

# Impacts of Bank Mergers on Zombie Firms: Evidence from Japan

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# Outline

1. Introduction
2. Related Literature
3. Hypotheses and Data
4. Methodology and Results
5. Conclusion

# 1. Introduction

- ❑ Bank merger potentially affects the bank-firm relationships, the availability of bank credit and the borrowing conditions of their client firms.
- ❑ This study examines the impact of Japanese bank mergers by:
  - Classify borrowers into private SMEs and publicly listed firms.
  - For each group, examine the effects on the borrowing conditions of continuing borrowers.
    - Investigate how the effects differ depending on (i) the size of the merger, (ii) merging banks' financial health, and (iii) the firm's zombie status.
  - To determine the characteristics of terminated borrowers, explore the impact on the probability of relationship discontinuation.

## 2. Related Literature

### ❑ Efficiency gains and market power:

- Traditional studies: Williamson (1968), Farrell and Shapiro (1990)
- Recent studies: Sapienza (2002), Montgomery and Takahashi (2020)

### ❑ The role of bank-firm lending relationship:

- Relationship disruption: Karceski et al. (2005), Montoriol-Garriga (2008)
- Borrowing conditions: Uchino and Uesugi (2022)

### ❑ Bank mergers and organizational changes:

- Destruction of valuable soft information: Ogura and Uchida (2014)
- Small business lending: Stein (2002), Panetta et al. (2009), Peek and Rosengren (1998)

### ❑ Market structure and banking competition:

- Market concentration and prices: Berger and Hannan (1989), Focarelli and Panetta (2003), Hannan (1991), Demsetz (1973), Peltzman (1977)
- Banking competition: Fraise et al. (2018), Erel (2011)

# 3. Hypotheses and Data

## Hypotheses

- ❑ **Hypothesis 1:** Bank mergers can positively affect lending outcomes through the efficiency effect, but can also have a negative effect on borrowers due to the exercise of market power and the loss of soft information.
- ❑ **Hypothesis 2:** The local market structure (the size of the merger and local market concentration) plays a significant role in determining the sign and magnitude of the impacts on borrowers.
- ❑ **Hypothesis 3:** The impact of a merger on borrowers may largely depend on the financial health of the banks involved in the merger.

# 3. Hypotheses and Data

## Hypotheses

### □ Hypothesis 4:

- **H4A:** Following the mergers, zombie client firms transacted with the merging banks may suffer from a higher probability of being dropped and/or face more stringent borrowing conditions.
  - The merged banks' improvement in screening abilities (Panetta et al., 2009) and financial health
- **H4B:** Alternatively, zombie firms may not experience a higher probability of being dropped and/or may receive more favorable loan terms.
  - The merged banks' improved monitoring abilities, the increased risk-taking capacity, or the beliefs in TBTF and local market stabilization policies (Hosono et al., 2007; Berger et al., 1999; Kobayashi and Bremer, 2022).

□ The impact of bank mergers may differ between public firms and private SMEs, since these groups of firms differ in terms of the closeness of relationship with merging banks, financial constraint level, and bargaining power.

# 3. Hypotheses and Data

## Data

- ❑ Japanese bank merger data during 2005-2018, including 50 mergers
  - Focus on single mergers: Each merging bank is engaged in only one merger event during the period
  - Two mega-mergers: BTM-UFJ in 2005, Mizuho Bank-Mizuho Corporate Bank in 2013
- ❑ Firm data from the TDB database
  - Listing information, corporate attribute, financial statement data, and bank-firm relationship information from 2004 to 2019
  - Focus on firm-main bank relationship
- ❑ HHI of the loan market at the year-prefecture level computed by Uesugi et al. (2022)
- ❑ Bank financial statement data from Nikkei FQ and Financial Book Consultants, Ltd. (Kinyu Tosho Consultant Sha)
  - Due to limited access to the latter source, the dataset starts in 2005 and ends in 2014.
- ❑ Short and long-term prime rates from the website of BOJ
- ❑ Coupon rates on convertible corporate bonds from Nikkei FQ

# 4. Methodology and Results

## 4.1. Impacts of bank mergers on continuing borrowers

$$Y_{i,t} = \alpha_0 + \alpha_1 Merger_{k,t} + \alpha_2 (Merger_{k,t} \times BankShare_{k,r}) + \alpha_3 HHI_{r,t} + \beta X_{i,t-1} + \gamma Z_{k,t} + d_t + f_i + \varepsilon_{ikt} \quad (1)$$

$$Y_{i,t} = \alpha_0 + \alpha_1 Period1_{k,t} + \dots + \alpha_5 Period5_{k,t} + \delta_1 (Period1_{k,t} \times BankShare_{k,r}) + \dots + \delta_5 (Period5_{k,t} \times BankShare_{k,r}) + \lambda HHI_{r,t} + \beta X_{i,t-1} + \gamma Z_{k,t} + d_t + f_i + \varepsilon_{ikt} \quad (2)$$

