterprise Agency. Firms surveyed were randomly drawn from the TSR database. For each of the sample firms, we add information on their primary characteristics for 2005 and 2008. We also add information on their balance sheets and their profits and losses for the years 2004-2008.

Since our focus is on borrower firms that are likely to be credit-constrained, we limit our analysis to non-listed firms in the database. Another reason for excluding listed firms from the analysis is that it is the large listed firms whose underperformance resulted in the massive non-performing loans that eventually triggered the merger of UFJ and BTM. Moreover, we restrict the sample to firms that transact with at least two banks in order to examine the effect of an exogenous reduction in the number of firm-bank relationships. Further, since there were bank mergers in 2005 other than the one between BTM and UFJ, we exclude firms that transacted with one or more of these other banks from the sample. As a result, we have an unbalanced panel dataset of 11,107 firms.

4.2 Variables

We have several sets of variables to examine our empirical hypotheses. A list of the variables and their definitions is provided in Table 1.

4.2.1 Outcome variables

First, in order to gauge the availability of loans to a firm, we use several variables. The first variable is the borrowing costs a firm faces ($RATE$), calculated using information from firms' financial statements. Following Caballero, Hoshi, and Kashyap (2008), we use interest and discount expenses divided by the sum of long-term loans, short-term loans, and bills discounted in the previous period. We also use the log of $RATE$ ($lnRATE$) in order to examine the semi-elasticity of borrowing costs to changes in the explanatory variables. As for the amount of loans that each firm obtains, we use total loans, short-term loans, and long-term loans, all standardized by the total amount of assets. We label these variables $LOAN$, $SHORT$, and $LONG$, respectively. Finally, to represent firms' performance, we use the return on total assets outstanding (ROA) and the capital ratio (CAP).

4.2.2 Variables used for the propensity score estimation

To examine the determinants of transaction relationships with banks, we consider four categories of variables: firm-bank relationship characteristics, which are used as the dependent variables, as well as firm characteristics, regional dummies, and industry dummies. For the firm-bank relationship variables, we generate several dummy variables based on the information on the identity of the banks and bank branches that firms transact with. In the TSR database, each firm reports the identities of up to ten banks and their branches that they deal with. When, in 2005, none of these banks are BTM or UFJ, we set $MERGER0$=1 and 0 otherwise. When one of these banks is either BTM or UFJ, we set $MERGER1$=1 and 0 otherwise. Moreover, in order to determine whether the effects of the merger are asymmetric depending on whether a firm transacted with BTM or UFJ prior to the merger, we set $MERGER1\_1$=1 when UFJ is one of the banks listed by a firm and 0 otherwise, and $MERGER1\_2$=1 when BTM is one of the banks and 0 otherwise. When the banks that a firm transacted with include both BTM and UFJ, we set $MERGER2$=1 and 0 otherwise. The variable $MERGER2$ is used specifically to examine our first hypothesis.

Summarizing these binary variables, we create two index variables, which are used for the multinomial probit estimations. The first is $MTYPE1$, for which the set of values is $MTYPE1 = \{0, 1, 2\}$. Firms with $MERGER0 = 1$ have a value of zero, those with $MERGER1 = 1$ have a value of one, and those with $MERGER2 = 1$ have a value of two. The second index variable is $MTYPE2$, which considers the acquiring and the acquired bank separately and for which the set of values consequently is $MTYPE2 = \{0, 1, 2, 3\}$. Firms with $MERGER0 = 1$ have a value of zero, those with $MERGER1\_1 = 1$ have a value of one, those with $MERGER1\_2 = 1$ have a value of two, and those with $MERGER2 = 1$ have a value of three. The great advantage of focusing on a merger of megabanks, as we are doing here, is that it allows us to employ this range of dummy variables as there are a sufficient number of observations that fall into each category.

As for firm characteristics, we use five variables: firm age, firm size, credit risk, and the number of banks the firm transacts with. For firm size, we use the logarithm of the number of employees as well as that of the total amount of assets outstanding. For credit risk, we employ the credit score provided in the TSR database as a proxy. The TSR credit score is an indicator widely used by financial institutions and non-financial firms to assess the credit risk of small businesses in Japan. Finally, the number of banks a firm transacts with is employed to gauge the relative importance of a specific firm-bank relationship.

In addition to the variables listed above, we also employ dummy variables for the region in which firms are located (10 regions) and for the industry a firm belongs to (11 industries).

5 Empirical Approach

5.1 Propensity score matching with multiple treatments

We measure the effect of the merger of BTM and UFJ on firms that transacted with either one or both of these banks. In most cases, we compare firms in the treatment group that had transaction relationships with either one (or both) of the merged banks and those in the control group that had no transaction relationship with the merged banks.

For each of these treatment and control group firms, we first calculate the differences of variables before and after the merger. Then we calculate another difference, namely the difference in these differences between the treatment and the control group. This estimator is the difference-in-differences (DID) estimator. The DID estimator first controls for firms' time-invariant fixed effects by taking the differences of a variable. Next, it controls for macroeconomic shocks by taking the difference between these two groups. Assuming that each borrower firm is too small to have affected the probability of the merger between BTM and UFJ, we regard the merger as an exogenous event.

There is possibly a selection bias in the DID estimator, since the firms in the treatment group are often sizable and creditworthy. Further, many of the firms in the treatment group are located in metropolitan areas. The treatment effect for firms with such characteristics may significantly differ from the treatment effect for firms with different characteristics. In order to control for the potential selection bias, we therefore employ the propensity-score-matching difference-in-difference (PSM-DID) estimator proposed by Rosenbaum and Rubin (1983). The estimator is unbiased for the average treatment effect on the treated (ATT) under the assumptions of unconfoundedness and the balancing condition.

However, for our purposes, the PSM-DID estimator as proposed by Rosenbaum and Rubin still suffers from the shortcoming that it allows for only a single type of treatment, while we need to have multiple treatment groups for our analysis: namely, a group of firms that transacted with both of the merged banks, a group of firms that transacted with either one of the merged banks, and a group of firms that transacted with the acquired (acquiring) bank. If we put all of these in one treatment group, we end up in confounding a variety of effects and cannot tell if the effects of the merger result from the exogenous decrease in the number of firm-bank relationships or from the organizational change at the merged bank. In order to overcome this problem, we adopt the PSM-DID estimator proposed by Lechner (2002), which allows for multiple treatments and calculates propensity scores from the multinomial probit model estimation. See the Appendix for details of how we employ the methodology proposed by Lechner.

5.2 Examination of hypotheses

Following Lechner (2002), we allow for multiple treatments and employ the multinomial probit model in order to obtain propensity scores for each outcome. We then arbitrarily choose pairs of outcomes $\{l, m\}$ and calculate conditional propensity scores. We use the group of firms with outcome $\{m\}$ as treatments and the group of firms with outcome $\{l\}$ as controls.

In order to examine Hypotheses 1 and 2, we employ the index variable $MTYPE1$ whose values in the set $\{0, 1, 2\}$ correspond to the three mutually exclusive outcomes $MERGER0 = 1, MERGER1 = 1, and MERGER2 = 1$, implement a baseline multinomial probit estimation, and calculate propensity scores for each outcome. We then choose three pairs of values, namely $MTYPE1 = \{0, 2\}$,$\{1, 2\}$, and $\{0, 1\}$. The first two pairs are used to examine Hypothesis 1. Using the pair $\{0, 2\}$, we compare firms that transacted with both BTM and UFJ and those that transacted with neither BTM and UFJ. The difference of these two outcomes, however, includes two distinct effects, namely, the effect of increased switching costs and the effect of managerial changes at the merged bank. In order to isolate the former effect, we employ the pair $\{1, 2\}$, where firms for which $MERGER2$=1 are the treatment group and those for which $MERGER1$=1 are the control group.

The third pair is used to examine Hypothesis 2. Using the pair of outcomes $\{0, 1\}$ means that we are employing firms that transacted with one of the merged banks as the treatment group and firms that transacted with neither of them as the control group. Estimating the treatment effect using our sample allows us to examine the effects of the merger transmitted through the relationship between a firm and one of the merged banks.

In order to examine Hypothesis 3, we use the index variable $MTYPE2$ whose values in the set $\{0, 1, 2, 3\}$ correspond to four outcomes that are again mutually exclusive, namely $\{MERGER0 = 1, MERGER1\_1 = 1, MERGER1\_2 = 1, MERGER2 = 1\}$, and implement a multinomial probit estimation. The difference from the baseline multinomial probit estimation is that we further divide the outcome $MERGER1 = 1$ into the outcome $MERGER1\_1 = 1$, in which firms transacted with UFJ, and the outcome $MERGER1\_2 = 1$, in which firms transacted with BTM. After attaching the propensity scores based on the multinomial probit estimation, we choose three pairs of values, namely $\{0, 1\}$, $\{0, 2\}$, and $\{2, 1\}$. Using the third pair of outcomes, firms that transacted with UFJ are the treatment group and firms that transacted with BTM are the control group. Estimating the treatment effect allows us to examine if there are any asymmetries in the way firms are affected by the merger depending on which of the two banks they transacted with, that is, whether they transacted with the acquiring bank (BTM) or with the acquired bank (UFJ).

