# Unsecured loans and intangible investment*

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**Abstract**

In 2008, a government policy bank in Japan expanded its provision of unsecured loans, with many small and medium-sized enterprises subsequently switching from secured to unsecured loans. In this paper, we examine the determinants of firms' choice and impacts of these unsecured loans to better understand the distortional effects of any collateral constraints that previously existed in the Japanese economy. Using propensity score matching analysis and instrumental variable regression, we reveal the following. First, younger and growing firms with fewer tangible assets use unsecured loans more intensively. Second, firms choosing unsecured loans increase their investment in intangible assets, including organizational capital. Third, unsecured loan users grew faster than secured loan users, although their credit ratings also deteriorated to some extent. Lastly, the impact of unsecured loans on firm productivity is neutral. Overall, the intrafirm asset reallocation from tangible to intangible assets among unsecured loan users highlights the distortionary effects of collateral constraints.

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## 1. Introduction

Collateral is a traditional and standard requirement for loans granted to informationally opaque borrowers. This provision of collateral reveals the borrower's confidence in their future repayment (Bester 1985). Collateral also works as a device to mitigate the moral hazard of borrowers (Boot, Thakor, and Udell 1991). For these reasons, theoretical models, including that by Kiyotaki and Moore (1997), have introduced a collateral constraint, with which borrower firms cannot obtain loans above the value of collateralized assets, to reflect the role of collateral in the economy.

However, recent studies show that the share of secured debts among newly issued debts has plummeted from 60% to just 10% in the US in the last 50 years (Benmelech, Kumar and Rajan 2020, Lian and Ma 2021). This trend is even evident in lending to small and medium-sized enterprises (SMEs) that are thought to be dependent on secured loans. Only 26% of Japanese SMEs with outstanding loans from their main bank pledged collateral to that bank in 2020, compared with 52% in 2005 (The Basic Survey of SMEs by the Small and Medium Enterprise Agency of the Japanese Government).

This decline in the use of secured loans suggests that the economic cost of collateral constraints led to distortions in resource allocation in the past. As a rule, assets eligible for collateral must be highly redeployable with high resale values. Therefore, collateral-constrained firms have an incentive to invest in eligible assets such as real estate because they can then pledge these assets as collateral for financing. Similarly, constrained firms are less likely to invest in intangible assets, such as customized software, human capital, or organizational capital, because these intangibles are not eligible as collateral. Both processes lead to underinvestment in intangible assets, distortions in resource allocation, and an increase in economic inefficiency, as quantified by Catherine et al. (2022). Moreover, the increased technological dependence on intangible assets,

which has been reported by many studies (e.g., Lev and Radhakrishnan, 2005; Corrado et al., 2009 Falato et al., 2022), further increases the economic costs of collateral constraints.

In this context, the full implementation of an unsecured loan program in August 2008 by the SME Unit of the Japan Finance Corporation (JFC-SME, hereafter), a government-controlled policy bank, is an internationally uncommon policy experiment that provides us with a laboratory perfectly suitable for testing the distortionary effect of the collateral constraint. Following the implementation of this program, firms could obtain unsecured loans from JFC at the cost of an additional interest rate as compared with secured loans. With the introduction of the unsecured loan program, we expect to provide clear evidence for the distortionary effect of collateral constraints by examining the difference in corporate investment behavior and performance between firms that continued to obtain secured loans and those that switched from secured to unsecured loans.

To this end, we apply a difference-in-differences approach to the firm–year panel data of SMEs that obtained loans from JFC-SME from 2008 to 2018. More concretely, we compare the investment, performance, and funding behavior of firms that obtained an unsecured loan for the first time, and those that continued using secured loans. Given that the loan program allowed borrowers rather than the JFC to choose between unsecured and secured loans, we need to control for observable firm characteristics, such as the credit quality of borrowers and the tangibility of their assets, which are usually identified as factors affecting the choice of unsecured loans in existing studies (e.g., Bester 1985; Rampini and Viswanathan 2022). For this purpose, we apply a propensity score matching (PSM) method and estimate the average treatment effect (ATE) of switching to unsecured loans as our baseline empirical test.

We provide several interesting empirical findings. First, with the determinants of the use of unsecured loans, firms are more likely to obtain these loans if they: i) have a better, if not the best,

and improving credit rating, ii) are relatively young, iii) invest in both tangible and intangible assets intensively, and iv) have higher leverage and less remaining capacity for providing collateral at the time they applied for the loans.

Second, we find from the analysis of the ATE of receiving unsecured loans that firms that switch to unsecured loans increase their: i) investment in intangible assets including organizational capital, and ii) outputs; however, we also find that iii) their internal credit ratings deteriorate after switching to unsecured loans, and iv) there is no significant impact on their productivity. More specifically, the treatment firms substitute tangible asset investment for investment in intangibles, including organizational capital, after switching to unsecured loans. Thus, the switch to unsecured loans enhances firm growth by promoting an intrafirm reallocation to intangible assets and additional risk-taking, as also predicted by theory. However, the resulting asset reallocation does not appear to be sufficiently effective to improve the productivity of these firms. In addition to these main findings, we obtain weak evidence that some firms use unsecured government bank loans to conserve their capacity for providing collateral for future loans from private banks.

To check the robustness of our key finding on intangible investment, we address a potential endogeneity problem due to any unobservable factors that affect both the choice of unsecured loans by borrowers and their investment behavior. We do this by employing two different instrumental variables (IVs) in the estimation of the investment function, namely, a dummy variable indicating that a firm does not have any tangible assets able to be pledged as collateral for a new loan, and another dummy variable identifying whether the firm uses a loan program without add-on interest spreads. The IV regressions reinforce the above results about investment behavior.

The contributions of our study to the existing literature are twofold. First, our analysis adds

new evidence from the standpoint of SME financing to contemporary academic discussion on the determinants of the increasingly prevalent use of unsecured loans. Among recent empirical studies, Rampini and Viswanathan (2022) find that firms with better credit quality or fewer tangible assets tend to use more unsecured loans in the US from Compustat data. Our findings complement their work and highlight similarities and differences between listed companies and SMEs regarding the determinants of the use of unsecured loans. Second, we demonstrate that the extent of the tangibility of firm assets, which would have been optimally determined without a collateral constraint, declined with the introduction of unsecured loans. This provides evidence of the distortionary effect of collateral constraints on resource allocation among constrained firms. This finding is also closely related to the studies finding that legal reform reinforcing the ability to collateralize movable assets promoted lending and sales growth in sectors with a higher dependence on movable assets (Campello and Larrain 2016; Calomiris et al. 2017). These studies provide evidence for the distortionary effect of collateral constraint. Our finding from the reform in the opposite direction reinforces the evidence for the distortionary effect of collateral constraint by examining the firm-level impact of the firm-level choice of unsecured loans, rather than the sector-level impact.

The remainder of the paper is organized as follows. Section 2 discusses the institutional features of the JFC and its unsecured loan program. Section 3 presents our dataset and discusses the sample selection. Section 4 provides our empirical hypotheses as derived from existing theory, and Section 5 details our empirical strategy. Section 6 reports the results of the logit estimation of the probability of using unsecured loans, Section 7 reports the results of the ATE using the PSM method, and Section 8 likewise for the IV regressions. Section 9 contains some additional analysis and discussion of the motivation of firms to conserve capacity for pledging collateral. Section 10 concludes. The appendices include details on the calculation of real values using book values and

the procedure adopted in estimating firm productivity. The online appendix includes the tables of ATE estimated by various subsample analyses and the full list of estimated coefficients in the IV regressions. .

## 2. Institutional background: JFC lending facility without collateral requirement

JFC is a bank 100% owned and controlled by the Japanese government, and it provides policy lending programs and a credit guarantee program for Japanese SMEs. Although a bank, it does not accept deposits, but instead funds itself by receiving loans from the government and issuing government-guaranteed bonds to the bond market. The JFC comprises three separate operating units that extend loans to i) SMEs, ii) microbusinesses, and iii) agriculture, forestry, fisheries, and food businesses. Of these three units, we focus on the one that specializes in extending loans to SMEs, which we refer to as the JFC-SME. The total loans outstanding of the JFC-SME was 5.5 trillion JPY as of March 2018; about the same size as a mid-sized regional bank, but smaller than the major banks operating nationwide.

The Japan Finance Corporation for Small and Medium Enterprise (JASME, the predecessor of JFC-SME) introduced an unsecured loan facility for the first time in 2005. This initially restricted the facility size per firm to up to 50 million JPY and imposed an additional interest spread and loan covenants. In August 2008, the upper limit for an unsecured loan was increased to the same level as a secured JFC loan, or 280 million JPY. The additional covenants were also abolished, but the additional spread remained. The size of the additional spread depends on a borrower's credit quality and loan maturity. However, such additional spreads are exempted for several special unsecured lending programs, such as those for natural disaster recovery or investment promotion in target sectors.

Figure 1 is a time-series plot of the total amount of newly issued JFC-SME loans. As shown,

the amount of unsecured lending increased in line with the surge in demand for working capital loans in the first quarter of 2009, corresponding to the shock of the global financial crisis (GFC) reaching Japan. Thereafter, as the adverse effect of the crisis gradually diminished, the demand for working capital loans also fell. In the current post-crisis period, more than half of all newly issued working capital loans are unsecured, as are also capital expenditure loans. The share of unsecured loans among capital expenditure loans sharply increased after 2009, now accounting for about half of the total.

[Figure 1 about here]

## 3. Hypothesis development: Reallocation from tangible assets to intangible assets

Traditionally, collateral has been considered an effective contractual device to mitigate adverse selection (Bester, 1985; Besanko and Thakor, 1987a, 1987b) and moral hazard (Boot et al., 1991) in firms, and to enhance the monitoring incentives of lenders (Rajan and Winton, 1995). However, there is a potential detrimental effect of collateral constraints in that an economy where constrained firms underinvest may suffer from lower production. Several studies provide evidence for such negative effects from several different perspectives. First, Catherine et al. (2022) estimate a structural model of dynamic investment decisions using data on publicly traded companies in the US and conclude that the distortion in asset allocation within a firm due to the collateral constraint reduces total factor productivity (TFP) by 1.4% on average.

Second, Calomiris et al. (2017) provide evidence for the same distortion but from a different point of view by focusing on an institutional change that reinforced collateral rights on movable assets, concluding that bank lending increased more in sectors with greater dependence on movable assets. Campello and Larrain (2016) examine similar revisions in eastern Europe

countries, and find that firms in sectors with greater dependence on movable assets obtain more bank loans, invest more, and hire more employees, and become more efficient than before the reform. These results imply that the expansion of assets pledgeable as collateral mitigates any distortion resulting from a binding collateral constraint.

However, there is an additional important aspect concerning the cost of collateral constraints and the allocation between tangible and intangible assets that has not yet been closely examined. In this regard, many recent studies report that firms in growing industries increasingly depend on intangible assets. These intangible assets typically include software, intellectual property rights, human capital, and organizational capital (Lev and Radhakrishnan, 2005; Corrado et al., 2009) which are then less suitable for collateral than tangible assets owing to their limited redeployability. In response to this recent technological development, the share of secured loans and other debt has been diminishing (Benmelech, Kumar and Rajan 2020) and firm cash holdings increasing (Falato et al. 2022) in the US. Both phenomena accentuate the economic cost of collateral constraints.

Assets most pledgeable for collateral, such as real estate, are highly redeployable and valuable in the resale market. In contrast, assets inalienable from the current owner, which have a value only when the current owner keeps using it, are less valuable as collateral. The intangible assets mentioned above are typical examples of the latter type of asset. A collateral-constrained firm will then prefer real estate to inalienable intangible assets because it is easier for the firm to pledge real estate than inalienable intangibles for collateral when obtaining loans. Thus, the asset allocation decision for collateral-constrained firms tends to be distorted toward tangible assets and away from intangibles.