- $Y_{i,t}$ : Interest Rate (= Interest Expenses\*100/(ST loans + LT loans)); or Loan Ratio =(ST loans + LT loans)/Total Assets) of firm  $i$  in year  $t$
  - $Merger_{k,t}$ : equals one for all years (one or more than one year) after the main bank  $k$  of firm  $i$  involved in a merger, and zero otherwise.
  - $BankShare_{k,r}$ : Number of borrowers of merged bank  $k$  in prefecture  $r$  at the time of merger / Total number of borrowers in prefecture  $r$  at the time of merger
  - $Period1-5_{k,t}$ : equal one if as of time  $t$ , firm  $i$ 's main bank  $k$  involved in a merger one to four, or more than five years ago, respectively; and zero otherwise.
  - $HHI_{r,t}$ : HHI of the loan market in prefecture  $r$  and year  $t$
  - $X_{i,t-1}$ : a vector of firm characteristics at time  $t-1$  (LnAge, Size, Profitability, Tangibility)
  - $Z_{k,t}$ : a vector of bank characteristics (Bank Size, Bank equity ratio, NPL ratio)
  - $d_t, f_i$ : time and firm fixed effects
- Models (1) and (2) are estimated for the public firm and SME samples. New borrowers and terminated borrowers are excluded from these regressions.



# Impact on continuing borrowers: SMEs

	(1)	(2)	(3)	(4)	(5)	(6)
	Interest Rate	Loan Ratio	Interest Rate	Loan Ratio	Interest Rate	Loan Ratio
<b>Merger</b>	-0.0388***	0.0010	-0.0279*	0.0067**	-0.0347*	0.0091**
<b>Merger*BankShare</b>	0.0968***	-0.0043	0.1500***	-0.0314***	0.1836***	-0.0212**
<b>HHI</b>	0.3881***	-0.1354***	0.3984**	-0.1576***	0.2775*	-0.1734***
<b>Sample</b>	All mergers	All mergers	All mergers	All mergers	Non-mega	Non-mega
<b>Period</b>	2005-2019	2005-2019	2005-2014	2005-2014	2005-2014	2005-2014
<b>Bank controls</b>	No	No	Yes	Yes	Yes	Yes
<b>Firm controls (L1.)</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Time FE</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Firm FE</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Observations</b>	1,471,838	1,601,195	866,036	936,319	789,688	848,849

# Impact on continuing borrowers over time: SMEs

	(1)	(2)	(3)	(4)	(5)	(6)
	Interest Rate	Loan Ratio	Interest Rate	Loan Ratio	Interest Rate	Loan Ratio
<b>Period 1</b>	-0.0212	0.0006	-0.0458	0.0076	0.0161	0.0021
<b>Period 2</b>	-0.0144	0.0030	0.0043	0.0025	-0.0507	0.0034
<b>Period 3</b>	0.0062	-0.0053	0.0421	-0.0046	-0.0052	0.0007
<b>Period 4</b>	-0.0288	0.0001	-0.0091	0.0028	-0.0975**	0.0200***
<b>Period 5</b>	-0.1004***	0.0027*	-0.0880***	0.0140***	-0.0735**	0.0261***
<b>Period 1 * Share</b>	0.1018**	0.0048	0.1783***	-0.0236***	0.0889	-0.0054
<b>Period 2 * Share</b>	0.1395***	0.0002	0.2036***	-0.0163*	0.1947**	-0.0028
<b>Period 3 * Share</b>	0.0256	0.0030	0.0375	-0.0168*	0.1066*	-0.0054
<b>Period 4 * Share</b>	0.0901	-0.0168*	0.1208	-0.0437***	0.2389***	-0.0427***
<b>Period 5 * Share</b>	0.1526***	-0.0089*	0.1843***	-0.0517***	0.3078***	-0.0624***
<b>HHI</b>	0.3369***	-0.1373***	0.3253***	-0.1632***	0.2862*	-0.1731***
<b>Sample</b>	All mergers	All mergers	All mergers	All mergers	Non-mega	Non-mega
<b>Period</b>	2005-2019	2005-2019	2005-2014	2005-2014	2005-2014	2005-2014
<b>Bank controls</b>	No	No	Yes	Yes	Yes	Yes
<b>Firm controls (L1.)</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Observations</b>	1,471,838	1,601,195	866,036	936,319	789,688	848,849 <sub>0</sub>