6 Results

6.1 Summary statistics

In this subsection, we provide summary statistics for the variables introduced in the previous section. Table 2 shows the summary statistics for the entire sample used for the multinomial probit model estimation, while Table 3 shows the summary statistics for the entire sample as well as for the subsamples that satisfy $MERGER0 = 1$, $MERGER1 = 1$, and $MERGER2 = 1$. Finally, Table 4 summarizes the variables used for measuring outcomes of the bank merger.

6.1.1 Variables used for the multinomial probit model estimation

Table 2 shows that the means of $MERGER0$, $MERGER1$, $MERGER2$, $MERGER1\_1$, and $MERGER1\_2$ are 0.636, 0.254, 0.110, 0.136, and 0.118, respectively, indicating that about 64% of firms in the entire sample did not have a transaction relationship with either of the merged banks prior to the merger, while about 25% had a transaction relationship with one of them and a further 11% with both. The 25% of firms that used to transact with one of the merged banks are relatively evenly split between those that used to transact with UFJ (14%) and those that used to transact with BTM (12%).

The mean values of $lnEMP$ and $lnASSETS$ are 3.69 and 0.15, corresponding to 40.06 employees and 1.17 billion yen in real terms. The distributions of these variables are skewed to the left, with an overwhelming majority of small firms and a small number of large firms that significantly increase the mean values. The mean of the proxy for firms' credit risk, $RATING$, is about 56, which is above the average for all firms in the TSR database. In terms of firms' location, the $KANTO$ area has the largest number of firms, followed by $KINKI$ and $TOHOKU$.

Table 3 presents the summary statistics for the different subsamples. As can be seen, there are considerable differences across the subsamples in the means of many of the variables just mentioned. The mean of $FIRMAGE$ differs moderately across subsamples: firms that transacted with both BTM and UFJ ($MERGER2 = 1$) are the oldest on average, while those that transacted with neither of the two ($MERGER0 = 1$) are the youngest. On the other hand, there are substantial differences in the variables on firm size: firms that transacted with both BTM and UFJ ($MERGER2 = 1$) were the largest in terms of employment with a mean of 238 employees and in terms of assets outstanding with a mean of 14 billion yen, followed by firms that transacted with one of the merged banks ($MERGER1 = 1$), while firms that transacted with neither of the merged banks were the smallest with a mean of 63 employees and 3 billion yen of total assets outstanding. Similar patterns can be found regarding the number of banks each firm transacted with as well as the credit score in that firms that fell into the $MERGER2 = 1$ group have the highest values on average, followed by those falling into the $MERGER1 = 1$ group. Since BTM and UFJ were city banks and the second- and fourth-largest in Japan, respectively, firms that transacted with them were on average also larger and more creditworthy than most other firms.

Firms' location also differs significantly across the different subsamples, which presumably reflects the geographical distribution of bank branches. The bank branches of both BTM and UFJ were concentrated in the metropolitan areas of $KANTO$, $KINKI$, and $TOKAI$, although each bank had at least one branch in each area. Approximately half of the firms that transacted either with one or both of the banks ($MERGER1 = 1$ or $MERGER2 = 1$) are located in $KANTO$, about a quarter to a third are located in $KINKI$, and between 10 and 18 percent are located in $TOKAI$. These figures are much higher than the corresponding figures for firms that transacted with neither of the two ($MERGER0 = 1$).

Taken together, these results suggest that there is considerable heterogeneity across the different subsamples, which is the reason why we decided to employ the matching approach outlined above.

6.1.2 Variables that measure the effects of the bank merger

Next, we provide an overview of the variables that measure the effects of the merger, including borrowing costs, loan availability, and firms' ex-post performance. Table 4 shows not only the level of each outcome variable in the year of the merger ($t = 2005$), but also its development from t to $t + 1$, $t + 2$, and $t + 3$. For borrowing costs, the mean value for the entire sample in year t is 2.54%. Looking at the different subsamples, firms that transacted with both banks ($MERGER2 = 1$) paid the lowest interest rates (2.39%), while those that transacted with neither ($MERGER0 = 1$) paid the highest rates (2.61%). Turning to the development in borrowing costs from year t, for the sample as a whole, there is actually a slight decrease from t to $t + 1$, followed by increases in $t + 2$ and $t + 3$. This trend reflects the tightening of monetary policy, which started in March 2006. Looking at the different subsamples, firms that transacted with both banks ($MERGER2 = 1$) experienced the largest increase in borrowing costs (+0.68 %), followed by firms that transacted with one of the banks ($MERGER1 = 1$) (+0.42%), while firms that transacted with neither bank ($MERGER0 = 1$) saw the smallest increase (+0.17%).

Figure 1 shows that there are considerable differences across the subsamples in the way the distribution of borrowing costs evolves over time from year t to $t+3$. Specifically, although the distribution shifts to the right in all subsamples, the extent of the shift appears to be greatest for firms that transacted with both banks ($MERGER2 = 1$) and smallest for those that transacted with neither ($MERGER0 = 1$). Even though a number of factors are yet to be controlled for, this simple comparison between subsamples suggests that firms that transacted with the two merged banks tend to have experienced a larger increase in borrowing costs than firms that had no relationship with the two banks. We will revisit this point using the PSM-DID estimator later in this section.

Returning to Table 4, considerable differences across subsamples can also be observed for the loan availability variables, especially for $LOAN$ and $LONG$. In year t, the levels of these variables were higher among firms that had transacted with neither of the banks ($MERGER0 = 1$) than those that had transacted with both ($MERGER2 = 1$). Moreover, for firms that had transacted with neither of the banks ($MERGER0 = 1$), $LOAN$ three years after the merger ($t+3$) was only marginally lower (-0.17%) than in the year of the merger, while $LONG$ had even increased (+0.76%). In contrast, firms that transacted with one or both of the banks prior to the merger ($MERGER1 = 1$ or $MERGER2 = 1$) experienced a decline in both these variables.

Finally, let us examine the firm performance variables, return on assets (ROA) and the capital ratio (CAP). As for ROA, three years after the merger, firms that had transacted with one or both of the merged banks ($MERGER2 = 1$ and $MERGER1 = 1$) had experienced a smaller decline than firms that had transacted with neither of the banks ($MERGER0 = 1$). At the same time, the former also saw a larger increase in CAP than the latter.

6.2 Multinomial probit estimation

We proceed to estimate the multinomial probit models in order to attach propensity scores to each observation. In our baseline model, we use $MTYPE1$. The marginal effects when $MTYPE1$ takes a value of 1 or 2 are shown in panel (a) of Table 5. For these values of the dependent variable, most of the explanatory variables have significant parameters. The signs of the parameters are almost the same for these two values and are consistent with what we observed in the summary statistics. We find that larger and more creditworthy firms, as well as firms located in metropolitan areas, are more likely to have had a transaction relationship with one or both of the banks. In addition, we find that the size of these parameters in most cases is larger for $MTYPE1 = 1$ than for $MTYPE1 = 2$.

In addition to the baseline model, we estimated a slightly different model in which the dependent variable is $MTYPE2$. The marginal effects when $MTYPE2$ takes a value of 1, 2, or 3 are shown in panel (b) of Table 5. For some of the variables we observe different parameter values for $MTYPE2 = 1$ and $MTYPE2 = 2$, meaning that the characteristics of firms that transacted with BTM are somewhat different from those that transacted with UFJ. For example, firms were more likely to have transacted with BTM the greater their number of employees; on the other hand, for UFJ, no such link between employment size and the likelihood of having a transaction relationship can be observed. In addition, the signs of the parameters on several of the area dummies differ for firms that transacted with BTM and those that transacted with UFJ. Being located in $TOKAI$ has a significant positive marginal effect on the likelihood that a firm will have transacted with UFJ, but a significant negative marginal effect on the likelihood that it will have transacted with BTM. Moreover, being located in $KANTO$ has a higher marginal effect on the likelihood that a firm will have transacted with BTM than that it will have transacted with UFJ, while the opposite is the case for $KINKI$. These differences in the regional parameters between the banks may reflect differences in the geographical distribution of bank branches.

Using the results of the above two multinomial probit model estimations, we form several pairs of outcomes in order to attach conditional propensity scores following Lechner's methodology. We then estimate the treatment effects. We detail these procedures in the next subsection.

6.3 Treatment effect estimation

In this subsection, we estimate the treatment effects of the bank merger using PSM-DID estimation. Since we allow for multiple treatments, we choose a pair of outcomes from the multinomial probit estimation in order to match treatment observations with non-treatment observations.