Regarding the event in our study, a government-controlled bank loosened the collateral constraint through the introduction of an unsecured loan facility. The unique feature of this policy

experiment enables us to examine the behavior of individual firms able to choose between two alternative loan contracts: unsecured loans with higher interest rates or secured loans with lower interest rates. We expect the effect of the now looser collateral constraint to emerge as a reduction in the distortion in firm investment choice between tangible and intangible assets. Given this context, our main hypotheses are as follows:

***Hypothesis 1.*** *The introduction of an unsecured loan program promotes corporate investment in intangible assets, including software, human capital, and organizational capital.*

***Hypothesis 2.*** *The asset reallocation from tangibles to intangibles within a firm enhances its production and productivity.*

Another hypothesis that is potentially testable in our context is the "collateral-saving" behavior of firms. In this, firms may wish to avoid pledging collateralizable assets for present government loans when they anticipate the need to obtain secured loans in the future from private commercial banks. This motivation for preferentially using an unsecured loan appears plausible and interesting, but we obtain weak evidence for this motivation in our estimations. We will discuss this point further after presenting the results of the main hypotheses.

## 4. Data

### 4.1. Source

We use the firm-year panel data collected from the JFC-SME to construct an unbalanced panel dataset, which includes firms that had borrowed from the JFC-SME not only in periods with positive outstanding loans, but also several years before and after when there was no JFC-SME

loan outstanding. The firm-year panel data includes balance sheet and income statement information, the amount of loans from the JFC,[4] and the amount of loans from and deposits at each of (up to four) other private financial institutions, including commercial banks and cooperative lending institutions. We identify the first institution in the list of these private banks as the main bank for each firm. We identify the industrial sector each firm belongs to by the Japan Standard Industrial Classification in 2014 (JSIC). We indirectly identify the location of each firm by the location of the JFC branch from which a firm borrows. We employ the data from 2008 to 2018, corresponding to the period after the JFC-SME substantially and extensively augmented its unsecured loan facility.

In addition, we merge the following items into the main dataset: i) the total amount of newly issued loans in each accounting period for each firm, ii) the purpose of loans (capital expenditure or working capital), and iii) whether these loans are secured by collateral. We can break down the amount of newly issued loans for capital expenditure into real estate, machinery, and other. We also merge the market value, as evaluated by JFC, of assets pledgeable for collateral at the time when the JFC made the lending decision for firms that borrowed in 2011 and after.

We also estimate the TFP of each firm. For this purpose, we convert nominal sales, value-added, and tangible assets into real terms. We use sectoral deflators for output, value-added, and input from the Japan Industrial Productivity (JIP) database 2021 provided by the Research Institute of Economy, Trade and Industry (RIETI) and land prices,[5] and construction cost deflators from the Ministry of Land, Infrastructure, Transport and Tourism (MLIT). We collect financial information on the primary bank from the Nikkei NEEDS FinancialQuest. The average

[4] As discussed, the JFC does not accept deposits. The JFC is also restricted to provide only long-term loans and is not allowed to provide short-term loans by regulation to avoid government-controlled banks crowding out private commercial banks from short-term lending business.

[5] We use the data from the Prefecture Survey on Land Price, which reports the price as of July in each year and covers more locations than the Official Land Price data.

Tobin's Q (market capitalization plus book liability divided by total assets) of each sector (JSIC medium classification) is calculated as the asset-weighted average of the average Tobin's Q of firms listed on any stock exchange in Japan[6] at the end of each month.

### 4.2. Sample selection

We drop from the sample firms in sectors with only a small number of observations (JSIC major classification: A. agriculture/forestry, B. fishery, C. mining, J. finance/insurance, K. real estate/lease, T. non-classified) from the dataset, for which we cannot estimate TFP properly. We also remove firms that changed their accounting period in 2005 or later to avoid inconsistency in the dataset, and outlier observations below the 1-percentile or above the 99-percentile in each year for each of the continuous financial condition explanatory variables in the logit estimation of the probability to obtain an unsecured loan. In a similar manner, we remove outlier observations for each of the investment, performance, and funding variables used for the PSM estimations.

We expect the impact of obtaining an unsecured loan to be smaller for firms that have used an unsecured loan on multiple occasions. There is also a nonnegligible number of firms that obtain secured loans after receiving an unsecured loan in the past. We exclude these firms from the dataset to correctly estimate the ATE of the use of an unsecured loan. More precisely, we specify firms that obtained an unsecured loan for the first time as the treatment group, and those that have never obtained an unsecured loan in the current and past three years as the control group. The shaded parts in Figure 2 represent the groups of sample firms in our baseline analysis.

[Figure 2 about here]

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[6] Including all sections on the Tokyo, Nagoya, Sapporo, and Fukuoka stock exchanges except for the Tokyo Stock Exchange's PRO market.

The remaining 165,638 firm-year observations constitute the baseline sample for our analysis (Table 1). The number of firms that received newly issued loans from the JFC ranges from 11,000 to 18,000 each year. The number of firms receiving a new unsecured loan was especially large (about 5,000 firms), during the GFC in 2009 and 2010 and the year of the East Japan Great Earthquake in 2011. This number has declined gradually since and has remained at around 2,000 firms since 2014.

Table 2 details the industrial composition of firms receiving new secured and unsecured loans from the JFC. As shown, the manufacturing sector accounts for about half of firms obtaining new loans from the JFC followed by the retail/wholesale and services sectors. Firms in the nonmanufacturing sector in general obtain unsecured loans more often than those in the manufacturing sector. Note that firms in the real estate sector are less likely to obtain these loans, as they hold a substantial amount of real estate property readily able to be pledged as collateral.

[Table 1 about here]

[Table 2 about here]

Table 3 provides the descriptive statistics of the variables used in our various analyses. Table 4 lists their definitions. Online Appendices A and B describe the procedures for calculating the real values of each variable and TFP, respectively.

[Table 3 about here]

[Table 4 about here]

## 5. Empirical approach

To test the hypotheses posited in Section 3, we exploit a unique policy change implemented by the JFC-SME, the introduction of an unsecured loan facility that started on a small scale in 2005, and was majorly augmented in August 2008. After 2008, borrowers were able to borrow the same amount either as a secured loan or through an unsecured loan contract. Our analysis comprises the following three steps. First, we examine the characteristics of firms that began using unsecured loans using logit estimation. In this analysis, we focus on firms that obtained a new loan from the JFC-SME each year. Of these, we assign firms that started using unsecured loans to the treatment group (firms in the upper shaded area in Figure 2), and those that have never used unsecured loans in the last three years to the control group (firms in the lower shaded area in Figure 2).

For the factors that affect firm choice between unsecured and secured loans, we employ the following explanatory variables: (i) firm repayment capacity or their profitability, (ii) firm growth potential and demand for investment, and (iii) firm main bank characteristics. In the estimation, we control for sectoral and regional factors by including dummy variables for the industrial sector (the major classification in the Japanese Standard Industrial Classification to which the firm belongs) and the prefecture where the JFC's branch transacting with the firm is located.

The variables we specify reflecting firm repayment capacity or profitability include *collateral capacity* (bank loans outstanding/tangible assets), *leverage* (debt/total assets), *profitability* (cash flow/assets in current and previous years), *credit rating* (dummy variables indicating internal credit rating assigned by the JFC), *Δcredit rating* (change in credit rating from the previous

period), *interest coverage* (sales/(interest expense + 1)), *firm age* (firm age), and *asset* (total assets). To observe the impact of these factors shortly before a firm's borrowing decision, we include one-year lagged values for each variable unless otherwise noted.

The variables indicating firm growth potential include *Δsales* (growth rate of real sales), *Δwage* (real growth rate of personnel expenses), and *ΔTFP* (TFP growth rate in the previous year). Variables specified to capture firm demand for investment include *I/K (tangible)* and *I/K (intangible)* (past real investment in tangibles and intangibles, respectively, normalized by fixed assets at the beginning of the year), and *Δloan (non-JFC)* (past increase in borrowing from institutions other than the JFC normalized by fixed assets at the beginning of the year).

In addition, we employ *Error correct. (tangible)* (each type of real tangible assets/real sales in the previous year) and *Error correct. (intangible)* (real intangible assets/real sales in the previous year) to capture the gradual error correction toward the optimal asset holding. Low values of these variables indicate that the firm runs short of these assets, and so has strong demand for each type of these assets. We also use *Disaster* (a dummy variable indicating that the firm receives a JFC loan from the disaster recovery program) to control for disaster recovery demand. As for the characteristics of main banks (iii), we employ dummy variables for bank type (large, regional, or cooperative banks), *MB deposit share* (deposit share), and *MB asset* (asset size) to control for the intensity of the bank–firm relationship. To control for the capacity and the willingness of a main bank to take on credit risk, we employ *MB leverage* (net assets/total assets of the main bank).

Second, we compare the investment behavior and performance of the treatment and control groups using PSM. We match each firm in the treatment group with firms in the control group that are closest to the propensity scores estimated by a logit model. We compare the difference in average between the treatment and control groups, i.e., estimate the ATE, after controlling for the various determinants of choosing an unsecured loan.

For the variables that measure investment behavior, we use the investment ratio in tangible assets (*I/K (tangible)*), intangible assets (*I/K (intangible)*), and real estate (*I/K (real estate)*), the growth rate of personnel expenses (*Δwage*), the number of employees (*Δ#employee*), sales (*Δsales*), and general administrative expenses except for personnel expenses (*ΔSGA*). We consider personnel expenses as an investment in human capital and selling, general, and administrative (SGA) expenses except for personnel expenses, which include advertisement and R&D expenses, as an investment in organizational capital.

The performance indicators include the growth rates of sales (*Δsales*) and value-added (*Δvalue-added*), return on assets (*ROA*), capital productivity (*Δcapital productivity*) – as measured by the ratio of real value-added to real tangible assets, labor productivity (*Δlabor productivity*), and total factor productivity (TFP). We employ two sets of variables for TFP: one measured based on a production function estimated by OLS (*ΔTFP (OLS)*) and the other one based on a production function estimated by instrumental variable regression as proposed by Ackerberg et al. (2015) (*ΔTFP (ACF)*).

Finally, we address the potential endogeneity of the use of unsecured loans in investment decisions given unobservable common factors that affect both collateral choice and the investment decision. We reexamine the effect of unsecured loans on investment behavior using the instrumental variable regression based on a linear investment model by Bloom et al. (2007), which is widely used in existing studies. We provide details of the instrumental variables in Section 8.

## 6. Characteristics of firms switching to unsecured loans

In this section, we present the results of the logit model estimation. Considering the possibility that the extent of impact of each factor on the use of unsecured lending may differ from year to

year due to the GFC and other macroeconomic events, we implement logit model estimations on a year-by-year basis.

Table 5 displays the marginal effects and their standard errors (in parentheses) for each explanatory variable. In the calculation of the marginal effect of each variable, other variables are set at the sample mean.

[Table 5 about here]

First, of the variables indicating a firm's ability to repay, the marginal effect of *leverage* is strongly and significantly positive in many years. The marginal effect of *loan/tangible assets*, a proxy for the inverse of the capacity of a firm to provide collateral, is always positive when it is statistically significant. These results indicate that firms that hold a large amount of liabilities and have already pledged a substantial amount of collateralizable assets tend to switch to unsecured loans.

The marginal effect of *cash flow/asset* is statistically significant and positive in the first half of the sample period, especially during the GFC. This suggest that firms with better performance in the previous year are more likely to use unsecured loans. Some of the credit rating dummies, from the second- to the fourth-highest credit rating dummies, exhibit a statistically significant positive marginal effect until 2012. After 2013, many of these dummy variables have no significant effect, with negative marginal effects for the sixth- and seventh-highest credit rating dummies. Given our specification that the base category for the credit rating dummies is the best rating, this result indicates that the use of unsecured loans expanded from firms with the second- to the fourth-highest credit ratings to those with the best rating.