# The role of bank health

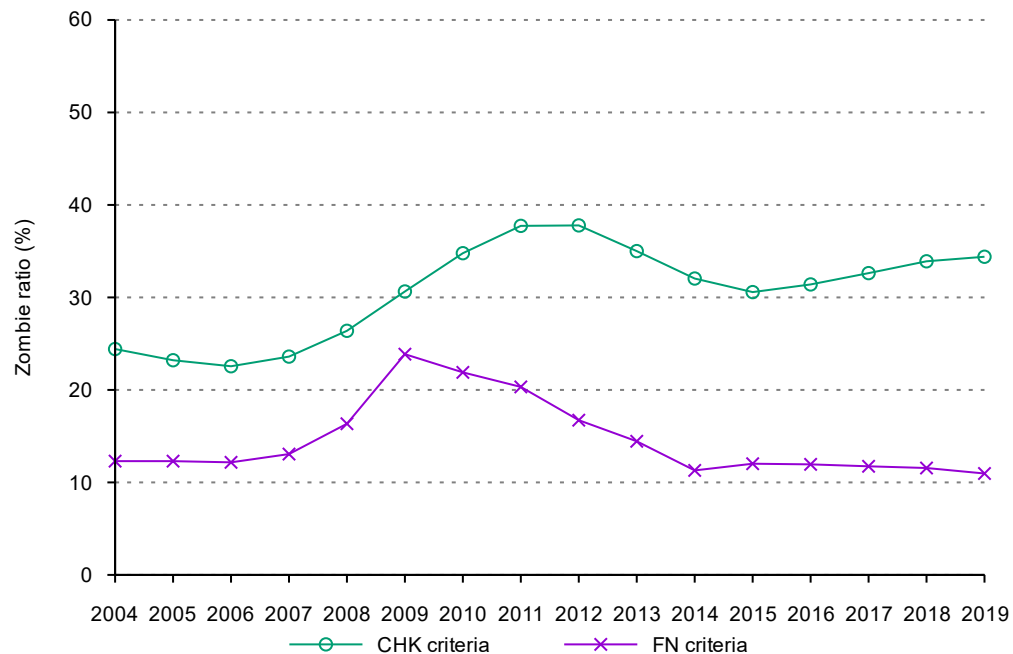
- Model (1) will be utilized for subsamples of mergers (i) between two healthy banks, (ii) between two unhealthy banks, and (iii) between a healthy acquirer and an unhealthy target.
  - A merging bank is classified as healthy if its pre-merger NPL ratio is below the bank sample median.
  - Of 42 mergers from 2005 to 2014, 37 were classifiable
    - 9 mergers between two healthy banks, 16 between two unhealthy banks, 9 between a healthy acquirer and an unhealthy target, and 3 between an unhealthy acquirer and a healthy target.
  - Due to data limitations, this study does not analyze mergers between an unhealthy acquirer and a healthy target, and this analysis is limited to the SME sample.

# Impact on continuing SME borrowers: Bank health

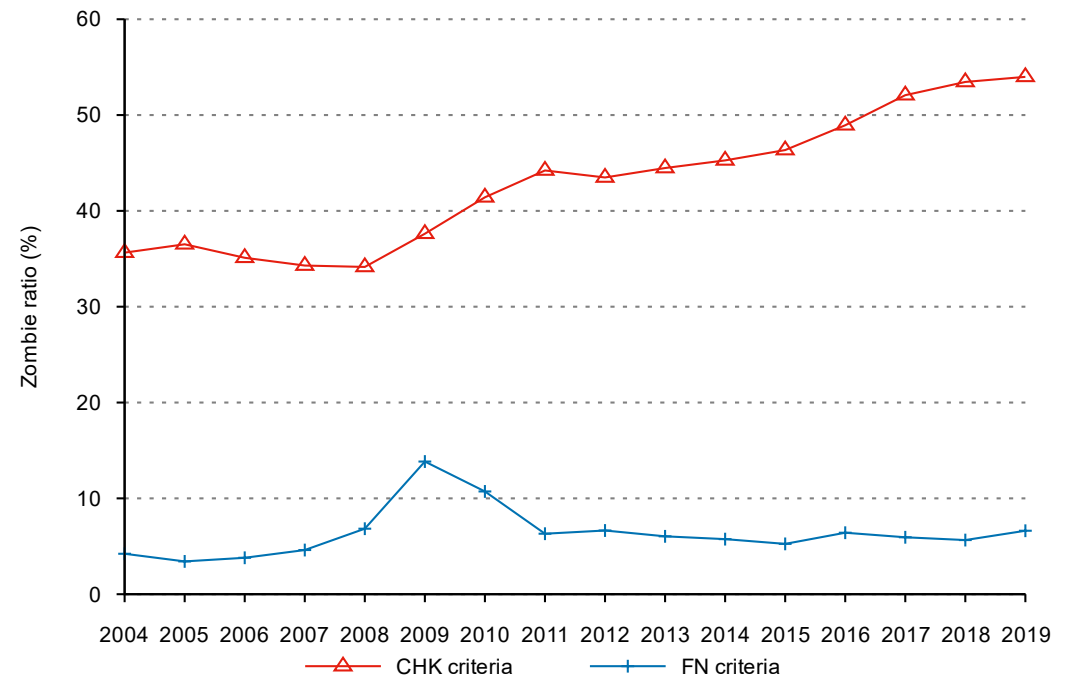
	(1)	(2)	(3)	(4)	(5)	(6)
	Interest Rate	Loan Ratio	Interest Rate	Loan Ratio	Interest Rate	Loan Ratio
<b>Merger</b>	-0.0312	0.0030	-0.0298	0.0608***	-0.0029	0.0147**
<b>Merger*BankShare</b>	0.1658***	-0.0278***	0.2802	-0.3680***	0.1168	-0.0288*
<b>HHI</b>	0.3676***	-0.1602***	0.1453	-0.1538***	0.2051	-0.1760***
<b>Sample</b>	Healthy – Healthy mergers		Unhealthy – Unhealthy mergers		Healthy – Unhealthy mergers	
<b>Period</b>	2005-2014	2005-2014	2005-2014	2005-2014	2005-2014	2005-2014
<b>Bank controls</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Firm controls (L1.)</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Time FE</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Firm FE</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Observations</b>	830,138	897,930	740,389	795,890	744,731	800,446