6.3.1 Examining Hypotheses 1 and 2

We employ the following three pairs of outcome values, $MTYPE1 = \{0, 2\}$, $\{1, 2\}$, and $\{0, 1\}$, and estimate the treatment effect within the group of firms that take either one of the values in each pair. Taking the first pair of outcomes, $MTYPE1 = \{0, 2\}$, as an example, firms whose outcome value corresponds to the second value in the bracket (2 in this case, indicating that a firm transacted with both banks) form the treatment group, while firms whose outcome value corresponds to the first value (0 in this case, indicating that a firm transacted with neither of the merged banks) form the non-treatment group. We calculate the conditional propensity scores for firms that belong to the treatment and non-treatment groups. We then apply the caliper matching procedure in order to choose a control group observation for each treatment observation. We conduct PSM-DID estimation for firms that belong to the treatment and control groups and compare the development in outcome variables over time between these groups. Table 6 shows the results.

Let us start with column (1), which focuses on firms that transacted with both banks and experienced an exogenous decrease in the number of firm-bank relationships as a result of the merger. In the column, we observe significant increases in borrowing costs ($RATES$) for treatment firms relative to the control firms between years t and $t + 3$. This provides support for Hypothesis 1, which stated that firms that transacted with both BTM and UFJ were expected to face higher switching costs and more stringent borrowing conditions, including higher interest rates, following the merger. Column (1) shows that $RATE$ increased by 40 basis points (bp) for firms that had transacted with both banks relative to firms that had transacted with neither bank.

Next, turning to Column (3), it is noteworthy that even here we find significant treatment effects for $RATE$. Since firms in the treatment and the control group have in common that they had a transaction relationship with the newly merged bank and they only differ in that the former transacted with both banks while the latter transacted with only one, one might expect that they were affected by the merger in the same way. Yet, this is not the case. What this suggests is that the merger reduced the number of financing sources for treatment firms (firms that transacted with both banks prior to the merger), resulting in a more stringent environment for the procurement of funds for these firms, while the number of financing sources for control firms remained unchanged.[4]

Further, Column (5) of Table 6 examines Hypothesis 2 that the procurement conditions of firms that transacted with at least one of the merged banks were adversely affected due to organizational changes at the merged bank. Possible adverse effects include the loss of soft information through the consolidation of branch networks and the reallocation of loan officers who have established long-term relationships with borrowers. On the other hand, it is also possible that firms that transacted with at least one of the merged banks before the merger may in fact enjoy more favorable procurement conditions after the merger, for example because of efficiency improvements at the merged bank. The results in the table, however, suggest that the negative effects dominate: relative to control firms, treatment firms' borrowing costs ($RATE$) three years after the merger had increased by 20bp.

A few additional remarks regarding the treatment effects obtained in the PSM-DID estimation in Table 6 are in order. First, essentially no statistically significant treatment effects can be observed for any of the variables apart from $RATE$ and $lnRATE$. Although based on the treatment effects calculated using simple DID estimation shown in Table 4 one might expect several other variables, such as $LOAN$ and $LONG$, to be significant, this is not the case in the PSM-DID estimation. Moreover, the maturity composition of loans in terms of $SHORT$ and $LONG$ loans as well as firm quality as measured by ROA and CAP show no significant change after the merger. Therefore, we are able to say that the increase in $RATE$ and $lnRATE$ seen in Table 6 is not due to a shift from short-term to long-term loans or to a change in the quality of borrower firms.

Second, the results in Table 6 suggest that it takes about three years for $RATE$ and $lnRATE$ to increase by a statistically significant margin. However, this does not necessarily mean that most individual loan contracts were fixed for the first year or two after the merger. Our measure of borrowing costs is the amount of annual interest payments divided by the total amount of

[4] Whether this result is a reflection of the Japanese context, where firm-bank relationships tend to be stable and establishing a new relationship is relatively costly, or whether a similar pattern can be observed elsewhere, is an interesting topic for future research.

loans outstanding. It may well be the case that individual loan contracts were revised to higher interest rates immediately after the bank merger. However, it may take some time for these new contracts to make up a substantial share in the total amount of loans outstanding.

6.3.2 Examining Hypothesis 3

We now turn to the examination of Hypothesis 3, which states that firms that transacted with the acquired bank are expected to face more stringent loan conditions than firms that transacted with the acquiring bank. We form the following three pairs of outcome values: $MTYPE2 = \{0, 1\}$, $\{0, 2\}$, and $\{2, 1\}$. Firms whose outcome value corresponds to the second value in the bracket belong to the treatment group and firms whose outcome value corresponds to the first value belong to the non-treatment group. Following the same steps as in the baseline case, we calculate conditional propensity scores, apply the caliper matching procedure to obtain a set of treatment and control observations, and obtain PSM-DID estimates for the treatment effects. Table 7 shows the results.

Looking at the results for $RATE$ three years after the merger ($t+3$) suggests that the positive treatment effects are very similar irrespective of whether a firm transacted with the acquiring or the acquired bank. Specifically, relative to firms that transacted with neither of the two banks, firms that transacted with UFJ saw an increase in $RATE$ of 19bp, while the corresponding figure for firms that transacted with BTM is 22bp. Thus, it seems that the newly merged bank did not treat former UFJ borrowers in a discriminatory manner in terms of borrowing costs. This contrasts with the results reported by Karceski, Ongena, and Smith (2005), who, focusing on listed firms, found that the share prices of firms that had borrowed from the acquired bank underperformed significantly relative to those of firms that had borrowed from the acquiring bank.

7 Further Examinations

7.1 Effects of the number of banks

In addition to the examination of Hypotheses 1 through 3, we provide further empirical analyses. In the first two subsections we implement robustness checks and in the third we interpret the results in the context of the literature arguing that loan pricing by Japanese banks during the 1990s and early 2000s was distorted (e.g., Peek and Rosengren 2005, Caballero, Hoshi, and Kashyap 2008). To this end, we employ a parametric approach for examining the treatment effect of the bank merger in place of the non-parametric approach with the PSM estimator used in the previous section.

Both the parametric and non-parametric estimators for the treatment effects are consistent under the assumption of unconfoundedness and the overlap condition. Since we introduce interaction terms and allow for the treatment effect to vary across subsamples, we employ the parametric estimator - Flores and Mitnik (2009) call it the partial mean linear estimator - rather than the non-parametric estimator, which is more flexible but relatively computationally burdensome.

We show that this parametric partial mean linear estimator provides quantitatively similar results to those in the baseline case presented in Table 6. We focus on the development of interest rates, that is, $RATE$ and $lnRATE$, between t and $t+3$, since we found in Section 6 that these variables changed significantly after the merger. The equation for the baseline estimation is:

$$E\left[\Delta RATE_{it+3}|X_i, MTYPE1_i\right] = const + \sum_{k\in\{1,2\}} \alpha_k 1(MTYPE1_i = k) + X_i^{'}\delta \tag{1}$$

where X_i is a vector of the explanatory variables employed in the previous section and $1(\cdot)$ is an indicator variable that is unity if the condition in parentheses is satisfied and zero otherwise. Our focus is on the parameters α_k with $k \in \{1,2\}$, which represent the treatment effect. α_2, $\alpha_2 - \alpha_1$, and α_1 respectively represent the treatment effects using the following pairs of outcome values: $MTYPE1 = \{0,2\}$, $\{1,2\}$, and $\{0,1\}$.

The results are shown in Table 8(a), with the column numbers corresponding to those in Table 6. The results are quantitatively similar to those for the non-parametric estimation in Table 6: The estimator values for $RATE$ are 41, 21, and 20bp, while the corresponding figures in Table 6 are 40, 25, and 20bp, respectively, with similar levels of statistical significance. The estimates for $lnRATE$ are also quantitatively close to each other in Tables 6 and 8(a). We start from this baseline parametric specification and add interaction terms to examine three issues.

The first issue concerns the measurement of the interest rate paid by firms. While Sapienza (2002) and Erel (2011) employ contract-level interest rates, our interest rate variable is calculated as a firm's total annual interest payments divided by its total amount of loans outstanding. This means that our interest rate measure includes not only interest payments to BTM and/or UFJ, but also to other banks, and it is therefore difficult to isolate the effects of the pricing behaviour of the two banks.