The marginal effect of *Δcredit rating* is negative and significant, indicating that unsecured

loans are used more frequently by firms that improve their credit quality. This finding is consistent with the finding by Rampini and Viswanathan (2022) using US data. The marginal effect of i*nterest coverage* is significantly negative in many years, suggesting that firms with smaller interest payment capacity use unsecured loans more often. *Firm age*, often used in existing studies as a measure of financial constraints, has a negative and significant marginal effect. This means that younger firms use unsecured loans more frequently than older firms. The marginal effect of *asset* is positive and significant, indicating that firms that hold more assets are more likely to use unsecured loans. However, this effect is no longer statistically significant after 2017.

Second, of the variables related to firm growth potential and investment demand, we observe no significant marginal effect of *Δsales*. The marginal effects of I/K (investment rate) in tangible and intangible assets and *Δwage* are always positive when they are statistically significant, except during the GFC. This suggests that firms that have actively invested in tangible and intangible assets in the previous year tend to use unsecured loans. A significant negative marginal effect is observed for the error correction term (*Error correct. (tangible)*) in many years. This indicates that firms with more tangible assets relative to sales are less likely to use unsecured loans and thereby opt for secured loans. The marginal effect of *Disaster*, the disaster recovery loan dummy, is significantly positive in many years. As loan programs for disaster recoveries do not require an additional interest spread for being unsecured, firms in disaster-affected areas that can take advantage of this special treatment tend to use unsecured loans. Third, we observe no stable results regarding the signs or the magnitudes of the marginal effects for any of the variables indicating the main bank's business type and financial condition.

[Table 6 about here]

Finally, we emphasize the relevance of the variable indicating collateral capacity in the estimation. Since 2011, the JFC has collected data on the assessed value of collateral capacity for a firm just prior to loan origination. *Collateral capacity* is the market value of assets that could be pledged as collateral and is calculated as the total value of collateralizable assets held by the firm or CEO less the liens already pledged as collateral to other lenders. We normalize this variable by dividing it by total assets in the previous period and use it in place of an explanatory variable, *loan/tangible assets,* in the logit model estimation.

The results in Table 6 show a statistically strong significant negative marginal effect of the variable in all years. That is, firms with smaller *collateral capacity* are more likely to use unsecured loans. It should be emphasized that this additional variable increases the explanatory power of the logit estimation in that the coefficients of determination are about twice as large as those in the previous estimations. For this reason, we include the variable for collateral capacity in the logit estimation again in the PSM in the following section, except when we need to obtain or compare the results for the period before 2011, when the collateral capacity data is not available.

To summarize the results of the logit model estimation, firms that switched to unsecured loans typically have the following characteristics:

i. Their credit ratings are higher, although not the best, and have been improving more than that of firms choosing a secured loan in the year before obtaining an unsecured loan.
ii. They are younger and more intensively invest in tangible and intangible assets.
iii. They have already been more leveraged and endowed with less capacity to provide collateral.

## 7. Average treatment effect of unsecured loans by PSM

In this section, we present the results of the ATE of switching to an unsecured loan, estimated

by PSM.

### 7.1. Baseline results on the effect of switching to an unsecured loan

Table 7 presents the estimated ATE of switching to an unsecured loan on various performance indicators, investment behaviors and funding behaviors in the period 2011–2018. This sample period corresponds to the period after the GFC and before the turmoil of the recent COVID-19 pandemic. The table indicates the average difference between the treatment group, i.e., those that obtained an unsecured loan for the first time, and the control group, i.e., those that obtained a secured loan and never used an unsecured loan in the past three years. For the estimation, we use the propensity estimated by the model without collateral capacity in Table 5 to compare the ATE in the crisis period of 2008–2010 when the data on collateral capacity are not available.

[Table 7 about here]

The table provides the results for the ATE in the year before obtaining a new loan, in the year of obtaining a new loan, and in the subsequent two years. By examining the ATE the year before obtaining a new loan, we can reveal if there is any significant difference between the treatment and control groups before obtaining a new loan. The column for the previous year in Table 7 indicates there is no statistically significant ATE. This suggests that the parallel pre-trend assumption is satisfied in this estimation.

We obtain the most noteworthy evidence of a treatment effect in the period after the year of obtaining a new loan in investments. There are positive and statistically significant treatment effects on the intangible investment rate, whereas we find no significant effects on the tangible investment rate in the first year. For the real growth of personnel expenditure and other SGA

expenditure, we observe a positive and statistically significant treatment effect in the first year, although there is no significant treatment effect on the number of employees.

Both the cumulative intangible and cumulative tangible investment rates for firms using an unsecured loan for three years after a loan origination are higher than those for firms using secured loans. For firms using an unsecured loan, the intangible investment rate is 0.5 percentage points higher in the first year and its three-year cumulative investment rate is 1.4 percentage points higher than for those using a secured loan. Both are statistically significant at the 1% significance level and economically significant for a median intangible investment rate of 0.1%. The difference is smaller and less clear for tangibles.

Regarding output growth, we find a positive and significant treatment effect on real sales growth in the first and second years, but a positive and significant treatment effect on real intermediate input growth only in the second year. The treatment effects on value-added also have a positive treatment effect in the second and third years, although the statistical significance is marginal. We also find that firms that switch to an unsecured loan grow faster than other firms. The magnitude of ATE on sales growth are 0.9 and 1.5 percentage points in the first and second years, respectively. These are also economically significant for a median growth rate of –1.1%.

As for productivity and profitability, the treatment effect is not significant in most cases except for the second-year TFP estimated by the method in Ackerberg et al. (2015). In contrast, the degree of deterioration in credit rating is larger for firms using unsecured loans in all years. Most of this negative effect is revealed in the first year and then the magnitude of the effect gradually increases in later years. This deterioration in credit rating is mainly due to larger extent of increase in leverage of firms who started using an unsecured loan and faced a loosened borrowing constraint as a result. Thus, we simultaneously observe a larger increase in sales and input growth and a larger extent of deterioration in credit risk for firms that use unsecured loans than for firms that

keep using secured loans.

Regarding firm financing, we observe an increasingly significant and positive effect on leverage in the second and third years. For non-JFC loans, there is no significant treatment effect on the change in loans extended by the main bank. However, there is a marginally significant and positive treatment effect on loans extended by a non-main (third-largest) bank in the third year. These results demonstrate that the use of unsecured loans has the benefit of preserving a firm's collateral capacity and leads to a positive impact on obtaining loans from an arm's length lender in later years.

In addition, we estimated ATE of starting to use an unsecured loan for various subsamples: i) the sample during the GFC from 2008 to 2010 (table A 2), ii) working capital loans versus capital expenditure loans s (table A 3), iii) subsample by industrial sectors s (table A 4), and iv) firms using JFC loans repeatedly versus those who uses a JFC loan for the first time s (table A 5). All tables of these results are presented in the Online Appendix C.

From these analyses, we find that switching to an unsecured loan had a positive impact on investment in intangible assets in the GFC period, too, and that the effect is significantly observed for capital expenditure loans, and is more significant among repeated users than new users, and is significant for those in manufacturing, retail and whole sale sectors.

**7.2. Types of investment financed by capital expenditure loans**

To this point we have used balance sheet information on the stock of tangible and intangible assets to measure the tangible and intangible investment rates. One of the advantages of the JFC database is the availability of information on the types of investment by a borrower financed by JFC capital expenditure loans. For each capital expenditure loan by the JFC, the database records the amount of a firm's investment in each of three categories: real estate, machinery, and others. The JFC classifies intangible investment as well as investment in tangibles except for real estate

and machinery into the "others" category. We estimate the ATE on the ratios of each of these types of investment to the total investment amount in the post-crisis period 2011–2018.[7]

Table 8 details the results. We observe a positive and significant effect on the share of "others." The ratio of "others" is 6.4 percentage points higher for firms that use unsecured loans than for other firms, while the ratios of real estate and machinery are 5.4 and 1.0 percentage points lower, respectively. The results in Table 8 are then consistent with the baseline results in Table 7. In the baseline estimation for the treatment effect in the first year, the sum of the treatment effects on investment in tangible assets other than real estate (0.1 percentage points) and investment in intangible assets (0.5 percentage points) exceeds the treatment effect on investment in real estate (0.3 percentage points). The results in Table 8 reinforce our findings in the baseline estimation concerning the shift in the types of investment from real estate to intangible assets.

[Table 8 about here]

## 8. Instrumental variable regressions for tangible and intangible investments

The PSM method enables us to estimate the impact of the introduction of unsecured loans after controlling for the observable characteristics of firms choosing unsecured loans. However, there remains a concern that an unobservable firm factor might significantly affect both their choice of loan type and investment decisions. To address this concern for our key finding on borrowers' intangible investment, we estimate the impact of unsecured loans on corporate investment using the instrumental variable regression, where the dummy variable indicating the choice of unsecured loans is treated as an endogenous variable.

[7] Note that this information is the planned amount of investment of different types, not the actual investment amount we used in previous estimations.

We consider two instrumental variables. One is the dummy variable, *no-more-collateral*, which equals one if a firm does not have any tangible assets pledgeable as collateral for a new loan. The JFC evaluates the pledgeability of collateral for each of the loans originated in 2011 and afterwards. The positive and significant coefficients on loan/tangible assets (Table 5) and collateral capacity (Table 6) in the logit estimation indicate that the dummy, *no-more-collateral*, is a strong predictor of the choice of unsecured loans. We conjecture that the dummy variable, *no-more-collateral*, does not have any significant correlation with the investment rate, conditional on the set of control variables we introduce later.

The other instrumental variable is the dummy variable, *unsecured program*, which equals one if a firm uses an unsecured loan program that does not require add-on interest spread except for disaster recovery programs. We consider that including the disaster recovery programs will violate the exclusion condition for an instrumental variable as firms that apply for these programs tend to demand a larger amount for investment than those that apply for other loan programs. This variable is also expected to be a strong predictor of a firm's choice of unsecured loans as firms eligible for no-add-on spread unsecured loan programs are more likely to choose unsecured loans than otherwise.

In the second-stage regression for the investment rate, we control for investment demand factors by including as many variables as possible, including internal credit rating, *leverage*, and the ratio of tangible assets to output. We expect these variables to effectively control for investment intensity in the past, the dependence on debt financing for their past investments, and the increased liquidity constraint due to the debt overhang problem. We also include a dummy indicating whether a firm participates in a disaster recovery loan program to control for the impact of natural disasters on investment demand. We conjecture that our instrumental variables, *no-more-collateral* and *unsecured program*, will not be significantly correlated with the investment

rate after controlling for these control variables. We statistically examine the validity of these instrumental variables econometrically later in this section.

The specification for the investment function in the second-stage regression is based on the widely accepted specification proposed by Bloom et al. (2007). The precise specification in our analysis is as follows:

$$\frac{I_{it}}{K_{it-1}} = \beta_0 + \beta_1 Unsecured\ first_{it} + \beta_2(Y_{it} - Y_{it-1})/Y_{it-1} \quad + \beta_3((Y_{it} - Y_{it-1})/Y_{it-1})^2 + \beta_4 CFK_{it}$$

$$+\beta_5 CFK_{it-1} + \beta_6\,(\kappa_{it-1} - Y_{it-1})/Y_{it-1} + ind_{it} + branch_{it} + \epsilon_{it}, \qquad (1)$$

where $I_{it}$ is the real investment in tangible assets, real estate, intangible assets, personnel expenses, i.e., the investment in human capital, SGA expenses except for personnel expenses, i.e., the investment in organizational capital by firm *i* in year *t*; $K_{it-1}$ is the real fixed asset at the end of the previous year; $Unsecured\ first_{it}$ is a dummy variable, which equals one when a firm obtains a unsecured loan for the first time; $(Y_{it} - Y_{it-1})/Y_{it-1}$ is the real growth rate of sales; $CFK_{it}$ is the nominal operating cashflow (EBIT + depreciation)/nominal fixed asset at the end of the previous year; $ind_{it}$ is the sector (medium JSIC classification) times the year fixed effect; $branch_{it}$ is JFC branch times the year fixed effect; and $\epsilon_{it}$ is the error term. $(\kappa_{it-1} - Y_{it-1})/Y_{it-1}$ is an error-correction term, where $\kappa_{it-1}$ is real tangible assets, real estate, tangible assets, and personnel expenses, or SGA expenses in the previous year in accordance with the dependent variable. If a firm holds an excessively large amount of a certain class of assets relative to other firms in the same sector in the same year, the firm will reduce investment in this class of assets. The coefficient for this term $\beta_6$ is supposed negative if it captures such adjustment behavior.