# Bank mergers and continuing zombie borrowers

- ❑ Zombie subsample: Includes firms being categorized as zombies based on the Fukuda and Nakamura (FN) criteria for at least 2 years during the period 2004-2019.
- ❑ Using the zombie subsample, model (1) is re-estimated.
- ❑ Zombie ratios – Caballero, Hoshi, and Kashyap (CHK) and FN criteria:



Private firm sample



Public firm sample

# Impact of mergers on continuing borrowers: Zombie SMEs

	(1)	(2)	(3)	(4)	(5)	(6)
	Interest Rate	Loan Ratio	Interest Rate	Loan Ratio	Interest Rate	Loan Ratio
<b>Merger</b>	-0.0055	-0.0020	0.0023	0.0077	-0.0259	0.0139
<b>Merger*BankShare</b>	0.0174	0.0044	0.0246	-0.0297*	0.2044**	-0.0288
<b>HHI</b>	0.0898	-0.1569	0.1661	-0.2486***	-0.0739	-0.2545***
<b>Sample</b>	All mergers	All mergers	All mergers	All mergers	Non-mega mergers	Non-mega mergers
<b>Period</b>	2005-2019	2005-2019	2005-2014	2005-2014	2005-2014	2005-2014
<b>Bank controls</b>	No	No	Yes	Yes	Yes	Yes
<b>Firm controls (L1.)</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Time FE</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Firm FE</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Observations</b>	492,694	506,776	307,313	314,961	284,716	291,536

# Impact on continuing zombie SMEs borrowers: Bank health

	(1)	(2)	(3)	(4)	(5)	(6)
	Interest Rate	Loan Ratio	Interest Rate	Loan Ratio	Interest Rate	Loan Ratio
<b>Merger</b>	0.0089	0.0007	-0.2062	0.0799**	-0.0025	0.0311**
<b>Merger*BankShare</b>	0.0180	-0.0230	0.9240	-0.4483*	0.0956	-0.0338
<b>HHI</b>	0.0612	-0.2405***	-0.2503	-0.2137***	-0.1702	-0.2517***
<b>Sample</b>	Healthy – Healthy mergers		Unhealthy – Unhealthy mergers		Healthy – Unhealthy mergers	
<b>Period</b>	2005-2014	2005-2014	2005-2014	2005-2014	2005-2014	2005-2014
<b>Bank controls</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Firm controls (L1.)</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Time FE</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Firm FE</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Observations</b>	293,388	300,710	265,881	272,274	267,949	274,385

# Impact on continuing zombie SMEs borrowers: Bank health

	(1)	(2)	(3)	(4)	(5)	(6)
	ROA	ROS	ROA	ROS	ROA	ROS
<b>Merger</b>	-0.0055	-0.0019	-0.0162	-0.0229**	-0.0057	-0.0058
<b>Merger*BankShare</b>	0.0040	-0.0007	0.1492	0.1646**	0.0015	0.0114
<b>HHI</b>	0.1548***	0.0967***	0.1673***	0.1052***	0.1796***	0.1108***
<b>Sample</b>	Healthy – Healthy mergers		Unhealthy – Unhealthy mergers		Healthy – Unhealthy mergers	
<b>Period</b>	2005-2014	2005-2014	2005-2014	2005-2014	2005-2014	2005-2014
<b>Bank controls</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Firm controls (L1.)</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Time FE</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Firm FE</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Observations</b>	322,316	322,272	291,234	291,192	293,435	293,392