One way to circumvent this problem of confounding factors with regard to the cost of borrowing is to control for the number of banks a firm transacts with at the time of the merger. If a firm in the treatment group for which $MTYPE1 = 2$ (i.e., it had transaction relationships with both BTM and UFJ) had only two banks as transaction partners, then we know that after the merger it paid interest only to the newly merged bank. Further, if the number of banks a firm transacts with is greater than two but nevertheless small, the merged bank will still account for a large share of the firm's interest payments and the firm is therefore more likely to be affected by the merger than other treatment firms that transact with a large number of banks. Based on this line of reasoning, we set up the following equation for the expected value of the change in $RATE$ conditional on the existence of a relationship with one or both of the merged banks, the number of banks, and the interaction term between the two:

$$E\left[\Delta RATE_{it+3}|X_i, MTYPE1_i, NBANK_i\right] = const + \sum_{k\in\{1,2\}} \alpha_k 1(MTYPE1_i = k)$$
$$+ \sum_{k\in\{1,2\}} \beta_k 1(\cdot) NBANK_i + \sum_{k\in\{1,2\}} \gamma_k 1(\cdot) NBANK_i^2 + \varphi_1 NBANK_i + \varphi_2 NBANK_i^2 + X_i\zeta \quad (2)$$

Note that we include quadratic terms for $NBANK$ in order to incorporate any possible non-linear relationships between $RATE$ and $NBANK$. Our aim is to measure the treatment effects represented by α_k, β_k, and γ_k. When we compare firms that transacted with both of the merged banks and those that transacted with neither of them, the treatment effect is calculated as $\alpha_2 + \beta_2 NBANK + \gamma_2 NBANK^2$. When we compare firms that transacted with either one of the merged banks and those that transacted with neither of them, the treatment effect is calculated as $\alpha_1 + \beta_1 NBANK + \gamma_1 NBANK^2$.

The results for the treatment effect, which differs depending on the number of banks each firm transacts with, are presented in Figure 2. In both cases, the size of the treatment effect gradually decreases as $NBANK$ increases.[5] This negative correlation between the size of the treatment effect and the number of banks is consistent with our discussion above in that the merger affects loan conditions more severely for firms with fewer alternative financing sources other than the merged banks.

7.2 Effects of bank branch consolidation

The second issue to be examined is the role of branch consolidation in relation to the results for Hypothesis 2. In the previous section, we speculated that the increase in borrowing costs among firms that transacted with the merged banks is attributable to the consolidation of the branch network of the merged banks and the resulting loss of soft information. In order to examine whether this is correct, we focus on firms that transacted with branches that were closed or merged with other branches within a few years of the merger. Following the merger between BTM and UFJ, about 20% of all branches were closed or merged with other branches and thus there is a sufficient number of firms that had transaction relationships with such branches.

When we estimate the treatment effect of bank branch consolidation, firms that belong to the treatment group are those that had transacted either with one or both of the merged banks (i.e., firms for which $MTYPE1 = 1$ or 2) and that saw at least one of the branches they used to transact with closed after the merger ($CNSL = 1$). Thus, we estimate the following equation for the expected value of the change in $RATE$ conditional on the existence of a relationship with one or both of the merged banks and the indicator of bank branch consolidation:

$$E\left[\Delta RATE_{it+3}|X_i, MTYPE1_i, CNSL_i\right] = const + \sum_{k\in\{1,2\}} \alpha_k 1(MTYPE1_i = k)$$
$$+\beta\left[1(CNSL_i = 1|MTYPE1_i = 1) + 1(CNSL_i = 1|MTYPE1_i = 2)\right] + X_i^{'}\delta \qquad (3)$$

Our aim is to measure the treatment effects represented by α_k and β. When we compare firms that transacted with at least one of the merged banks and those that transacted with neither of them, the treatment effect is calculated as $\alpha_k + \beta$. Table 8(b) shows the estimation

[5] Note that due to the small number of observations for firms transacting with only two banks, the treatment effect for $NBANK = 2$ is not significantly different from zero. Note also that firms for which $NBANK = 1$ are excluded from the sample since $p(MTYPE1 = 2|NBANK = 1) = 0$ and thus these firms do not satisfy the positive support condition for $MTYPE1 = 2$.

results for the treatment effect of firms' bank branch being closed, which we compare with the results in Table 8(a). The comparison shows that the treatment effect between t and $t+3$ with regard to $RATE$ is larger for firms that saw their bank branch closed than for treatment firms in the benchmark case. For example, among treatment firms that transacted with both of the merged banks (i.e., $MTYPE1 = 2$), the $RATE$ increase is 41bp in the baseline case. On the other hand, in the case where such firms saw their bank branch closed, the $RATE$ increase becomes even larger, ranging from 56 to 68bp. We obtain similar results for the treatment effect among firms that transacted with one of the two banks (i.e., for which $MTYPE1 = 1$).

In sum, firms that saw a bank branches they used to transact with being closed paid higher interest rates than firms that were only indirectly affected by the consolidation of bank branches. This indicates that the observed interest rate increase is at least partly attributable to the loss of soft information caused by branch consolidation.

7.3 Loan pricing and credit risk

Finally, the third issue we examine is whether loan pricing following the merger better reflects borrowers' credit risk. Studies on loan mispricing in Japan, such as Smith (2003) and Caballero, Hoshi, and Kashyap (2008), have shown that during the 1990s and early 2000s the interest rates charged by banks were insensitive to any increase in borrowers' credit risk. Our dataset allows us to examine whether more recently the interest rates charged by banks have come to better reflect borrowers' credit risk, so that riskier firms are charged significantly higher interest rates than before, while less risky firms are not.

Thus, we estimate the following equation for the expected value of the change in $RATE$ conditional on the existence of a relationship with one or both of the merged banks and an indicator of riskiness, $RISKY$. We define $RISKY$ in two ways. In the first definition, it is set to unity if a firm's $RATING$ is below the median value, and zero otherwise. In the second, it is set to unity if the firm's interest rate spread is negative, and zero otherwise.[6] We examine if treatment firms for which $RISKY = 1$ experience a greater increase in borrowing costs after the bank merger than firms for which $RISKY = 0$. Specifically, we estimate the following equation:

[6] This is the definition employed by Caballero, Hoshi, and Kashyap (2008) to detect "zombie" firms.

$$
\begin{aligned}
E\left[\Delta RATE_{it+3}|X_i, MTYPE1_i, RISKY_i\right] &= const + \sum_{k\in\{1,2\}} \alpha_k 1(MTYPE1_i = k) \\
+ \sum_{k\in\{1,2\}} \beta_k 1(MTYPE1_i &= k)1(RISKY_i = 1) + X_i^{'}\delta \qquad (4)
\end{aligned}
$$

Our aim is to measure the treatment effects represented by α_k and β_k, that is, $\alpha_k + \beta_k$. Table 8(c) shows the estimation results for the treatment effects. Relative to the treatment effects in the baseline case (Table 8(a)), however, Table 8(c) indicates that riskier firms did not necessarily face a larger increase in borrowing costs. Thus, although borrowing costs rose significantly after the bank merger, we find no evidence that loan pricing after the bank merger better reflects borrowers' credit risk.

8 Conclusion

This study examined the effects of a major bank merger on firms' financing conditions by focusing on Japan's largest bank merger in history, that between the Bank of Tokyo-Mitsubishi (BTM) and UFJ Bank (UFJ) in 2005. In contrast with many previous studies investigating the effects of bank mergers, including those by Sapienza (2002) and Erel (2011), which concentrate on the impact on local loan markets, the present study focused on the role of firm-bank relationships in transmitting the effects of a bank merger. This emphasis on firm-bank relationships is based on the theoretical literature on financial intermediation (e.g., Sharpe 1990; Rajan 1992), which assumes that banks establish customer relationships with borrowers in order to gather information and that such information is available only to banks that have lent to a firm. In this case, it is unlikely that both incumbent and potential lenders are able to exercise market power and set loan conditions such as interest rates in a similar manner. Therefore, firm-bank relationships play an important role in determining loan conditions.

The megabank merger we used for our analysis provides an excellent case study for examining the relevance of such firm-bank relationships, since both of the merged banks had relationships with a large number of firms. In addition, a substantial number of firms had relationships with both banks at the time of the merger and continued to maintain them for a considerable period of time. Exploiting the information on firm-bank relationships in our dataset, we were able to investigate how the impact of the merger on firms' borrowing conditions differed depending on whether they had a transaction relationship with none, one, or both of the merged banks. Our findings can be summarized as follows.

First, the borrowing costs of firms that transacted with both BTM and UFJ prior to the merger increased by 40bp relative to firms that transacted with neither. We also detect significant treatment effects even after controlling for the number of banks a firm transacted with. Second, the borrowing costs of firms that transacted with one of the two banks rose by a smaller but still significant margin of 20bp. The margin increases to 28-36bp when we focus on firms that transacted with bank branches that were subsequently closed. Third, we do not find a significant difference in the extent of the relative increase in borrowing costs between firms that transacted with the acquiring bank (BTM) and those that transacted with the acquired bank (UFJ). Overall, these results suggest that the bank merger increased firms' borrowing costs partly through an exogenous decrease in the number of firm-bank relationships and partly through changes in the merged bank's organizational structure. Finally, the treatment effect does not significantly differ across firms of different degrees of riskiness, meaning that our results provide no evidence that the interest rate that a firm is charged better reflects firms' credit risk than before.

There are several directions for future research. First, the newly merged bank may have "dropped" particular firms. Our analysis here is limited to firms that maintained their relationship with the newly merged bank during the period 2005-2008. However, examining what firms were dropped and why following the bank merger and comparing the results with those of other studies such as the ones by Degryse, Masschelein, and Mitchell (2011) and Di Patti and Gobbi (2007) represents an interesting avenue for further research.