The specification in Bloom et al. (2007) includes daily stock return volatility in each industrial sector to capture the effect of uncertainty on investment behavior. Given our dataset consists of unlisted small firms, we control for sectoral uncertainty by introducing sector times year fixed effects and JFC branch times year fixed effects. We also expect that these fixed effects control for

the development in investment opportunities in each sector and region.

The key coefficient in our context is on *Unsecured first*$_{it}$ $\beta_1$. A positive $\beta_1$ implies that the unsecured loan promotes investment. If the coefficient is significantly positive in estimations for the investment in intangible assets, personnel expenses, or SGA expenses, but smaller in the estimations for the investment in tangible assets, we infer that the introduction of unsecured loans contributes to the within-firm asset reallocation from tangible assets to intangibles.

Table 9 provides a summary of the result for the IV regressions for the period from 2011 to 2018, for which the full set of our instrumental variables are available. The full list of the estimated coefficients is reported in Teble A6 in the online appendix D.[8] As shown, the coefficient on *Unsecured first*$_{it}$ is positive and statistically significant in the estimations for the investment in intangible assets (column 2) and for the growth rate of SGA expenses except for personnel expenses (column 4), whereas the coefficient in the estimation for the tangible investment (column 1) is negative. These results reinforce our earlier evidence that the introduction of unsecured loans promotes a shift of corporate investments from tangible to intangible assets, including organizational capital. In contrast, we do not find a statistically significant coefficient for personnel expense growth, as a proxy for the investment in human capital (column 3).

The *F*-test for the joint significance of our instrumental variables in the first-stage regression shows that they are very highly correlated with *Unsecured first*$_{it}$ and free from the weak instrument problem in all columns. The overidentification test does not reject the null hypothesis that these instrumental variables are not correlated with the error term in the second-stage

[8] The estimated coefficients in the first-stage regression with the dependent variable of *nocoll first*$_{it}$ are not shown as qualitatively identical to those in the logit analysis in the previous section. The full set of estimation results is available from the corresponding author upon request.

regression conditional on control variables in all columns. These results support the validity of our instrumental variables. The regression-based test for the endogeneity of *Unsecured first*$_{it}$ shows that the endogeneity is significant for tangible asset investment, while it is not for the other dependent variables.

[Table 9 about here]

## 9. Additional analyses

### 9.1. What firms increased investment in intangibles using an unsecured loan?

The analyses thus far have shown that firms that obtain unsecured loans tend to increase investment in intangible assets. However, there remains room for several interpretations about the motivations of firms for this. The primary purpose of firms to use this type of loan might be to circumvent the debt overhang problem given the lack of assets eligible as collateral. Or firms with growth potential might use an unsecured loan to finance investment in intangible assets as it contributes more to their corporate value than tangible assets. To clarify this point, we augment the linear model (1) with interaction terms between *Unsecured first*$_{it}$ and each firm's leverage in the previous year (*Leverage (t-1)*), and the sectoral average Tobin's Q. The variable, *Tobin's Q*, is the asset-weighted average of the Tobin's Q for listed companies in each JSIC medium (2-digit) classification. The *Tobin's Q* term without interactions is absorbed by the sector-year fixed effect as it is a sectoral variable.

The leverage before obtaining a loan is expected to have a negative coefficient if there exists a debt overhang problem. The interaction term between *Unsecured first* and *Leverage* is expected to be positive if the debt overhang problem is alleviated by the opportunity to obtain an unsecured

loan. The interaction term between *Unsecured first* and *Tobin's Q* is expected to display a positive coefficient if firms use unsecured loans to take advantage of growth opportunities from the investment in intangible assets.

Table 10 details the coefficients estimated by OLS for the augmented model in the post-crisis period 2011–2018. As shown, *leverage* does not have a significant coefficient, i.e., the debt overhang problem does not exist for all types of investment. Starting to use an unsecured loan has a further positive impact on the personnel and other SGA expenditures for highly leveraged firms. The interaction term with Tobin's Q has a positive and significant coefficient in investment in tangibles, intangibles, and personnel expenses. These results imply that firms use an unsecured loan to take advantage of a growth opportunity rather than to circumvent the debt overhang problem.

[Table 10 about here]

Table 11 summarizes the estimation results with the same model for the crisis period 2008–2010. The coefficients on leverage are negative and statistically significant in estimations for tangible and intangible investment. This indicates the presence of a debt overhang problem in the crisis period. However, the coefficients on the interaction term of leverage and the unsecured-first dummy are statistically insignificant or negative when significant. This is contrary to our prior expectation that the provision of unsecured loans alleviates the debt overhang problem. The interaction term for the unsecured-first dummy and Tobin's Q displays a positive and significant coefficient in the estimations for tangible assets and personnel expenses, indicating the presence of a firm's motivation to take advantage of growth opportunities.

[Table 11 about here]

### 9.2. Do firms save collateralizable assets for future borrowing?

The estimation results of the logit estimation for the probability of using unsecured loans shows that young firms that actively invest but are limited in their capacity for providing collateral are more likely to use an unsecured loan. The PSM analysis for the post-crisis period 2011–2018 shows that firms obtaining an unsecured loan marginally increase their borrowing from a non-main bank three years later (Table 7). This weakly evidences the behavior of firms in saving collateralizable assets for future secured borrowing from private banks. However, we do not find any significant results relating to this in the crisis period 2008–2010. Overall, our estimation results provide no strong evidence that firms use JFC unsecured loans as a means to conserve collateralizable assets and increase their financial flexibility in the future.

## 10. Conclusion

In this analysis, we investigated the introduction of a secured lending facility by a government bank and examined its impact on borrower firms using various firm characteristics, behaviors, and measures of performance to obtain the following findings. For the determinants of the use of unsecured loans, we found young and growing firms with less collateral capacity used unsecured loans more intensively than other firms. For the impact of the use of unsecured loans, we concluded firms that receive unsecured loans increase investment in assets not effectively pledgeable as collateral, including non-real estate tangible assets, and intangible assets including organizational capital. However, the extent of any increase in human capital investment is less substantial. Further, we demonstrate that these shifts in firm investment promote output growth and improve labor productivity. However, TFP did not improve, and credit risk worsened through

the introduction of the unsecured loan facility. We found only weak evidence that some firms use unsecured loans to avoid pledging collateral to increase their financial flexibility in the future. Overall, we conclude that the unsecured loan facility introduced by the JFC-SME encouraged risk-taking and intangible investment by young firms endowed with less tangible assets which led to higher output growth.

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**Appendix A. Calculation of real values of the financial variables**

1. Output (sales), value-added (sales – amount of goods purchased – raw material expenses – amount paid to subcontractors), intermediate inputs (amount of goods purchased + raw material expenses + amount paid to subcontractors) are deflated by the output deflator, the value-added deflator, and the intermediate input deflator (2015 basis), respectively, of each sector reported in the JIP database 2021 (RIETI) at 2015 prices.[9] We use the JSIC-JIP industrial classification matching table provided by JIP database. We match the deflator in the previous year for firms with an accounting year from January to June, or that in the current year for firms with an accounting year from July to December.
2. To calculate the labor input for the estimation of TFP, we obtain the annual average working hours in each sector by dividing sectoral personhours by the total number of employees in each sector obtained from the JIP database. We use this annual average working hours times

[9] JIP database (RIETI) available at https://www.rieti.go.jp/en/database/jip.html.

the number of employees for each firm as the total labor input of each firm in the estimation of TFP.

3. We obtained the real value of fixed assets (land, building, construction in progress, other tangible assets, and intangible assets) and the real value of investments for these assets by using the firm data and various price data from 2004 to 2018.

   a. Land: At first, we obtain an approximate market value from book value in the following procedure. The first observation of each firm is converted to an approximate market value by multiplying the book value of landholding in the balance sheet with the market-to-book ratio of lands. We obtain this ratio by dividing the total amount of landholding of nonfinancial private corporations in the SNA statistics (Statistics Bureau) by the total amount of landholding of all sizes and all industrial sectors of corporations excluding finance and insurance in Financial Statements Statistics of Corporations by Industry (Ministry of Finance) by following existing studies. The calculated market-to-book ratio for each year is in Table A1. We apply the previous-year market-to-book ratio for firms whose accounting year ends in January to June, or the current market-to-book ratio for all other firms with other accounting years.

      Nominal investment in land each year is the change in landholding on the balance sheet from the previous year. Real investment in land, in 2015 JPY, is obtained by dividing this nominal value by the land price deflator, which is normalized so that the national average of all usages in 2015 equals one. The land price deflator is calculated from the average land price in each prefecture published in the Prefectural Land Price Survey by MLIT. We use the deflator of land price for commercial zones for the retail, wholesale, and service sectors, or that for all usages for the other sectors. We merge this information with the financial information by calendar year as the survey reports the price as of July, the midpoint of each year.

      The real landholding of each firm is calculated by adding the real land investment to the real landholding in the previous year. If there is a data gap for a firm, we treat it as different firms before and after the gap, i.e., restart with the adjustment of the initial observation by the annual market-to-book value ratio after the gap.

      [Table A1 about here]

   b. Building, construction in progress: We convert the initial observation of these items into real terms using the construction cost deflator (general construction, monthly, 2015 basis, MLIT). The real investment in these items is obtained by dividing the change of these

items in the balance sheet from the previous year plus depreciation by the average deflator in each accounting year. We obtain the real value of building and construction in progress by adding this real investment to the real value of building and construction in progress in the previous year. We treat firms as different firms before and after a gap if there is a gap, corresponding to a year missing these items.

As for the depreciation, the dataset reports only all-inclusive depreciation. We approximate the depreciation for building by multiplying total depreciation by the ratio of building and construction in progress over total tangible assets. The remaining part of depreciation is used as the depreciation for other tangible assets.

c. Other tangible assets: We convert these into real terms by using the investment goods deflator in each sector collected from the JIP database (2015 basis) in the same way as for building and construction in progress. The investment goods deflator is calculated by dividing the nominal investment flow by the real investment flow, reported in the JIP database.

d. Intangible assets: We convert these into real terms using the consumer price index (general, monthly, 2015 basis) to calculate the real holding of intangible assets. The real investment in intangible assets is the difference in real holdings from the previous year.

**Appendix B. Estimation of TFP.**

We use the following three productivity measures: 1. labor productivity, 2. capital productivity, and 3. total factor productivity.