# Bank mergers and Relationship termination

□ The following logit model is employed using the sample of SMEs or public firms (new borrowers are excluded):

$$Pr(Discontinued_{i,t} = 1) = G[\alpha_0 + \alpha_1 Merger\_ST_{k,t} + \alpha_2 Merger_{k,t} + \alpha_3 (Merger\_ST_{k,t} \times Zombie_{i,t-1}) + \alpha_4 (Merger_{k,t} \times Zombie_{i,t-1}) + \alpha_5 Zombie_{i,t-1} + \lambda HHI_{r,t} + \beta X_{i,t-1} + \gamma Z_{k,t}] \quad (3)$$

$$Pr(Discontinued_{i,t} = 1) = G[\alpha_0 + \alpha_1 Acquirer\_ST_{i,k,t} + \alpha_2 Acquirer_{i,k,t} + \alpha_3 Target\_ST_{i,k,t} + \alpha_4 Target_{i,k,t} + \alpha_5 (Acquirer\_ST_{i,k,t} \times Zombie_{i,t-1}) + \alpha_6 (Acquirer_{i,k,t} \times Zombie_{i,t-1}) + \alpha_7 (Target\_ST_{i,k,t} \times Zombie_{i,t-1}) + \alpha_8 (Target_{i,k,t} \times Zombie_{i,t-1}) + \alpha_9 Zombie_{i,t-1} + \lambda HHI_{r,t} + \beta X_{i,t-1} + \gamma Z_{k,t}] \quad (4)$$

- $G(\cdot)$  is a cumulative distribution function of a logistic distribution:  $G(z) = \exp(z)/[1 + \exp(z)]$
- $Discontinued_{i,t}$ : equals one for year  $t$  if firm  $i$  report having the firm-main bank relationship with a different bank in the subsequent year, and zero otherwise.
- $Merger\_ST_{k,t}$ : equals one for the year of the merger and the nearest year before the merger (the maximum gap between these two time-points is 3 years) that the main bank  $k$  of firm  $i$  involved in, and zero otherwise.
- $Merger_{k,t}$ : equals one for all years (one or more than one year) after the main bank  $k$  of firm  $i$  involved in a merger, and zero otherwise.
- $Acquirer\_ST_{i,k,t}, Target\_ST_{i,k,t}$ : equals one for the year of the merger or the nearest year before the merger (the maximum gap is 3 years) that the main bank  $k$  of firm  $i$  involved in as an acquirer or a target, respectively, and zero otherwise.
- $Acquirer_{i,k,t}, Target_{i,k,t}$ : equals one for all years (one or more than one year) after the main bank  $k$  of firm  $i$  involved in a merger, and zero otherwise, provided that firm  $i$  had a main bank relationship with the acquirer or the target bank, respectively, prior to this merger event.
- $Zombie_{i,t-1}$ : equals one if firm  $i$  was classified as a zombie based on the FN criteria in year  $t-1$
- The remaining variables are defined as in model (1).

# Impact of mergers on relationship termination of SMEs - AME

Dependent variable: Discontinued				
	(1)	(2)	(3)	(4)
<b>Merger_ST</b>	0.0086***		0.0077***	
<b>Merger</b>	-0.0018***		-0.0026***	
<b>Merger_ST*Zombie</b>			0.0117***	
<b>Merger*Zombie</b>			0.0075***	
<b>Target_ST</b>		0.0085***		0.0077***
<b>Target</b>		-0.0003		-0.0014
<b>Acquirer_ST</b>		0.0088***		0.0078***
<b>Acquirer</b>		-0.0027***		-0.0033***
<b>Target_ST*Zombie</b>				0.0103**
<b>Target*Zombie</b>				0.0095***
<b>Acquirer_ST*Zombie</b>				0.0123***
<b>Acquirer*Zombie</b>				0.0061**
<b>Zombie</b>			-0.0010	-0.0010
<b>HHI</b>	-0.0438***	-0.0436***	-0.0459***	-0.0457***
<b>Period</b>	2005-2014	2005-2014	2005-2014	2005-2014
<b>Observations</b>	1,084,397	1,084,397	1,017,079	1,017,079

# Impact of mergers on relationship termination of SMEs: Bank health

Dependent variable: Discontinued						
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Merger_ST</b>	0.0103***	0.0092***	0.0001	-0.0004	0.0022	0.0026
<b>Merger</b>	0.0023***	0.0012	0.0032	0.0024	-0.0077***	-0.0076***
<b>Merger_ST*Zombie</b>		0.0139***		-0.0068		0.0127
<b>Merger*Zombie</b>		0.0095***		0.0076		0.0028
<b>Zombie</b>		-0.0011		-0.0009		-0.0010
<b>HHI</b>	-0.0441***	-0.0463***	-0.0558***	-0.0586***	-0.0584***	-0.0614***
<b>Sample</b>	Healthy – Healthy mergers		Unhealthy – Unhealthy mergers		Healthy – Unhealthy mergers	
<b>Period</b>	2005-2014	2005-2014	2005-2014	2005-2014	2005-2014	2005-2014
<b>Observations</b>	1,039,407	975,203	916,779	857,124	921,927	861,975