Second, it would be worthwhile to analyze the impact of bank mergers on the Japanese loan market from a more comprehensive perspective rather than just focusing on one specific merger. Whether similar patterns can be found as in this study, i.e., that borrowers tend to face higher borrowing costs following a merger, has important policy implications.

A Appendix: Propensity Score Matching Estimation with Multiple Treatments

The treatment effect of the merger we would like to detect is the average treatment effect on the treated (ATT), which is expressed as

$$\theta_{ATT} = E\left(Y(1) \mid MTYPE = 1\right) - E\left(Y(0) \mid MTYPE = 1\right) \tag{5}$$

A simple comparison of the outcome variables for firms that transacted with a bank that merged ($MTYPE = 1$) and those for firms that did not ($MTYPE = 0$) can be biased. More precisely, if outcomes of $Y(0)$ are expected to be different between firms that transacted with the merged bank and those that transacted with neither of the merged banks, the simple comparison has the following bias:

$$\begin{aligned} & E\left(Y(1) \mid MTYPE = 1\right) - E\left(Y(0) \mid MTYPE = 0\right) \\ = \quad & \theta_{ATT} + E\left(Y(0) \mid MTYPE = 1\right) - E\left(Y(0) \mid MTYPE = 0\right) \end{aligned} \tag{6}$$

To circumvent this problem, we need to control for possible selection bias in our estimation. Thus, we employ the propensity score matching (PSM) estimation approach proposed by Rosenbaum and Rubin (1983). Their methodology is applicable to the case in which the treatment is a binary choice. However, in practice, choices often are multinomial rather than binary. For example, among the firms that transacted with the merged banks, there is likely to be heterogeneity regarding the way they were involved with the banks that merged. That is, some firms will have transacted with the acquiring bank only, while others will have transacted with the acquired bank only, and yet others will have transacted with both banks. Since each of these treatment groups potentially faces different outcomes from the bank merger, it is necessary to examine the differences among the different treatment groups.

Lechner (2002) extends the analysis of Rosenbaum and Rubin, allowing for multiple treatments. In our case, we define the set of treatments as $MTYPE = \{0, 1, \ldots, M\}$, where $M \geq 2$. The corresponding outcomes for these treatments are $\{Y(0), Y(1), \ldots, Y(M)\}$. Unconfoundedness is assumed as

$$\{Y(0), Y(1), ..., Y(M)\} \perp MTYPE \mid X \tag{7}$$

Further, another assumption, which we call the balancing condition, has to be satisfied in order to ensure that we have a consistent estimator of the treatment effect,

$$X \perp MTYPE|p(X) \tag{8}$$

In other words, for a given propensity score, there exists a pool of treatment and control observations. They are, on average, identical and the treatment observations are randomly chosen from the pool. As Flores and Mitnik (2009) point out, satisfying the balancing condition is more difficult in the case of multiple treatments than in the case of a single treatment. Hence, it is important to check for the existence of overlaps prior to the matching estimation. To do so, we not only examine the distributions of propensity scores (results not shown in the paper) but also employ the caliper matching rule, which is the most suitable approach for this purpose. Caliper matching arbitrarily sets a tolerance level and for each treatment observation i searches a control observation j that satisfies the condition $c(p_i) = min_j \|p_i - p_j\| \leq \varepsilon$. For our analysis we do not use treatment observations for which we cannot find a matched observation satisfying the above condition. We set $\varepsilon = 0.01$ here. Thus, we are more likely to satisfy the balancing condition by employing caliper matching.

We estimate the multinomial probit model for the probability of each treatment $\{p^k\}_{k=0}^{M}$. Then we calculate the probability for the treatment m conditional on a pair of two treatments $\{l, m\}$:

$$\begin{aligned} p^{m|l,m}(X) &= p(MTYPE = m \mid MTYPE = l, or MTYPE = m, X) \\ &= \frac{p^m(X)}{p^l(X) + p^m(X)} \end{aligned} \tag{9}$$

We employ the propensity score matching difference-in-differences (PSM-DID) approach. Under the above assumptions, ATT is expressed as:

$$\theta_{ATT}^{l,m} = E_{p^{m|l,m}(X)|MTYPE=m}\left[\begin{array}{c} E\left\{\Delta Y(m) \mid p^{m|l,m}(X), MTYPE=m\right\} \\ -E\left\{\Delta Y(l) \mid p^{m|l,m}(X), MTYPE=l\right\} \end{array}\right] \tag{10}$$

$$= E\left(\Delta Y(m) \mid MTYPE=m\right) - E_{p^{m|l,m}(X)|MTYPE=m}\left[E\left\{\Delta Y(l) \mid p^{m|l,m}(X), MTYPE=l\right\}\right] \tag{11}$$

And a consistent PSM-DID estimator for ATT is

$$\hat{\theta}_{ATT}^{l,m} = \frac{1}{N_T}\sum_{i\in\{MTYPE=m\}}\left[\Delta Y_{it+k}(m) - \sum_{i\in\{MTYPE=l\}} w(i,j)\Delta Y_{jt+k}(l)\right] \tag{12}$$

Using this estimator, we take into consideration the heterogeneity in the way firms were involved with the banks that merged and examine how this heterogeneity affects ex-post firm-bank relationships as well as firms' borrowing conditions after the merger.

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Table 1: List of variables and their definitions

Variable	Definition
Variables used for propensity score estimation	
Dependent variable	
MERGER0	1 if the firm had a relationship with neither BTM nor UFJ in 2005, otherwise 0.
MERGER1	1 if the firm had a relationship with either BTM or UFJ in 2005, otherwise 0.
MERGER1_1	1 if the firm had a relationship with UFJ in 2005, otherwise 0.
MERGER1_2	1 if the firm had a relationship with BTM in 2005, otherwise 0.
MERGER2	1 if the firm had a relationship with both BTM and UFJ in 2005, otherwise 0.
MTYPE1	0 if MERGER0=1, 1 if MERGER1=1, 2 if MERGER2=1
MTYPE2	0 if MERGER0=1, 1 if MERGER1_1=1, 2 if MERGER1_2=1, 3 if MERGER2=1
Firms' characteristics	
lnFIRMAGE	Natural log of firm age in 2005.
lnEMP(t-1)	Natural log of number of employees in 2004.
lnASSETS(t-1)	Natural log of total assets in 2004.
NBANK	Number of bank relationships in 2005.
RATING	Credit rating in 2005 taking a value from 0 to 100.
Firms' location	
HOKKAIDO	1 if the firm is located in the Hokkaido area, otherwise 0.
TOHOKU	1 if the firm is located in the Tohoku area, otherwise 0.
KANTO	1 if the firm is located in the Kanto area, otherwise 0.
KOSHINETSU	1 if the firm is located in the Koshinetsu area (Niigata, Nagano, and Yamanashi), otherwise 0.
HOKURIKU	1 if the firm is located in the Hokuriku area (Ishikawa, Toyama, and Fukui), otherwise 0.
TOKAI	1 if the firm is located in the Tokai area (Aichi, Shizuoka, and Gifu), otherwise 0.
KINKI	1 if the firm is located in the Kinki area, otherwise 0.
CHUGOKU	1 if the firm is located in the Chugoku area, otherwise 0.
SHIKOKU	1 if the firm is located in the Shikoku area, otherwise 0.
KYUSHU	1 if the firm is located in the Kyushu area, otherwise 0.
Industry dummies	
INDUSTRY1-11	1: Mining, 2: Construction, 3: Manufacturing, 4: Electricity, gas, and heat supply, 5: Telecommunications, 6: Transportation, 7: Wholesale trade, 8: Retail trade, 9: Finance and insurance, 10: Restaurants and accommodation, 11: Other
Outcome variables	
RATE	Borrowing cost: interest and discount expenses divided by the sum of long-term loans, short-term loans, and "notes discounted.
lnRATE	Natural log of RATE.
LOAN	Loan ratio: sum of long-term loans and short-term loans divided by total assets.
SHORT	Short-tem loan ratio: short-term loans divided by total assets.
LONG	Long-tem loan ratio: short-term loans divided by total assets.
ROA	Return on assets: operating profit divided by total assets.
CAP	Capital ratio: net assets divided by total assets.