1. labor productivity: real value-added (million JPY) / number of employees (persons).
2. capital productivity: real value-added (million JPY) / {real tangible assets + real intangible assets} (million JPY).
3. Total factor productivity (TFP): We estimate TFP by OLS or the instrumental variable regression in Ackerberg, Caves, and Frazer (2015) with the observation in 2004 and later for each subsample split by the intermediate classification in JSIC. We drop sectors with less than 100 observations.

   a. OLS. We estimate the following production function by OLS.

$$\ln y_{it} = \beta_0 + \beta_1 \ln k_{it} + \beta_2 \ln l_{it} + \beta_3 \ln m_{it} + \mu_i + \epsilon_{it} \quad \text{(A.1)}$$

   where $y_{it}$ is real sales, $k_{it}$ is real tangible assets, $l_{it}$ is labor input (number of employees times annual average working hours), $m_{it}$ is real intermediate input, $\mu_i$ is the firm fixed effect, and $\epsilon_{it}$ is the error term. From the estimated model, we estimate the TFP of each firm in each year using

$$\widehat{TFP_{OLS}} = \ln y_{it} - \widehat{\beta_1} \ln k_{it} - \widehat{\beta_2} \ln l_{it} - \widehat{\beta_3} \ln m_{it}. \text{ (A.2)}$$

   b. IV by Ackerberg, Caves, and Frazer (2015). We estimate the following value-added

version of the production function:

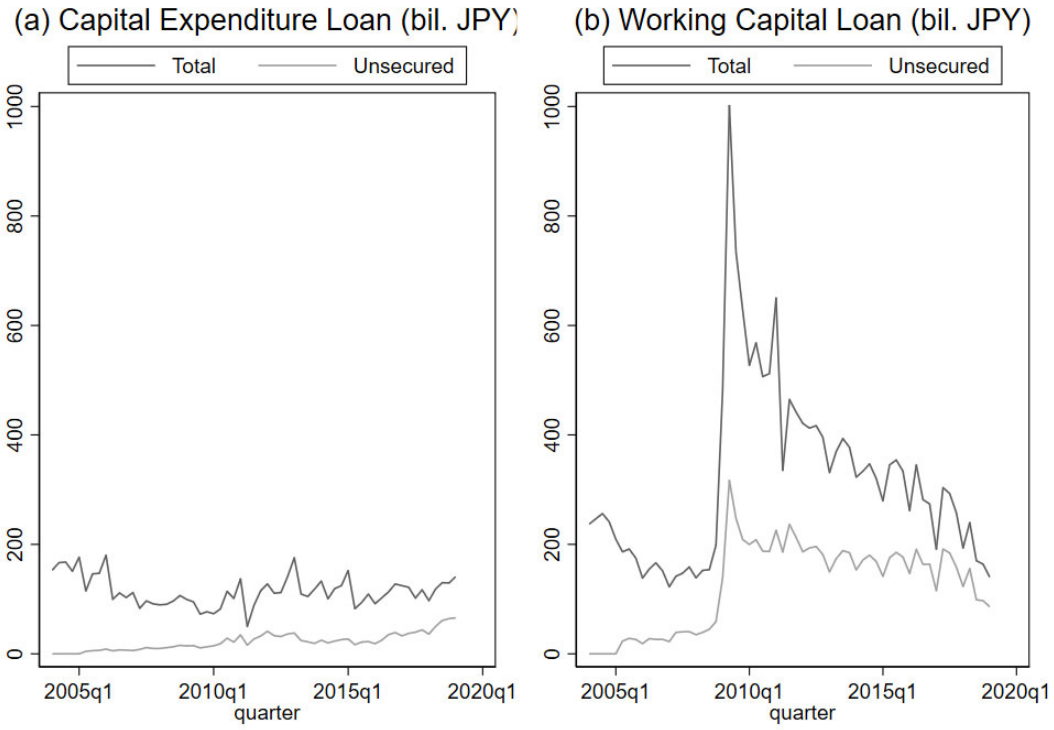
$$\ln v_{it} = \beta_0 + \beta_1 \ln k_{it} + \beta_2 \ln l_{it} + \mu_i + \epsilon_{it} \quad \text{(A.3)}$$

where $v_{it}$ is real value-added, and the definition of the other variables is the same as in the OLS. The OLS estimates are inconsistent if some variables omitted from this model affect both value-added and capital stock $k_{it}$. To avoid this problem, we treat $\ln k_{it}$ as an endogenous variable by specifying the intermediate input $\ln m_{it}$ as an instrumental variable. After deleting the firm fixed effect by subtracting the within-firm average from both sides of (A.3), we estimate the coefficients of (A.3) using this IV regression. From the estimates, we estimate the TFP of each firm in each year using

$$\widehat{TFP_{ACF}} = \ln v_{it} - \widehat{\beta_1} \ln k_{it} - \widehat{\beta_2} \ln l_{it}. \quad \text{(A.4)}$$

Note that firms with non-positive value-added are removed from the sample.

**Figure 1. Newly issued loans, JFC SME Unit, total and unsecured**




(Source) Authors' calculation from the loan data of JFC SME Unit.

**Figure 2. Sample structure**

(Note) Shaded areas are the sample for the baseline analysis.

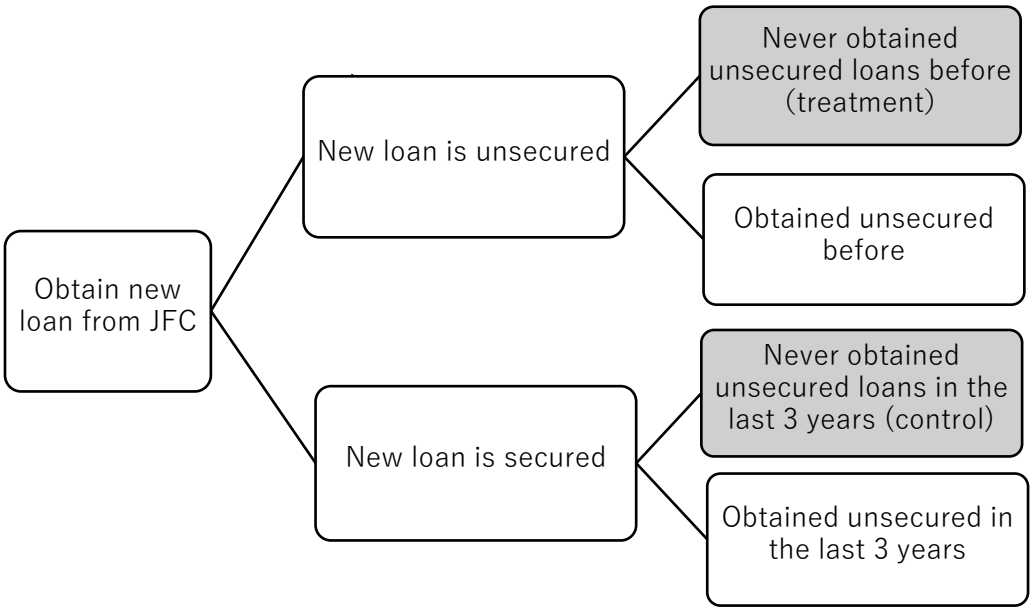


**Table 1. Number of firms obtaining new loans from the JFC**

(Notes) Number of firms given here is from before the sample selection process identifying firms for the logit analyses in Table 5. The figure in each cell is the number of firms at the end of each firm's accounting period ending in each calendar year. The number of firms is before excluding outliers and those in the following industries: (A) agriculture and forestry, (B) fisheries, (C) mining and quarrying of stone and gravel, (J) finance and insurance, (K) real estate and lease, and (T) industries unable to classify.

| Year | (1) Total number of firms obtaining a new loan from the JFC | | | |
|---|---|---|---|---|
| | | (2) Obtained an unsecured loan for the first time | (3) Never obtained an unsecured loan in the past 3 years | (4) Other |
| 2008 | 11,005 | 2,529 | 6,366 | 2,110 |
| 2009 | 14,761 | 4,115 | 7,079 | 3,567 |
| 2010 | 17,634 | 5,321 | 6,907 | 5,406 |
| 2011 | 17,298 | 4,310 | 5,700 | 7,288 |
| 2012 | 16,996 | 3,901 | 4,623 | 8,472 |
| 2013 | 17,026 | 3,045 | 4,896 | 9,085 |
| 2014 | 15,532 | 2,236 | 4,225 | 9,071 |
| 2015 | 14,647 | 1,982 | 3,839 | 8,826 |
| 2016 | 14,060 | 2,037 | 3,499 | 8,524 |
| 2017 | 13,564 | 2,227 | 3,100 | 8,237 |
| 2018 | 13,115 | 2,325 | 2,756 | 8,034 |
| Total | 165,638 | 34,028 | 52,990 | 78,620 |

**Table 2. Number of firms obtaining new loans from the JFC by sector (total in 2008–2018)**

(Notes) Number of firms given here is from before the sample selection process identifying firms for the logit analyses in Table 5. The figure in each cell is the number of firms at the end of each firm's accounting period ending in each calendar year. The share in the final column is the percentage of firms using collateralized loans to the total number of firms in each segment.

| | (1) Firms with a secured loan | (2) Other | (3) Total | (4) Share = (1)/(3) |
|---|---|---|---|---|
| Construction | 7,560 | 4,138 | 11,698 | 64.6% |
| Manufacturing | 44,859 | 31,675 | 76,534 | 58.6% |
| Electricity, gas, heat supply and water | 9,610 | 5,913 | 15,523 | 61.9% |
| Wholesale and retail trade | 21,912 | 13,418 | 35,330 | 62.0% |
| Real estate and goods rental and leasing | 4,242 | 5,278 | 9,520 | 44.6% |
| Services | 10,958 | 6,075 | 17,033 | 64.3% |
| Total | 99,141 | 66,497 | 165,638 | 59.9% |

**Table 3. Descriptive statistics**

(Note) Figures calculated after dropping firms in agriculture and forestry (JSIC large category A), fisheries (B), mining and quarrying of stone and gravel (C), finance and insurance (J), real estate and lease (K), and industries unable to be classified (I), and outliers (>99 percentile and <1 percentile continuous explanatory variables for firm financial conditions in logit estimations in Table 5, but before dropping outliers for the outcome variables in the PSM (Table 7). Variable definitions in Table 4.