## 4.2. Impact of bank mergers on publicly listed borrowers

### Impact on continuing borrowers: Public firms

	(1)	(2)	(3)	(4)
	Interest Rate	Loan Ratio	Interest Rate	Loan Ratio
<b>Merger</b>	-0.0971	0.0003	0.0485	0.0046
<b>Merger*BankShare</b>	0.2705	0.0005	0.0018	-0.0039
<b>HHI</b>	-1.0535	-0.0663**	0.8139	-0.0946**
<b>Sample</b>	All mergers	All mergers	All mergers	All mergers
<b>Period</b>	2005-2019	2005-2019	2005-2014	2005-2014
<b>Bank controls</b>	No	No	Yes	Yes
<b>Firm controls (L1.)</b>	Yes	Yes	Yes	Yes
<b>Time FE</b>	Yes	Yes	Yes	Yes
<b>Firm FE</b>	Yes	Yes	Yes	Yes
<b>Observations</b>	28,421	36,923	18,837	24,426

# Impact on continuing borrowers over time: Public firms

	(1)	(2)	(3)	(4)
	Interest Rate	Loan Ratio	Interest Rate	Loan Ratio
<b>Period 1</b>	0.0264	-0.0021	0.0520	0.0015
<b>Period 2</b>	0.0485	0.0012	0.3801	0.0024
<b>Period 3</b>	-0.1458	-0.0011	-0.0280	0.0059
<b>Period 4</b>	-0.1432	0.0007	0.0320	0.0070
<b>Period 5</b>	-0.1599	0.0025	-0.0369	0.0150**
<b>Period 1 * Share</b>	0.0713	0.0065	0.0053	0.0013
<b>Period 2 * Share</b>	0.1393	-0.0032	-0.5691	-0.0022
<b>Period 3 * Share</b>	0.1084	0.0035	0.0172	-0.0031
<b>Period 4 * Share</b>	0.2194	-0.0028	0.0957	-0.0118
<b>Period 5 * Share</b>	0.4542	-0.0023	0.1947	-0.0204*
<b>HHI</b>	-0.9776	-0.0662**	0.8378	-0.0942**
<b>Sample</b>	All mergers	All mergers	All mergers	All mergers
<b>Period</b>	2005-2019	2005-2019	2005-2014	2005-2014
<b>Bank controls</b>	No	No	Yes	Yes
<b>Firm controls (L1.)</b>	Yes	Yes	Yes	Yes
<b>Observations</b>	28,421	36,923	18,837	24,426

# Impact on continuing borrowers: Public zombie firms

	(1)	(2)	(3)	(4)
	Interest Rate	Loan Ratio	Interest Rate	Loan Ratio
<b>Merger</b>	0.2777**	-0.0126*	0.4999***	-0.0192
<b>Merger*BankShare</b>	-0.4695	0.0285	-0.6049	0.0439
<b>HHI</b>	0.9457	0.0820	4.5311**	0.0531
<b>Sample</b>	All mergers	All mergers	All mergers	All mergers
<b>Period</b>	2005-2019	2005-2019	2005-2014	2005-2014
<b>Bank controls</b>	No	No	Yes	Yes
<b>Firm controls (L1.)</b>	Yes	Yes	Yes	Yes
<b>Time FE</b>	Yes	Yes	Yes	Yes
<b>Firm FE</b>	Yes	Yes	Yes	Yes
<b>Observations</b>	7,352	7,960	4,867	5,237

# Impact on relationship termination of public firms - AME

Dependent variable: Discontinued				
	(1)	(2)	(3)	(4)
Merger_ST	0.0041		0.0030	
Merger	-0.0082**		-0.0097**	
Merger_ST*Zombie			0.0161	
Merger*Zombie			0.0166**	
Target_ST		0.0005		-0.0000
Target		-0.0107		-0.0131
Acquirer_ST		0.0071		0.0057
Acquirer		-0.0054*		-0.0062*
Target_ST*Zombie				0.0156
Target*Zombie				0.0232**
Acquirer_ST*Zombie				0.0151
Acquirer*Zombie				0.0073
Zombie			0.0012	0.0013
HHI	-0.0715***	-0.0747***	-0.0723***	-0.0753***
Period	2005-2014	2005-2014	2005-2014	2005-2014
Observations	25,719	25,719	25,693	25,693

# 5. Conclusion

- ❑ Bank mergers can generate heterogeneous effects on the financing of the client firms, depending on the characteristics of the mergers, firms, and bank-firm relationships.
- ❑ Overall impacts:
  - For SME borrowers, mergers generally reduce interest rates and increase loan ratios in the long run. However, when large or financially healthy banks are involved, the effects could be reversed.
  - The impact of mergers on publicly listed firms are significantly weaker.
- ❑ Zombie client firms:
  - Mergers between healthy banks are likely to result in the termination of relationships with zombie SMEs, while mergers involving at least one unhealthy bank tend to result in continued relationships and increased lending to zombie SMEs.
  - The adverse impact of bank mergers on zombie SMEs, if any, is reflected in the termination of bank-firm relationships, whereas the impact on listed zombie firms appears in stricter borrowing terms.