Table 2: Summary statistics for the entire sample

Variable	Obs.	Mean	Median	Std. Dev.	Min.	Max.
Dependent variable						
MERGER0	11107	0.6358	1.0000	0.4812		
MERGER1	11107	0.2543	0.0000	0.4355		
MERGER1_1	11107	0.1360	0.0000	0.3428		
MERGER1_2	11107	0.1183	0.0000	0.3230		
MERGER2	11107	0.1099	0.0000	0.3128		
Firms' characteristics						
lnFIRMAGE	11107	3.4915	3.6376	0.5717	1.0986	4.4773
lnEMP(t-1)	11107	3.6903	3.5835	1.2813	0.0000	8.3885
lnASSETS(t-1)	11107	0.1545	0.0846	1.6296	-5.4230	6.4185
NBANK	11107	4.2788	4.0000	2.0028	2.0000	10.0000
RATING	11107	55.7009	55.0000	7.2863	9.0000	84.0000
Firms' location						
HOKKAIDO	11107	0.0711	0.0000	0.2570		
TOHOKU	11107	0.0972	0.0000	0.2963		
KANTO	11107	0.2615	0.0000	0.4394		
KOSHINETSU	11107	0.0773	0.0000	0.2671		
HOKURIKU	11107	0.0431	0.0000	0.2031		
TOKAI	11107	0.0952	0.0000	0.2935		
KINKI	11107	0.1499	0.0000	0.3570		
CHUGOKU	11107	0.0798	0.0000	0.2709		
SHIKOKU	11107	0.0421	0.0000	0.2009		
KYUSHU	11107	0.0827	0.0000	0.2755		
Industry dummies						
INDUSTRY1	11107	0.0071	0.0000	0.0840		
INDUSTRY2	11107	0.2173	0.0000	0.4124		
INDUSTRY3	11107	0.2744	0.0000	0.4462		
INDUSTRY4	11107	0.0063	0.0000	0.0791		
INDUSTRY5	11107	0.0275	0.0000	0.1634		
INDUSTRY6	11107	0.0289	0.0000	0.1675		
INDUSTRY7	11107	0.1761	0.0000	0.3809		
INDUSTRY8	11107	0.0978	0.0000	0.2970		
INDUSTRY9	11107	0.0435	0.0000	0.2040		
INDUSTRY10	11107	0.0086	0.0000	0.0926		
INDUSTRY11	11107	0.1125	0.0000	0.3160		

Table 3: Summary statistics for subsamples

	ALL	Subsample		
		MERGER0	MERGER1	MERGER2
Firms' characteristics				
FIRMAGE	37.4727	35.2635	40.3647	43.5610
EMP(t-1)	100.3525	62.8859	134.6686	237.6831
ASSETS(t-1)	5.2278	2.5951	8.0644	13.8948
NBANK	4.2788	3.7186	4.8757	6.1384
RATING	55.7009	54.8183	56.7192	58.4505
Firms' location				
HOKKAIDO	0.0711	0.1028	0.0191	0.0082
TOHOKU	0.0972	0.1459	0.0156	0.0049
KANTO	0.2615	0.1553	0.4150	0.5201
KOSHINETSU	0.0773	0.1155	0.0149	0.0008
HOKURIKU	0.0431	0.0595	0.0170	0.0090
TOKAI	0.0952	0.0586	0.1831	0.1032
KINKI	0.1499	0.0872	0.2337	0.3186
CHUGOKU	0.0798	0.1032	0.0478	0.0180
SHIKOKU	0.0421	0.0586	0.0163	0.0066
KYUSHU	0.0827	0.1133	0.0375	0.0106
No. of Obs.	11107	7062	2824	1221

Table 4: Summary statistics for the level and development of outcome variables

	ALL	Subsample		
		MERGER0=1	MERGER1=1	MERGER2=1
RATE(t)	0.0254	0.0261	0.0241	0.0239
ΔRATE(t+1)	-0.0004	-0.0005	-0.0008	0.0009
ΔRATE(t+2)	0.0012	0.0006	0.0017	0.0034
ΔRATE(t+3)	0.0030	0.0017	0.0042	0.0068
CASH(t)	0.1761	0.1797	0.1699	0.1673
ΔCASH(t+1)	-0.0027	-0.0024	-0.0045	-0.0004
ΔCASH(t+2)	-0.0048	-0.0037	-0.0073	-0.0056
ΔCASH(t+3)	-0.0083	-0.0076	-0.0085	-0.0112
LOAN(t)	0.3532	0.3756	0.3186	0.2901
ΔLOAN(t+1)	-0.0057	-0.0037	-0.0068	-0.0152
ΔLOAN(t+2)	-0.0107	-0.0058	-0.0175	-0.0237
ΔLOAN(t+3)	-0.0083	-0.0017	-0.0185	-0.0213
SHORT(t)	0.1535	0.1504	0.1749	0.1235
ΔSHORT(t+1)	0.0125	0.0032	0.0466	-0.0086
ΔSHORT(t+2)	0.0095	-0.0004	0.0438	-0.0096
ΔSHORT(t+3)	-0.0017	0.0016	-0.0076	-0.0061
LONG(t)	0.2290	0.2438	0.2148	0.1667
ΔLONG(t+1)	0.0002	0.0010	-0.0004	-0.0037
ΔLONG(t+2)	0.0000	0.0025	-0.0009	-0.0122
ΔLONG(t+3)	0.0006	0.0076	-0.0099	-0.0138
ROA(t)	0.0240	0.0192	0.0312	0.0382
ΔROA(t+1)	0.0002	0.0008	-0.0009	-0.0014
ΔROA(t+2)	-0.0014	-0.0025	0.0008	-0.0004
ΔROA(t+3)	-0.0034	-0.0042	-0.0022	-0.0019
CAP(t)	0.2814	0.2736	0.2941	0.3018
ΔCAP(t+1)	0.0039	0.0025	0.0055	0.0094
ΔCAP(t+2)	0.0064	0.0033	0.0099	0.0165
ΔCAP(t+3)	0.0123	0.0069	0.0206	0.0233

Table 5: Multinomial probit estimation results

(a) Baseline estimation

Multinomial probit estimation

Dependent variable: MTYPE1={0,1,2}

	Marginal effect	p>|z|	Std. err.	Marginal effect	p>|z|	Std. err.
	MTYPE1=1(MERGER1)			MTYPE1=2(MERGER2)		
lnFIRMAGE	0.0025		0.0087	0.0057		0.0025
lnEMP(t-1)	0.0157	***	0.0061	0.0060	***	0.0015
lnASSETS(t-1)	0.0333	***	0.0054	0.0074	***	0.0015
NBANK	0.0377	***	0.0025	0.0146	***	0.0015
RATING	0.0032	***	0.0008	0.0013	***	0.0002
HOKKAIDO	-0.0490		0.0315	-0.0187	***	0.0061
TOHOKU	-0.0789	***	0.0290	-0.0180	**	0.0067
KANTO	0.3732	***	0.0341	0.1269	***	0.0279
KOSHINETSU	-0.0916	***	0.0289	-0.0320	***	0.0029
TOKAI	0.4740	***	0.0361	0.0729	***	0.0264
KINKI	0.3648	***	0.0384	0.1471	***	0.0353
CHUGOKU	0.0721	**	0.0356	-0.0092		0.0083
SHIKOKU	-0.0047		0.0359	-0.0184	**	0.0060
KYUSHU	-0.1825		0.0321	-0.0219	***	0.0049
Industry dummies	Yes			Yes		
No. of Obs.	11107					
Wald chi2 (40)	4017.62					
p-value	0.000					
Log likelihood	-6732.47					

(b) Estimation with four outcome values

Multinomial probit estimation

Dependent variable: MTYPE2={0,1,2,3}

	Marginal effect	p>|z|	Std. err.	Marginal effect	p>|z|	Std. err.	Marginal effect	p>|z|	Std. err.
	MTYPE2=1(MERGER1_1)			MTYPE2=2(MERGER1_2)			MTYPE2=3(MERGER2)		
lnFIRMAGE	0.0011		0.0061	0.0001		0.0061	0.0062	**	0.0027
lnEMP(t-1)	0.0046		0.0043	0.0110	***	0.0041	0.0063	***	0.0016
lnASSETS(t-1)	0.0163	***	0.0038	0.0160	***	0.0037	0.0078	***	0.0016
NBANK	0.0138	***	0.0018	0.0229	***	0.0018	0.0154	***	0.0015
RATING	0.0010	**	0.0005	0.0020	***	0.0006	0.0013	***	0.0003
HOKKAIDO	-0.0300		0.0202	-0.0151		0.0245	-0.0197	***	0.0066
TOHOKU	-0.0649	***	0.0157	-0.0035		0.0254	-0.0191	***	0.0072
KANTO	0.0848	***	0.0245	0.2789	***	0.0351	0.1361	***	0.0297
KOSHINETSU	-0.1029	***	0.0097	0.0192		0.0283	-0.0337	***	0.0031
TOKAI	0.4674	***	0.0426	-0.0454	**	0.0183	0.0886	***	0.0302
KINKI	0.2506	***	0.0377	0.0895	***	0.0306	0.1624	***	0.0381
CHUGOKU	-0.0267		0.0194	0.1015	***	0.0344	-0.0093		0.0090
SHIKOKU	-0.0421	**	0.0201	0.0219		0.0307	-0.0194	***	0.0065
KYUSHU	-0.0717	***	0.0135	0.0716	**	0.0313	-0.0229	***	0.0053
Industry dummies	Yes			Yes			Yes		
No. of Obs.	11107								
Wald chi2 (60)	4769.68								
p-value	0.000								
Log likelihood	-8222.79								

Note: *,**,*** indicate significance at the 10%, 5%, and 1% level respectively.