| Variables | Obs. | Mean | S.D. | Min. | p1 | p50 | p99 | Max. |
|---|---|---|---|---|---|---|---|---|
| *Δsales* | 53,759 | -0.004 | 0.199 | -0.979 | -0.475 | -0.011 | 0.612 | 8.146 |
| *Δvalue-added* | 53,759 | 0.004 | 1.993 | -395.846 | -0.532 | -0.008 | 0.905 | 117.715 |
| *I/K (tangible)* | 53,751 | 0.072 | 0.382 | -0.866 | -0.146 | 0.009 | 1.092 | 37.590 |
| *I/K (real estate)* | 53,752 | 0.050 | 0.343 | -0.847 | -0.147 | 0.006 | 0.890 | 37.399 |
| *I/K (other tangible)* | 53,751 | 0.022 | 0.132 | -0.912 | -0.068 | 0.000 | 0.389 | 9.142 |
| *I/K (intangible)* | 53,760 | 0.008 | 0.134 | -0.989 | -0.226 | 0.001 | 0.322 | 10.502 |
| *ΔTFP (OLS)* | 50,360 | -0.001 | 0.145 | -0.960 | -0.268 | -0.004 | 0.330 | 10.981 |
| *ΔTFP (ACF)* | 49,943 | 0.006 | 0.337 | -0.983 | -0.500 | -0.014 | 0.819 | 23.963 |
| *Δcapital productivity* | 53,759 | -0.053 | 0.805 | -26.438 | -1.363 | -0.016 | 0.832 | 124.856 |
| *Δlabor productivity* | 50,615 | -0.196 | 9.577 | -1012.966 | -12.913 | -0.106 | 12.227 | 1117.391 |
| *Δintermed input* | 53,759 | 0.004 | 0.383 | -1.000 | -0.643 | -0.016 | 0.984 | 25.255 |
| *Δwage* | 53,760 | 0.000 | 0.149 | -1.000 | -0.345 | -0.002 | 0.413 | 8.094 |
| *Δ#employee* | 51,717 | 0.004 | 0.353 | -1.000 | -1.000 | 0.000 | 0.776 | 17.000 |
| *ΔSGA* | 53,741 | 0.023 | 0.341 | -1.000 | -0.407 | -0.005 | 0.771 | 32.713 |
| *Collateral capacity* | 26,879 | 0.200 | 0.233 | 0.000 | 0.000 | 0.129 | 1.000 | 1.000 |
| *Credit rating* | 53,600 | 3.240 | 2.006 | 1.000 | 1.000 | 3.000 | 9.000 | 12.000 |
| *Δcredit rating* | 51,169 | 0.133 | 1.363 | -7.000 | -4.000 | 0.000 | 5.000 | 10.000 |
| *Firm age* | 53,714 | 56.846 | 35.875 | 2.000 | 7.000 | 53.000 | 154.000 | 1007.000 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Loan/tangible asset* | 53,175 | 2.215 | 11.452 | 0.000 | 0.057 | 1.116 | 20.618 | 1159.458 |
| *Leverage* | 53,759 | 0.742 | 0.213 | 0.069 | 0.237 | 0.766 | 1.250 | 2.410 |
| *Cash flow/asset* | 53,760 | 0.093 | 0.169 | -0.763 | -0.257 | 0.062 | 0.726 | 2.200 |
| *ROA* | 53,759 | 0.018 | 0.053 | -0.992 | -0.147 | 0.017 | 0.164 | 0.575 |
| *Error correct. (tangible)* | 53,760 | -0.148 | 0.949 | -1.000 | -0.989 | -0.447 | 3.715 | 8.156 |
| *Error correct. (intangible)* | 53,760 | -0.861 | 0.176 | -0.999 | -0.997 | -0.917 | -0.104 | 1.144 |
| *Error correct. (employee)* | 53,760 | -0.946 | 0.044 | -1.000 | -0.996 | -0.956 | -0.778 | -0.112 |
| *Error correct. (SGA)* | 53,760 | -0.873 | 0.112 | -1.000 | -0.987 | -0.909 | -0.452 | 0.115 |
| *Interest coverage* | 53,760 | 155.549 | 172.606 | 4.136 | 14.953 | 98.727 | 881.625 | 5129.200 |
| *Asset* | 53,760 | 1417.672 | 1589.820 | 0.000 | 103.800 | 865.800 | 7974.600 | 17703.800 |
| *MB deposit share* | 50,903 | 0.527 | 0.289 | 0.000 | 0.000 | 0.531 | 1.000 | 1.000 |
| *MB asset* | 50,212 | 32.792 | 55.824 | 0.029 | 0.126 | 4.859 | 200.262 | 212.247 |
| *MB leverage* | 49,979 | 4.853 | 1.521 | -6.019 | 1.716 | 4.818 | 8.789 | 22.720 |
| *Δloan (non-JFC)* | 53,179 | -0.016 | 2.740 | -14.597 | -1.378 | -0.023 | 1.211 | 620.371 |
| *Δloans growth 1* | 53,179 | -0.024 | 0.334 | -12.165 | -0.950 | -0.016 | 0.794 | 14.432 |
| *Δloans growth 2* | 53,179 | -0.008 | 0.192 | -6.761 | -0.485 | 0.000 | 0.454 | 7.787 |
| *Δloans growth 3* | 53,179 | 0.016 | 2.706 | -9.481 | -0.551 | 0.000 | 0.665 | 620.462 |

**Table 4. Variable definitions**

| Variables | Definitions |
|---|---|
| *Unsecured first* | Dummy variable, which equals one if a firm uses an unsecured loan from JFC for the first time, or zero otherwise. |
| *Δsales* | Annual growth rate of real sales. Deflated by the sectoral output deflator in JIPS database. |
| *Δvalue-added* | Annual growth rate of real value-added. Deflated by the sectoral value-added deflator in JIPS database. |
| *I/K (tangible)* | Ratio of tangible asset investment over lagged fixed assets (real value). |
| *I/K (real estate)* | Ratio of real estate investment over lagged fixed assets (real value). |
| *I/K (other tangible)* | Ratio of other tangible assets investment to lagged property, plant, and equipment (real value). |
| *I/K (intangible)* | Ratio of intangible assets investment to lagged property, plant, and equipment. |
| *ΔTFP (OLS)* | Annual growth rate of total factor productivity based on ordinary least squares model. |
| *ΔTFP (ACF)* | Annual growth rate of total factor productivity based on Ackerberg, Caves, and Frazer (2015). |
| *Δcapital productivity* | Annual increase in the ratio of value-added to total fixed assets, tangibles, and intangibles (real value). |
| *Δlabor productivity* | Annual increase in the ratio of value-added to total number of employees (real value). |
| *Δwage* | Annual growth rate of personnel expenses (real value). |
| *Δ#employee* | Annual growth rate of #employees. |
| *ΔSGA* | Annual growth rate of selling, general, and administrative expenses (excluding personnel expenses). |
| *Δintermed input* | Annual growth rate of real intermediate inputs. Deflated by the sectoral intermediate input deflator in JIPS database. |
| *Collateral capacity* | Ratio of assets eligible but not yet pledged as collateral over total assets. |
| *Credit rating* | Credit ratings. Higher values indicate lower creditworthiness. |
| *Δcredit rating* | Annual change in credit ratings. |
| *Firm age* | Firm age (years). |
| *Loan/tangible asset* | Ratio of loans from financial institutions to tangible assets. |
| *Leverage* | Ratio of total debt to total assets. |
| *Cash flow/asset* | Ratio of operating cash flow to total assets. |
| *ROA* | Ratio of operating income to total assets. |
| *Error correct. (tangible)* | Ratio of real tangible assets to real sales minus one (real value). Sales deflated by the sectoral output deflator in JIPS database. See Appendix for details of process used to obtain real tangible assets. |
| *Error correct. (intangible)* | Ratio of real intangible assets to real sales minus one (real value). Sales are deflated by the sectoral output deflator in JIPS database. See Appendix for details of process used to obtain real tangible assets. |
| *Error correct. (employee)* | Ratio of total number of employees to sales minus one (real value). |

| | |
|---|---|
| *Error correct. (SGA)* | Ratio of SGA expenses (excluding personnel expenses) to sales minus one (real value). SGA is deflated by CPI (general) in each region. Sales deflated by the sectoral output deflator in JIPS database. |
| *Interest coverage* | Ratio of (sales) to (interest expenses plus one) (%). |
| *Asset* | Total firm assets (in billion JPY). |
| *MB deposit share* | Primary main bank share of firm deposits. |
| *MB asset* | Total assets of primary main bank (in trillion JPY). |
| *MB leverage* | Leverage ratio of the primary main bank, i.e., the ratio of net assets over total assets (%). |
| *Δloan (non-JFC)* | Ratio of annual change of loans from non-JFC to lagged total assets. |
| *Δloans growth 1* | Ratio of annual change of loans from the primary main bank to lagged total assets. |
| *Δloans growth 2* | Ratio of annual change of loans from the secondary submain bank to lagged total assets. |
| *Δloans growth 3* | Ratio of annual change of loans from the third submain bank to lagged total assets. |
| *Disaster* | Dummy variable that equals one if a firm uses a JFC's loan program for disaster recovery, zero otherwise. |
| *Regional bank* | Dummy variable that equals one if the primary main bank of a firm is a regional bank, zero otherwise. Regional banks include banks belonging to the Regional Bankers' Association or the Second Regional Bankers' Association. |
| *Large bank* | Dummy variable that equals one if the primary main bank of a firm is a major bank, zero otherwise. Major banks include city banks and major trust banks, which operate nationwide and internationally. |
| *Tobin's Q* | Book value asset-weighted average of Tobin's Q, (market capitalization + book value of liability)/(book value of asset), in each industrial sector (medium "chu" classification of Japanese Standard Industrial Classification) at the end of the accounting period for each firm. |
| *no-more-collateral* | Dummy variable that equals one if a firm does not have any tangible assets pledgeable as collateral for a new loan. |
| *unsecured program* | Dummy variable that equals one if a firm uses a loan program that allows unsecured loans without add-on interest rates, excepting disaster recovery programs. |