# Appendix

# Number of merger cases

	City bank	Regional bank	Trust bank	Shinkin bank	Credit Cooperatives	Total
<b>2005</b>	0	0	0	4	4	8
<b>2006</b>	1	2	0	4	1	8
<b>2007</b>	0	1	0	2	0	3
<b>2008</b>	0	1	0	5	1	7
<b>2009</b>	0	0	0	3	0	3
<b>2010</b>	0	2	1	2	2	7
<b>2011</b>	0	0	0	1	0	1
<b>2012</b>	0	1	0	1	0	2
<b>2013</b>	1	0	0	0	1	2
<b>2014</b>	0	0	0	1	0	1
<b>2015</b>	0	0	0	0	0	0
<b>2016</b>	0	0	0	2	0	2
<b>2017</b>	0	0	0	1	1	2
<b>2018</b>	1	1	0	1	1	4
<b>Total</b>	3	8	1	27	11	50

# Largest mergers in terms of total assets

No.	Merger_YM	Merged Bank	Acquirer	Targets	Classification
1	2006/01	MUFG Bank	Bank of Tokyo Mitsubishi	United Financial of Japan	City Bank
2	2013/07	Mizuho Bank	Mizuho Bank	Mizuho Corporate Bank	City Bank
3	2012/09	Juroku Bank	Juroku Bank	Gifu Bank	Regional Bank
4	2018/10	Aozora Bank	Aozora Bank	GMO Aozora Net Bank	City Bank
5	2006/10	Kiyo Bank	Kiyo Bank	Wakayama Bank	Regional Bank
6	2018/05	Kiraboshi Bank	Tokyo Tomin Bank	Yachiyo Bank, Shin-Ginko Tokyo	Trust Bank
7	2010/05	Senshu Ikeda Bank	Senshu Bank	Ikeda Bank	Regional Bank
8	2006/01	Tama Shinkin Bank	Tama Chuo Shinkin Bank	Taihei Shinkin Bank, Hachioji Shinkin Bank	Shinkin Bank
9	2010/03	Ibaraki Bank	Kanto Tsukuba Bank	Ibaraki Bank	Regional Bank
10	2006/03	Yamagata Bank	Yamagata Bank	Yamagata Kencho Shokuin Credit Cooperative	Regional Bank

# Mergers with the highest local market share (at the time of the merger)

No.	Merger Y/M	Prefecture	Merged Bank	Acquirer	Target	Classification
1	2006/10	Wakayama	Kiyo Bank	Kiyo Bank	Wakayama Bank	Regional Bank
2	2008/10	Hokkaido	Hokuyo Bank	Hokuyo Bank	Sapporo Bank	Regional Bank
3	2012/09	Gifu	Juroku Bank	Juroku Bank	Gifu Bank	Regional Bank
4	2006/03	Yamagata	Yamagata Bank	Yamagata Bank	Yamagata Kencho Shokuin Credit Cooperative	Regional Bank
5	2006/01	Tokyo	MUFG Bank	Bank of Tokyo Mitsubishi	United Financial of Japan	City Bank
6	2007/05	Yamagata	Kirayaka Bank	Yamagata Shiawase Bank	Shokusan Bank	Regional Bank
7	2006/01	Aichi	MUFG Bank	Bank of Tokyo Mitsubishi	United Financial of Japan	City Bank
8	2006/01	Osaka	MUFG Bank	Bank of Tokyo Mitsubishi	United Financial of Japan	City Bank
9	2013/07	Tokyo	Mizuho Bank	Mizuho Bank	Mizuho Corporate Bank	City Bank
10	2010/03	Ibaraki	Ibaraki Bank	Kanto Tsukuba Bank	Ibaraki Bank	Regional Bank

# Summary statistics – Firm variables

Variable	Obs.	Mean	SD	Min	Max
<b>A. Private SMEs</b>					
Loan ratio	1,783,142	0.5170	0.4914	0	3.2464
Interest rate	1,637,431	2.2656	1.7282	0	12.2311
Tangibility	1,782,656	0.2685	0.2227	0	1.0847
Size	1,783,142	12.3047	1.6429	0	21.1091
Profitability	1,755,699	0.0282	0.1650	-2.5685	1.0554
Ln Age	1,783,142	3.2740	0.6483	0.6928	4.8461
<b>B. Public firms</b>					
Loan ratio	40,945	0.1374	0.1470	0	3.2464
Interest rate	31,618	2.2593	2.1518	0	12.2311
Tangibility	40,945	0.2477	0.1860	0	0.9441
Size	40,945	17.1711	1.6177	11.3919	23.5978
Profitability	40,909	0.0487	0.0836	-3.7396	0.8864
Ln Age	40,945	3.8727	0.5715	1.0694	4.9404