Table 6: Treatment effects estimation results

Baseline estimation

		Method: Caliper Matching									
		Treated: MTYPE1=2 (MERGER2) Control: MTYPE1=0 (MERGER0)			Treated: MTYPE1=2 (MERGER2) Control: MTYPE1=1 (MERGER1)			Treated: MTYPE1=1 (MERGER1) Control: MTYPE1=0 (MERGER0)			
		(1)		(2)	(3)		(4)	(5)		(6)	
		DID		Std. err.	DID		Std. err.	DID		Std. err.	
RATE	*t+1*	0.0010		0.0010	0.0009		0.0007	-0.0001		0.0007	
	t+2	0.0020	*	0.0012	0.0010		0.0009	0.0015	*	0.0008	
	t+3	0.0040	***	0.0014	0.0025	**	0.0012	0.0020	**	0.0009	
lnRATE	*t+1*	0.0463		0.0350	0.0282		0.0219	0.0088		0.0201	
	t+2	0.0710	*	0.0426	0.0720	***	0.0254	0.0340		0.0240	
	t+3	0.1349	***	0.0486	0.0790	***	0.0289	0.0686	**	0.0271	
CASH	*t+1*	0.0076		0.0053	0.0024		0.0031	-0.0006		0.0030	
	t+2	0.0033		0.0060	0.0043		0.0038	-0.0044		0.0034	
	t+3	0.0072		0.0067	0.0010		0.0041	0.0008		0.0038	
LOAN	*t+1*	-0.0057		0.0063	-0.0051		0.0039	-0.0012		0.0036	
	t+2	-0.0078		0.0082	-0.0060		0.0048	-0.0034		0.0047	
	t+3	-0.0051		0.0096	-0.0017		0.0058	-0.0042		0.0056	
SHORT	*t+1*	-0.0074		0.0055	-0.0031		0.0035	-0.0016		0.0032	
	t+2	-0.0098		0.0070	-0.0039		0.0040	-0.0061		0.0041	
	t+3	-0.0037		0.0085	0.0000		0.0051	-0.0056		0.0049	
LONG	*t+1*	0.0014		0.0183	-0.0007		0.0035	-0.0001		0.0096	
	t+2	0.0023		0.0204	-0.0003		0.0044	0.0014		0.0108	
	t+3	-0.0009		0.0267	0.0002		0.0049	0.0006		0.0140	
ROA	*t+1*	0.0000		0.0035	0.0001		0.0017	-0.0001		0.0020	
	t+2	0.0011		0.0041	0.0005		0.0021	0.0021		0.0023	
	t+3	0.0041		0.0044	0.0002		0.0025	0.0029		0.0025	
CAP	*t+1*	0.0056		0.0054	-0.0024		0.0036	0.0018		0.0030	
	t+2	0.0096		0.0070	0.0011		0.0041	-0.0002		0.0040	
	t+3	0.0167	*	0.0092	0.0002		0.0052	0.0074		0.0052	

Note: *,**,*** indicate significance at the 10%, 5%, and 1% level respectively.

Table 7: Treatment effects estimation results
Estimation with four outcome values

		Method: Caliper Matching					
		Treated: MTYPE2=1 (MERGER1_1) Control: MTYPE2=0 (MERGER0)		Treated: MTYPE2=2 (MERGER1_2) Control: MTYPE2=0 (MERGER0)		Treated: MTYPE2=1 (MERGER1_1) Control: MTYPE2=2 (MERGER1_2)	
		(1)	(2)	(3)	(4)	(5)	(6)
		DID	Std. err.	DID	Std. err.	DID	Std. err.
RATE	*t+1*	0.0002	0.0008	-0.0005	0.0008	0.0002	0.0016
	t+2	0.0018 *	0.0011	0.0012	0.0010	0.0003	0.0023
	t+3	0.0019 *	0.0011	0.0022 **	0.0011	0.0008	0.0025
lnRATE	*t+1*	0.0083	0.0257	0.0034	0.0231	0.0236	0.0456
	t+2	0.0324	0.0308	0.0432	0.0274	0.0167	0.0571
	t+3	0.0536	0.0351	0.0879 ***	0.0306	0.0154	0.0611
CASH	*t+1*	-0.0009	0.0039	-0.0001	0.0035	0.0013	0.0071
	t+2	-0.0032	0.0044	-0.0021	0.0041	0.0013	0.0088
	t+3	0.0041	0.0049	0.0006	0.0045	0.0027	0.0093
LOAN	*t+1*	0.0015	0.0047	-0.0068 *	0.0041	0.0083	0.0088
	t+2	-0.0002	0.0062	-0.0084	0.0055	0.0116	0.0113
	t+3	0.0026	0.0071	-0.0117 *	0.0064	0.0198	0.0135
SHORT	*t+1*	-0.0004	0.0043	-0.0046	0.0036	0.0018	0.0081
	t+2	-0.0060	0.0054	-0.0051	0.0048	0.0000	0.0099
	t+3	-0.0019	0.0065	-0.0060	0.0057	0.0058	0.0114
LONG	*t+1*	0.0013	0.0116	-0.0050	0.0036	0.0074	0.0082
	t+2	0.0035	0.0131	-0.0066	0.0048	0.0114	0.0103
	t+3	0.0034	0.0170	-0.0090	0.0056	0.0148	0.0107
ROA	*t+1*	-0.0010	0.0025	0.0002	0.0102	-0.0031	0.0039
	t+2	0.0009	0.0022	0.0034	0.0115	-0.0078 *	0.0046
	t+3	0.0016	0.0025	0.0049 *	0.0148	-0.0100 *	0.0055
CAP	*t+1*	-0.0012	0.0038	0.0065 *	0.0035	-0.0061	0.0078
	t+2	-0.0033	0.0051	0.0053	0.0046	-0.0150	0.0093
	t+3	0.0059	0.0066	0.0125 **	0.0061	-0.0130	0.0120

Note: *,**,*** indicate significance at the 10%, 5%, and 1% level respectively.

Table 8: Partial mean linear estimations for the treatment effect

(a) Baseline estimation

		Baseline								
		Treated: MTYPE1=2 (MERGER2) Control: MTYPE1=0 (MERGER0)			Treated: MTYPE1=2 (MERGER2) Control: MTYPE1=1 (MERGER1)			Treated: MTYPE1=1 (MERGER1) Control: MTYPE1=0 (MERGER0)		
		(1)		(2)	(3)		(4)	(5)		(6)
		DID		Std. err.	DID		Std. err.	DID		Std. err.
RATE	t+3	0.0041	***	0.0011	0.0021	*	0.0011	0.0020	***	0.0007
LnRATE	t+3	0.1335	***	0.0310	0.0627	**	0.0270	0.0708	***	0.0214

Note: *,**,*** indicate significance at the 10%, 5%, and 1% level respectively. Standard errors are calculated by the delta method utilizing the heteroskedasticity robust matrix estimator.

(b) Effect of bank branch consolidation

		Consolidation of bank branches											
		ALL						Subsample					
		Treated: MTYPE1=2 (MERGER2) Control: MTYPE1=0 (MERGER0)			Treated: MTYPE1=1 (MERGER1) Control: MTYPE1=0 (MERGER0)			Treated: MTYPE1=2 (MERGER2) Control: MTYPE1=0 (MERGER0)			Treated: MTYPE1=1 (MERGER1) Control: MTYPE1=0 (MERGER0)		
		DID		Std. err.	DID		Std. err.	DID		Std. err.	DID		Std. err.
RATE	t+3	0.0056	***	0.0016	0.0036	***	0.0013	0.0068	***	0.0024	0.0028	*	0.0014
LnRATE	t+3	0.1693	***	0.0405	0.1107	***	0.0338	0.2093	**	0.0543	0.0915	**	0.0397

Notes: *,**,*** indicate significance at the 10%, 5%, and 1% level respectively. Standard errors are calculated by the delta method utilizing the heteroskedasticity robust matrix estimator.
In the subsample estimation, treatment observations are limited to firms that saw a closure of their bank branch.