**Table 5. Logit estimation of the probability of firms switching to unsecured loans**

(Note) The table provides the logit estimation results for the characteristics of firms switching to unsecured loans. The logit estimation is conducted each year from 2008 to 2018, as shown by the column headings. The coefficients for the dummy variables indicating 1) JFC branch with which firms have transactions, 2) industrial sector (large class in Japanese SIC), and the constant term are estimated but omitted from the table. Marginal effects shown, standard errors in parentheses. Variable definitions in Table 4. *, **, and *** denote (two-sided t-test, H0: marginal effect is zero) statistical significance at the 10%, 5%, and 1% levels, respectively.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Explanatory variables | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
| *Loan/tangible asset (t-1)* | 0.008*** | 0.006*** | -0.000 | 0.003 | 0.007*** | 0.000 | 0.004 | 0.005** | 0.004* | 0.005* | 0.020*** |
| | (0.003) | (0.002) | (0.002) | (0.002) | (0.003) | (0.001) | (0.003) | (0.002) | (0.002) | (0.003) | (0.006) |
| *Leverage (t-1)* | 0.229*** | 0.216*** | 0.218*** | 0.239*** | 0.086* | 0.232*** | 0.205*** | 0.177*** | 0.187*** | 0.113* | 0.086 |
| | (0.048) | (0.042) | (0.041) | (0.043) | (0.046) | (0.047) | (0.050) | (0.053) | (0.054) | (0.063) | (0.070) |
| *Cash flow/asset* | -0.088 | -0.058 | 0.053 | 0.125** | 0.109 | 0.050 | 0.045 | 0.001 | 0.028 | 0.015 | -0.038 |
| | (0.068) | (0.048) | (0.056) | (0.062) | (0.072) | (0.065) | (0.065) | (0.060) | (0.072) | (0.079) | (0.082) |
| *Cash flow/asset (t-1)* | 0.145** | 0.279*** | 0.132** | 0.177** | -0.051 | -0.023 | 0.119 | 0.052 | -0.105 | 0.141 | 0.127 |
| | (0.073) | (0.056) | (0.064) | (0.071) | (0.080) | (0.077) | (0.079) | (0.065) | (0.082) | (0.091) | (0.092) |
| *Credit rating=2 (t-1)* | 0.085*** | 0.083*** | 0.075*** | 0.050** | 0.075*** | 0.036* | 0.043* | 0.041* | 0.007 | 0.042 | 0.033 |
| | (0.022) | (0.019) | (0.020) | (0.020) | (0.020) | (0.022) | (0.024) | (0.024) | (0.026) | (0.031) | (0.033) |
| *Credit rating=3 (t-1)* | 0.137*** | 0.075*** | 0.095*** | 0.106*** | 0.043* | 0.029 | 0.048* | 0.074*** | 0.014 | 0.086** | 0.019 |
| | (0.023) | (0.022) | (0.023) | (0.023) | (0.025) | (0.025) | (0.027) | (0.028) | (0.030) | (0.037) | (0.040) |
| *Credit rating=4 (t-1)* | 0.111*** | 0.095*** | 0.075*** | 0.092*** | 0.119*** | 0.071** | 0.032 | 0.050 | 0.079** | 0.089* | 0.026 |
| | (0.029) | (0.026) | (0.029) | (0.031) | (0.034) | (0.033) | (0.036) | (0.037) | (0.037) | (0.048) | (0.055) |
| *Credit rating=5 (t-1)* | 0.101*** | 0.029 | 0.038 | 0.005 | 0.004 | 0.002 | -0.050 | 0.033 | 0.024 | 0.038 | 0.067 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (0.031) | (0.030) | (0.031) | (0.035) | (0.040) | (0.039) | (0.043) | (0.041) | (0.042) | (0.053) | (0.060) |
| *Credit rating=6 (t-1)* | 0.030 | -0.032 | 0.119*** | 0.047 | -0.002 | -0.067** | -0.111*** | -0.087** | -0.055 | 0.037 | -0.041 |
| | (0.032) | (0.030) | (0.029) | (0.032) | (0.034) | (0.034) | (0.035) | (0.036) | (0.037) | (0.042) | (0.048) |
| *Credit rating=7 (t-1)* | -0.087 | 0.010 | 0.092** | -0.012 | 0.009 | -0.144*** | -0.100** | -0.086 | -0.269*** | 0.094 | 0.024 |
| | (0.062) | (0.047) | (0.036) | (0.041) | (0.044) | (0.048) | (0.049) | (0.053) | (0.079) | (0.065) | (0.068) |
| *Credit rating=8 (t-1)* | 0.074 | 0.084 | -0.203 | 0.275* | -0.060 | 0.139 | 0.029 | 0.128 | -0.022 | 0.309*** | 0.100 |
| | (0.076) | (0.086) | (0.220) | (0.162) | (0.149) | (0.102) | (0.133) | (0.121) | (0.111) | (0.118) | (0.184) |
| *Credit rating=9 (t-1)* | 0.123 | 0.121 | 0.326** | -0.072 | 0.006 | -0.036 | 0.008 | -0.072 | 0.159 | | 0.183 |
| | (0.087) | (0.074) | (0.130) | (0.141) | (0.127) | (0.110) | (0.105) | (0.202) | (0.111) | | (0.132) |
| *Δcredit rating (t-1)* | -0.012** | -0.002 | -0.005 | -0.010* | -0.018*** | -0.011** | -0.011* | -0.015*** | -0.012* | -0.021*** | -0.002 |
| | (0.005) | (0.005) | (0.005) | (0.005) | (0.006) | (0.005) | (0.006) | (0.006) | (0.006) | (0.007) | (0.008) |
| *Interest coverage (t-1)* | -0.000*** | -0.000*** | -0.000*** | -0.000*** | -0.000*** | -0.000* | -0.000* | -0.000*** | -0.000** | -0.000* | -0.000** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| *Firm age* | -0.001*** | -0.001*** | -0.001*** | -0.001*** | -0.001*** | -0.001*** | -0.001*** | -0.000 | -0.001*** | 0.000 | -0.001* |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| *Asset (t-1)* | 0.011*** | 0.024*** | 0.022*** | 0.011** | 0.022*** | 0.013*** | 0.010* | 0.015*** | 0.011* | -0.005 | 0.000 |
| | (0.004) | (0.004) | (0.004) | (0.004) | (0.004) | (0.004) | (0.005) | (0.005) | (0.005) | (0.007) | (0.007) |
| *Δsales (t-1)* | 0.063 | -0.040 | 0.001 | 0.002 | 0.031 | 0.051 | 0.025 | 0.007 | 0.096 | 0.110 | 0.159* |
| | (0.050) | (0.049) | (0.048) | (0.043) | (0.045) | (0.056) | (0.059) | (0.058) | (0.073) | (0.089) | (0.086) |
| *I/K (tangible) (t-1)* | -0.080* | -0.034 | 0.099* | 0.040 | 0.202*** | 0.071 | -0.038 | 0.106 | -0.002 | 0.068 | -0.024 |
| | (0.041) | (0.050) | (0.059) | (0.068) | (0.078) | (0.066) | (0.055) | (0.066) | (0.058) | (0.073) | (0.084) |
| *I/K (intangible) (t-1)* | 0.081 | 0.249** | 0.174 | 0.186 | 0.069 | 0.203 | 0.378*** | 0.052 | 0.436*** | 0.054 | 0.300 |
| | (0.111) | (0.106) | (0.113) | (0.130) | (0.142) | (0.138) | (0.132) | (0.150) | (0.159) | (0.161) | (0.187) |
| *Δloan (non-JFC) (t-1)* | 0.214*** | 0.092 | -0.018 | 0.058 | -0.180* | 0.217** | 0.103** | -0.250** | 0.068 | 0.007 | -0.139 |
| | (0.067) | (0.068) | (0.070) | (0.083) | (0.096) | (0.087) | (0.049) | (0.104) | (0.099) | (0.095) | (0.128) |
| *Δwage (t-1)* | -0.083 | 0.044 | -0.014 | -0.002 | 0.069 | 0.014 | 0.068 | 0.193** | -0.099 | -0.027 | 0.152 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (0.062) | (0.059) | (0.062) | (0.060) | (0.069) | (0.072) | (0.075) | (0.081) | (0.088) | (0.111) | (0.110) |
| *ΔTFP (OLS)* | -0.162* | 0.048 | -0.126 | -0.036 | 0.129 | -0.079 | -0.128 | 0.135 | -0.191 | -0.228 | -0.009 |
| | (0.092) | (0.086) | (0.081) | (0.084) | (0.094) | (0.100) | (0.110) | (0.099) | (0.118) | (0.149) | (0.146) |
| *Error correct. (tangible)* | -0.028*** | -0.043*** | -0.052*** | -0.026*** | -0.039*** | -0.040*** | -0.022** | -0.033*** | -0.035*** | -0.008 | -0.002 |
| | (0.009) | (0.009) | (0.009) | (0.008) | (0.009) | (0.010) | (0.010) | (0.011) | (0.012) | (0.012) | (0.013) |
| *Error correct. (intangible)* | -0.053 | -0.032 | 0.027 | 0.052 | 0.026 | 0.043 | 0.072* | 0.138*** | -0.012 | 0.063 | -0.042 |
| | (0.042) | (0.041) | (0.036) | (0.037) | (0.041) | (0.044) | (0.040) | (0.046) | (0.054) | (0.060) | (0.065) |
| *Disaster* | -0.080 | 0.067 | | 0.084*** | 0.071*** | 0.096*** | 0.209*** | 0.130 | 0.268** | 0.217** | |
| | (0.144) | (0.275) | | (0.019) | (0.014) | (0.031) | (0.070) | (0.092) | (0.126) | (0.089) | |
| *Regional bank* | 0.021 | -0.025 | 0.010 | 0.014 | 0.011 | 0.011 | 0.001 | -0.049** | -0.010 | -0.036 | 0.012 |
| | (0.017) | (0.017) | (0.018) | (0.020) | (0.022) | (0.022) | (0.023) | (0.022) | (0.025) | (0.030) | (0.030) |
| *Large bank* | -0.028 | -0.027 | -0.029 | 0.011 | -0.022 | -0.075* | -0.019 | -0.037 | -0.084 | -0.098 | -0.084 |
| | (0.034) | (0.032) | (0.033) | (0.037) | (0.040) | (0.040) | (0.043) | (0.047) | (0.057) | (0.066) | (0.067) |
| *MB deposit share* | -0.009 | -0.020 | -0.060*** | -0.013 | -0.014 | -0.024 | -0.013 | 0.015 | 0.024 | -0.006 | -0.014 |
| | (0.022) | (0.021) | (0.022) | (0.024) | (0.026) | (0.026) | (0.027) | (0.029) | (0.031) | (0.036) | (0.040) |
| *MB asset* | 0.000 | -0.000 | 0.000 | -0.000 | -0.000 | 0.001** | 0.000 | -0.000 | 0.001* | 0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| *MB leverage (t-1)* | 0.000 | 0.005 | 0.002 | 0.000 | -0.010 | -0.002 | -0.007 | 0.002 | -0.005 | -0.020** | 0.002 |
| | (0.003) | (0.005) | (0.005) | (0.006) | (0.006) | (0.007) | (0.007) | (0.007) | (0.008) | (0.009) | (0.009) |
| | | | | | | | | | | | |
| Observations | 5,510 | 6,385 | 5,871 | 4,813 | 3,770 | 3,130 | 2,779 | 2,420 | 2,009 | 1,455 | 1,261 |
| Pseudo R-sq. | 0.075 | 0.071 | 0.065 | 0.058 | 0.089 | 0.092 | 0.088 | 0.101 | 0.104 | 0.106 | 0.130 |
| Log-likelihood | -2921 | -3606 | -3375 | -2782 | -2054 | -1453 | -1281 | -1077 | -843.5 | -639.6 | -550.2 |

**Table 6. Collateral capacity impact on firm switching decision to unsecured loans**

(Note) The table provides the estimation results of the impact of collateral capacity on the firm decision of switching to unsecured loans using logit model estimation. The dummy variable coefficients for 1) JFC branch with which firms have transaction, and 2) industrial sector (large class in Japanese SIC), and the constant term are estimated but not shown. Estimates of other explanatory variables in Table 5 are also not shown. Set of other explanatory variables same as in Table 5. Figures are marginal effects, standard errors in parentheses. Variable definitions in Table 4. *, **, and *** denote (two-sided t-test, H0: marginal effect is zero) statistical significance at the 10%, 5%, and 1% levels, respectively.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| Explanatory variables | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
| *Collateral capacity* | -0.643*** | -0.675*** | -0.490*** | -0.575*** | -0.654*** | -0.683*** | -0.576*** | -0.854*** |
| | (0.051) | (0.041) | (0.041) | (0.047) | (0.052) | (0.055) | (0.064) | (0.074) |
| Other controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 2,322 | 3,730 | 3,106 | 2,743 | 2,399 | 1,989 | 1,439 | 1,245 |
| Pseudo R-sq. | 0.146 | 0.162 | 0.143 | 0.149 | 0.183 | 0.207 | 0.170 | 0.267 |
| Log-likelihood | -1213 | -1864 | -1360 | -1190 | -975 | -743.3 | -586.1 | -457.9 |

**Table 7. Average treatment effect (ATE) of switching to an unsecured loan in post-crisis period (2011–18)**

(Note) The table provides the estimated ATE of switching to an unsecured loan, estimated by the propensity score matching in Table 5 from 2011 to 2018. Annual changes in variables and investments (I./K) in Panel A. Cumulative changes from the end of the year before switching to an unsecured JFC loan to the second and third years after switching in Panel B. Variable definitions in Table 4. *, **, and *** denote (two-sided) statistical significance at the 10%, 5%, and 1% levels, respectively.

**Panel A. Previous and current years of switching to an unsecured loan.**

| | Previous year | | | 1st year | | | |
|---|---|---|---|---|---|---|---|
| | ATE | S.E. | N | ATE | S.E. | | N |
| Asset and investment type | | | | | | | |
| *I/K (tangible)* | 0.000 | 0.002 | 21,620 | 0.002 | 0.003 | | 21,501 |
| *I/K (real estate)* | 0.000 | 0.002 | 21,578 | 0.003 | 0.003 | | 21,469 |
| *I/K (other tangible)* | 0.001 | 0.001 | 21,530 | 0.001 | 0.001 | | 21,550 |
| *I/K (intangible)* | 0.000 | 0.001 | 21,620 | 0.005 | 0.001 | *** | 21,523 |
| Employment and intermediate input | | | | | | | |
| *Δwage* | 0.000 | 0.002 | 21,620 | 0.006 | 0.003 | ** | 21,610 |
| *Δ#employee* | 0.001 | 0.003 | 21,504 | -0.006 | 0.005 | | 20,515 |
| *ΔSGA* | -0.001 | 0.003 | 21,417 | 0.013 | 0.004 | *** | 21,412 |
| *Δintermed input* | 0.001 | 0.005 | 21,604 | 0.009 | 0.005 | | 21,618 |
| Performances | | | | | | | |
| *Δsales* | 0.001 | 0.004 | 21,620 | 0.009 | 0.004 | ** | 21,612 |
| *Δvalue-added* | -0.002 | 0.005 | 21,572 | 0.007 | 0.004 | | 21,566 |
| *ΔTFP (OLS)* | -0.001 | 0.002 | 21,620 | 0.001 | 0.002 | | 19,686 |
| *ΔTFP (ACF)* | 0.001 | 0.004 | 21,323 | 0.003 | 0.004 | | 19,485 |
| *Δcapital productivity* | 0.002 | 0.005 | 21,389 | 0.005 | 0.005 | | 21,626 |
| *Δlabor productivity* | 0.070 | 0.080 | 21,519 | 0.006 | 0.071 | | 19,821 |
| *ΔROA* | -0.001 | 0.001 | 21,440 | 0.000 | 0.001 | | 21,479 |
| *Δcredit rating* | -0.011 | 0.031 | 21,620 | 0.086 | 0.032 | *** | 21,564 |
| Financing | | | | | | | |
| *Leverage* | 0.000 | 0.005 | 21,525 | 0.005 | 0.005 | | 21,636 |
| *Δloan (non-JFC)* | -0.001 | 0.005 | 21,620 | -0.004 | 0.006 | | 21,505 |
| *Δloans growth 1* | -0.002 | 0.003 | 21,572 | -0.003 | 0.004 | | 21,443 |
| *Δloans growth 2* | 0.000 | 0.002 | 21,480 | -0.001 | 0.002 | | 21,410 |
| *Δloans growth 3* | 0.001 | 0.003 | 21,539 | 0.002 | 0.003 | | 21,507 |