# Summary statistics – Market concentration and bank variables

Variable	Obs.	Mean	SD	Min	Max	Period
<b>A. Market concentration</b>						
HHI	705	0.2213	0.0706	0.0486	0.3700	2005-2019
<b>B. Bank characteristics</b>						
Bank size	5,170	12.7748	1.5125	8.3081	19.1219	2005-2014
Bank equity ratio	5,170	0.0529	0.0205	0.0096	0.2092	2005-2014
Bank NPL	5,144	0.0741	0.0434	0	0.4846	2005-2014
<b>C. Merged banks' market shares</b>						
Bank share (Full sample)	220	0.0630	0.1253	0.0000	0.8593	2005-2018
Bank share (SME sample)	187	0.0698	0.1319	0.0000	0.8593	2005-2014
Bank share (SME sample)	211	0.0656	0.1272	0.0000	0.8593	2005-2018
Bank share (Public firms)	89	0.1060	0.1713	0.0001	0.8593	2005-2014
Bank share (Public firms)	96	0.1004	0.1665	0.0001	0.8593	2005-2018

# Impact of mergers on continuing SME borrowers: Sub-period analysis

	(1)	(2)	(3)	(4)
	Interest Rate	Loan Ratio	Interest Rate	Loan Ratio
<b>Merger</b>	-0.0134	0.0022	-0.0371*	0.0107**
<b>Merger*BankShare</b>	0.3102***	-0.0353***	0.0388	0.0009
<b>HHI</b>	0.3476**	-0.0492	-0.5275*	0.0729
<b>Period</b>	2005-2009	2005-2009	2010-2014	2010-2014
<b>Bank controls</b>	Yes	Yes	Yes	Yes
<b>Firm controls (L1.)</b>	Yes	Yes	Yes	Yes
<b>Time FE</b>	Yes	Yes	Yes	Yes
<b>Firm FE</b>	Yes	Yes	Yes	Yes
<b>Observations</b>	389,093	417,208	476,943	519,111

# Impact of mergers on continuing SME borrowers by banking categories

	(1)	(2)	(3)	(4)
	Interest Rate	Loan Ratio	Interest Rate	Loan Ratio
<b>Merger</b>	-0.0537*	0.0121**	0.0107	-0.0236***
<b>Merger*BankShare</b>	0.2529***	-0.0324***	-0.2596	0.1828***
<b>HHI</b>	0.1701	-0.1253***	-0.1231	-0.3002***
<b>Subsample</b>	Regional Banks	Regional Banks	Shinkin, Credit Cooperatives	Shinkin, Credit Cooperatives
<b>Period</b>	2005-2014	2005-2014	2005-2014	2005-2014
<b>Bank controls</b>	Yes	Yes	Yes	Yes
<b>Firm controls (L1.)</b>	Yes	Yes	Yes	Yes
<b>Time FE</b>	Yes	Yes	Yes	Yes
<b>Firm FE</b>	Yes	Yes	Yes	Yes
<b>Observations</b>	494,549	535,300	233,846	245,571



# Methodology – Identify Zombie firms

## □ Caballero, Hoshi, and Kashyap (CHK) criteria (Caballero et al., 2008)

- The minimum required interest payment -  $R_{k,t}^*$ :

$$R_{i,t}^* = rs_{t-1}BS_{i,t-1} + \left( \frac{1}{5} \sum_{j=1}^5 rl_{t-j} \right) BL_{i,t-1} + rcb_{\min \text{ over last 5 years}, t} \times Bonds_{i,t-1}$$

where  $BS_{i,t}$ ,  $BL_{i,t}$ , and  $Bond_{i,t}$  are short-term bank loans, long-term bank loans, and total bonds outstanding, respectively, of firm  $i$  at the end of year  $t$ ;  $rs_t$ ,  $rl_t$ ,  $rcb_{\min \text{ over the last 5 years}, t}$  are the average short-term prime rate in year  $t$ , the average long-term prime rate in year  $t$ , and the minimum observed coupon rate on any convertible corporate bond issued in the last five years before  $t$ .

- Zombies are those whose interest payments were lower than the minimum required interest payment.

## □ Fukuda and Nakamura (FN) criteria (Fukuda and Nakamura, 2011)

- FN proposed two additional criteria to identify zombies more accurately:
- *Profitability* criterion: firms whose EBIT (Current Profit + Interest and Discount Expenses - Interest Income) exceeded the hypothetical risk-free interest payments ( $R_{k,t}^*$ ) were excluded from being categorized as zombies.
- *Evergreen lending* criterion: firms whose EBIT was less than  $R_{k,t}^*$  in period  $t$ , total external debt was over half of their total assets in period  $t-1$ , and borrowings increased in period  $t$  were categorized as zombies in the period  $t$ .