(c) Effect of firms' credit risk

		RATING<median											
		ALL						Subsample					
		Treated: MTYPE1=2 (MERGER2) Control: MTYPE1=0 (MERGER0)			Treated: MTYPE1=1 (MERGER1) Control: MTYPE1=0 (MERGER0)			Treated: MTYPE1=2 (MERGER2) Control: MTYPE1=0 (MERGER0)			Treated: MTYPE1=1 (MERGER1) Control: MTYPE1=0 (MERGER0)		
		DID		Std. err.	DID		Std. err.	DID		Std. err.	DID		Std. err.
RATE	t+3	0.0032	*	0.0018	0.0007		0.0009	0.0049	**	0.0019	0.0020	**	0.0009
LnRATE	t+3	0.0914	*	0.0499	0.0532	*	0.0311	0.1569	***	0.0604	0.0977	***	0.0369
		SPREAD<0											
		ALL						Subsample					
		Treated: MTYPE1=2 (MERGER2) Control: MTYPE1=0 (MERGER0)			Treated: MTYPE1=1 (MERGER1) Control: MTYPE1=0 (MERGER0)			Treated: MTYPE1=2 (MERGER2) Control: MTYPE1=0 (MERGER0)			Treated: MTYPE1=1 (MERGER1) Control: MTYPE1=0 (MERGER0)		
		DID		Std. err.	DID		Std. err.	DID		Std. err.	DID		Std. err.
RATE	t+3	0.0009		0.0016	0.0016		0.0011	0.0033	*	0.0020	0.0029	***	0.0011
LnRATE	t+3	0.0953	**	0.0473	0.0462		0.0351	0.1260	**	0.0560	0.0598		0.0372

Notes: *,**,*** indicate significance at the 10%, 5%, and 1% level respectively. Standard errors are calculated by the delta method utilizing the heteroskedasticity robust matrix estimator.
In the subsample estimation, the sample is limited to observations that satisfy RATING<median or SPREAD<0.

Figure 1: Distributions of borrowing costs by subsample

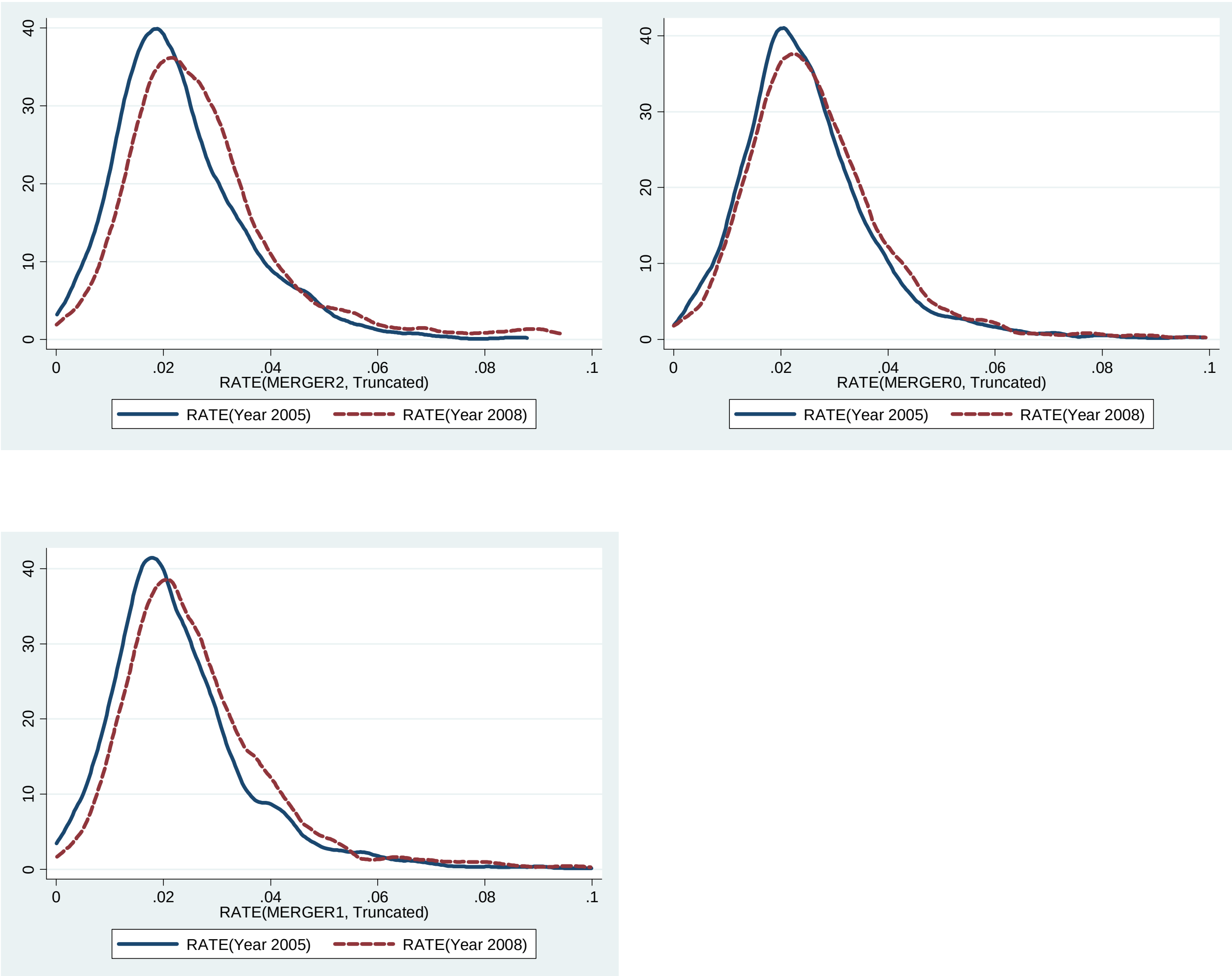
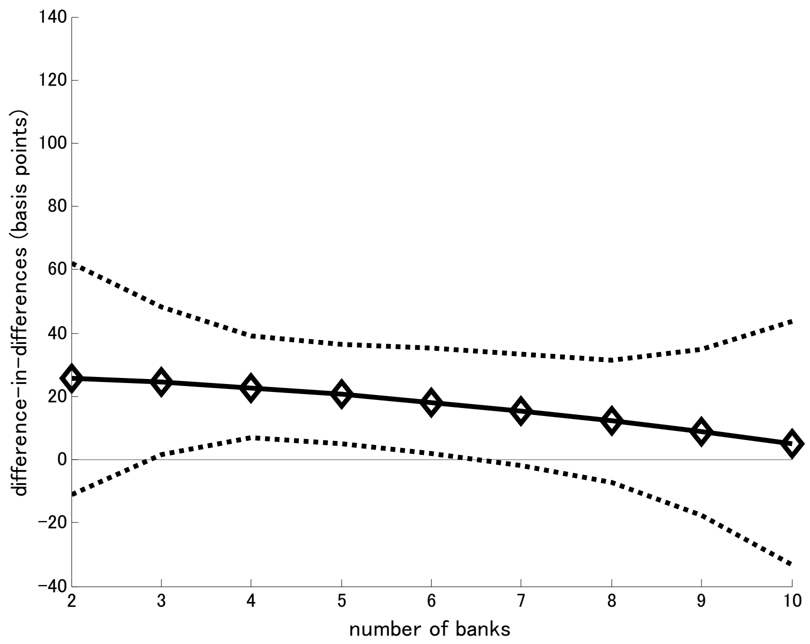
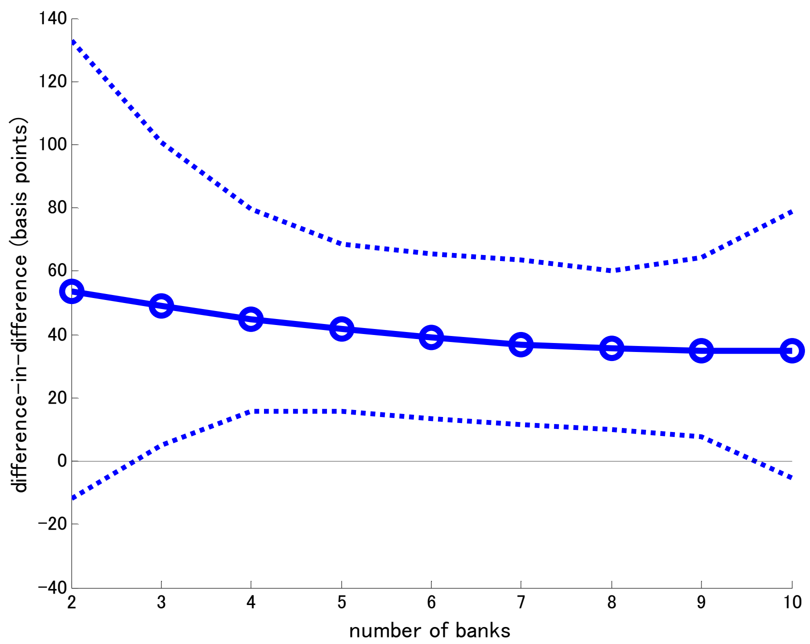


Figure 2: Treatment effect depending on the number of firm-bank relationships

Treatment: MTYPE1=1 (MERGER1) and Control: MTYPE1=0 (MERGER0)



Treatment: MTYPE1=2 (MERGER2) and Control: MTYPE1=0 (MERGER0)



Note: The dotted lines represent the 95% confidence interval. Standard errors are estimated by bootstrapping (non-parametric bootstrap) with 1,000 replications.