**Pane B. Second and third years after switching to an unsecured loan.**

| | 2nd year | | | | 3rd year | | | |
|---|---|---|---|---|---|---|---|---|
| | ATE | S.E. | | N | ATE | S.E. | | N |
| Asset and investment type | | | | | | | | |
| *I/K (tangible)* | 0.009 | 0.005 | * | 19,917 | 0.013 | 0.006 | ** | 18,017 |
| *I/K (real estate)* | 0.002 | 0.003 | | 19,876 | 0.009 | 0.005 | * | 17,998 |
| *I/K (other tangible)* | 0.004 | 0.002 | * | 19,981 | 0.003 | 0.002 | | 18,071 |
| *I/K (intangible)* | 0.010 | 0.003 | *** | 19,960 | 0.014 | 0.004 | *** | 18,077 |
| Employment and intermediate input | | | | | | | | |
| *Δwage* | 0.010 | 0.004 | ** | 19,909 | 0.009 | 0.005 | ** | 18,110 |
| *Δ#employee* | 0.006 | 0.007 | | 18,832 | -0.001 | 0.010 | | 16,950 |
| *ΔSGA* | 0.017 | 0.006 | *** | 19,821 | 0.008 | 0.007 | | 18,060 |
| *Δintermed input* | 0.020 | 0.008 | ** | 19,927 | 0.009 | 0.011 | | 18,162 |
| Performance | | | | | | | | |
| *Δsales* | 0.015 | 0.006 | ** | 20,032 | 0.011 | 0.007 | | 18,089 |
| *Δvalue-added* | 0.000 | 0.007 | | 18,769 | 0.012 | 0.007 | * | 18,108 |
| *ΔTFP (OLS)* | 0.003 | 0.003 | | 17,544 | 0.004 | 0.004 | | 15,065 |
| *ΔTFP (ACF)* | 0.010 | 0.005 | * | 17,375 | 0.006 | 0.006 | | 14,918 |
| *Δcapital productivity* | 0.000 | 0.007 | | 20,037 | -0.004 | 0.010 | | 18,132 |
| *Δlabor productivity* | -0.013 | 0.095 | | 17,759 | -0.021 | 0.106 | | 15,334 |
| *ΔROA* | 0.000 | 0.001 | | 19,917 | -0.001 | 0.001 | | 18,130 |
| *Δcredit rating* | 0.104 | 0.039 | *** | 19,885 | 0.159 | 0.046 | *** | 17,974 |
| Financing | | | | | | | | |
| *Leverage* | 0.011 | | ** | 19,977 | 0.017 | 0.007 | ** | 18,040 |
| *Δloan (non-JFC)* | 0.000 | 0.003 | | 19,792 | 0.003 | 0.004 | | 18,053 |
| *Δloans growth 1* | -0.001 | 0.002 | | 19,765 | 0.000 | 0.003 | | 18,034 |
| *Δloans growth 2* | -0.001 | 0.001 | | 19,801 | -0.001 | 0.001 | | 18,078 |
| *Δloans growth 3* | 0.002 | 0.001 | | 19,826 | 0.003 | 0.002 | * | 18,110 |

**Table 8. ATE on the contents of capital expenditures**

(Note) This table provides the estimated ATE of switching to an unsecured loan for capital expenditure loans granted from 2011 to 2018. Propensity score estimated using the model in Table 6. ATE is estimated for the share (%) of each category: real estate, machinery, and others including tangible and intangible assets, over the total amount of a loan. *, **, and *** denote (two-sided) statistical significance at the 10%, 5%, and 1% levels, respectively.

| | ATE | S.E. | | N |
|---|---|---|---|---|
| Real estate (%) | -5.368 | 1.437 | *** | 7,652 |
| Machinery (%) | -1.030 | 1.626 | | 7,652 |
| Others (%) | 6.398 | 1.464 | *** | 7,652 |

**Table 9. Instrumental variable (IV) regressions for tangible and intangible investments**

(Note) The table provides the result of the IV regressions for the data set from 2011 to 2018. Dependent variable for each regression at the top of each column. Each column lists the estimated coefficient and other statistics for each regression. Values in parentheses are firm-clustered standard errors unless otherwise noted. Set of control variables is the same as the logit for the unsecured probability (Table 5) except that IV regressions include the current sales growth and its square, and the one-year lagged error-correction term with respect to the dependent variable, i.e., dep. var / sales - 1 in the previous year. Excluded instrumental variables are, 1. *no-more-collateral dummy*, and 2. *unsecured program dummy*. All estimated coefficients are available in the online appendix (Table A6). *, **, and *** denote (two-sided, H0: coefficient is zero) statistical significance at the 10%, 5%, and 1% levels, respectively.

| Variables | (1) I/K tangible | | (2) I/K intangible | | (3) Δwage | | (4) ΔSGA | |
|---|---|---|---|---|---|---|---|---|
| *Unsecured first* | -0.023 | *** | 0.008 | ** | 0.000 | | 0.027 | *** |
| | (0.008) | | (0.004) | | (0.006) | | (0.010) | |
| Controls | Yes | | Yes | | Yes | | Yes | |
| Industry*year fe | Yes | | Yes | | Yes | | Yes | |
| JFC branch*year fe | Yes | | Yes | | Yes | | Yes | |
| Test of excl. IVs. (F-stat.) | 514.76 | *** | 515.39 | *** | 506.23 | *** | 504.78 | *** |
| (p-value) | (0.000) | | (0.000) | | (0.000) | | (0.000) | |
| Hansen J stat. (chi-sq.) | 0.367 | | 0.122 | | 1.092 | | 2.428 | |
| (p-value) | (0.545) | | (0.727) | | (0.296) | | (0.119) | |
| Endogeneity test (t-stat.) | 3.05 | *** | -1.05 | | 0.48 | | -2.26 | ** |
| (p-value) | (0.002) | | (0.294) | | (0.631) | | (0.024) | |
| N | 19,492 | | 19,492 | | 19,358 | | 19,358 | |
| (1st st.) Centered R sq. | 0.132 | | 0.131 | | 0.130 | | 0.129 | |
| (1st st.) Uncentered R sq. | 0.329 | | 0.329 | | 0.328 | | 0.328 | |
| (2nd st.) Centered R sq. | 0.067 | | 0.028 | | 0.230 | | 0.147 | |
| (2nd st.) Uncentered R sq. | 0.160 | | 0.032 | | 0.240 | | 0.173 | |

**Table 10. Determinants of the impact of unsecured loans on investments in the post-crisis period (2011–2018)**

(Note) The table provides the estimated coefficients of the investment equation (eq.1) including interaction terms between unsecured first and each firm's leverage in the previous year (Leverage (t-1)), and sectoral average Tobin's Q. Dependent variable at top of each column. Figures in parentheses are firm-level clustered standard errors. The set of other control variables is the same as in Table 9. Estimation conducted for the post-crisis period 2011–18. Variable definitions in Table 4. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | I/K | I/K | | |
| Variables | tangible | intangible | Δwage | ΔSGA |
| *Unsecured first* | -0.018 | -0.001 | -0.025** | -0.017 |
| | (0.020) | (0.010) | (0.010) | (0.012) |
| *Leverage (t-1)* | 0.007 | 0.001 | 0.009*** | 0.003 |
| | (0.007) | (0.003) | (0.003) | (0.006) |
| *Leverage (t-1)*Unsecured first* | -0.004 | -0.010 | 0.016*** | 0.025*** |
| | (0.015) | (0.006) | (0.006) | (0.009) |
| *Tobin'Q*Unsecured first* | 0.029* | 0.019** | 0.021*** | 0.008 |
| | (0.016) | (0.008) | (0.008) | (0.008) |
| Observations | 37,679 | 37,679 | 37,623 | 38,250 |
| Adjusted R-squared | 0.111 | 0.055 | 0.236 | 0.188 |
| controls | yes | yes | yes | yes |
| industry*year fe | yes | yes | yes | yes |
| JFC branch*year fe | yes | yes | yes | yes |
| firm fe | no | no | no | no |

**Table 11. Determinants of the impact of unsecured loans on investments in the crisis period (2008–2010)**

(Note) The table provides the estimated coefficients of the investment equation (eq.1) including interaction terms between *Unsecured loan*$_{it}$ and each firm's leverage in the previous year (*Leverage (t-1)*), and sectoral average Tobin's Q. Dependent variable at top of each column. Figures in parentheses are firm-level clustered standard errors. The set of other control variables is the same as in Table 9. Estimation conducted for the crisis period 2008–10. Variable definitions in Table 4. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

| Variables | (1) I/K tangible | (2) I/K intangible | (3) Δwage | (4) ΔSGA |
|---|---|---|---|---|
| *Unsecured first* | -0.040* | 0.021* | -0.025** | -0.003 |
| | (0.021) | (0.011) | (0.011) | (0.015) |
| *Leverage (t-1)* | -0.022*** | -0.009*** | 0.010** | -0.002 |
| | (0.008) | (0.003) | (0.005) | (0.007) |
| *Leverage (t-1)*Unsecured first* | 0.001 | -0.018*** | 0.005 | -0.007 |
| | (0.015) | (0.006) | (0.007) | (0.011) |
| *Tobin'Q*Unsecured first* | 0.040** | 0.000 | 0.018** | 0.008 |
| | (0.016) | (0.011) | (0.009) | (0.010) |
| Observations | 24,826 | 24,826 | 25,108 | 25,071 |
| Adjusted R-sq. | 0.104 | 0.035 | 0.360 | 0.243 |
| Controls | Yes | Yes | Yes | Yes |
| industry*year fe | Yes | Yes | Yes | Yes |
| JFC branch*year fe | Yes | Yes | Yes | Yes |
| firm fe | No | No | No | No |

**Table A1. Market-to-book value ratio (M/B ratio) of land**

(Note) Ratio of the total amount of land holding of nonfinancial private corporations in the SNA statistics (Statistics Bureau, Japan) over the total amount of land holding of all sizes and all industrial sectors of corporations excluding finance and insurance in Financial Statements Statistics of Corporations by Industry (Ministry of Finance, Japan).

| Year | M/B ratio | Year | M/B ratio | Year | M/B ratio |
|---|---|---|---|---|---|
| 1994 | 3.450 | 2003 | 1.914 | 2012 | 1.579 |
| 1995 | 3.349 | 2004 | 1.861 | 2013 | 1.394 |
| 1996 | 3.193 | 2005 | 1.814 | 2014 | 1.492 |
| 1997 | 2.919 | 2006 | 1.864 | 2015 | 1.571 |
| 1998 | 2.692 | 2007 | 1.985 | 2016 | 1.632 |
| 1999 | 2.349 | 2008 | 1.848 | 2017 | 1.640 |
| 2000 | 2.207 | 2009 | 1.672 | 2018 | 1.639 |
| 2001 | 2.238 | 2010 | 1.574 | 2019 | 1.752 |
| 2002 | 2.013 | 2011 | 1.524 | | |