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EFFECT OF BANK MERGERS ON CLIENT FIRMS: EVIDENCE FROM THE CREDIT SUPPLY CHANNEL

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This study investigates the effects of bank mergers on client firms. A rich panel of data detailing firm borrowing from individual banks enables controls for demand-side effects to isolate the effect of bank mergers on the supply of credit. The impact of bank mergers on other firm outcomes (growth in total borrowing, distance to default and investment) is also examined. A merger announcement by a firm's main bank results in a contraction in credit supply from the merging bank. Firms are not able to compensate for the reduced credit supply from the main bank, so overall borrowing also declines.
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1. Introduction

Finance theory holds that banks are special because of their ability to gather soft information about their client firms (Fama, 1985). Because such information builds over time, access to bank finance is particularly valuable in relationship-based banking systems where bank–firm relationships are long-term commitments. Thus, bank mergers, which may result in the loss of soft information or just weaken one of the merging banks' decision authority to make use of soft information, may damage affiliated client firms' access to bank credit.

Studies examining the effects of bank mergers on client firms generally support this hypothesis. There is evidence that client firms whose main bank merges are more likely to have their main bank relationship terminated (Karceski *et al.*, 2005; Degryse *et al.*, 2011) suffer the loss of soft information (Ogura and Uchida, 2014), experience declines in aggregate outstanding loans and credit lines (Bonaccorsi di Patti and Gobbi, 2007), and pay higher borrowing costs (Sapienza, 2002; Uchino and Uesugi, 2012).

However, no existing study has been able to estimate the effect of bank mergers on individual loans to specific firms. The present study fills that gap in the literature. Using a unique data set that links non-financial client firm outstanding loans to the originating banks, we are able to analyse the effect of banks mergers on the supply of loans from individual banks to specific firms. Applying methodology pioneered by Khwaja and Mian (2008) and Giannetti and Simonov (2013), we control for any omitted variables that may influence firm demand for loans, isolating the effect of bank mergers on the supply of credit. This allows us to examine whether the supply of credit is affected by the announcement of a merger by the firms' main bank. We then look at the effect of bank mergers on a number of other longer-term variables: growth in total firm borrowing, distance to default and firm investment.

We find that banks involved in mergers supply statistically significantly lower credit to their client firms in the year of a bank merger announcement and over the following 3 years. The decline is especially sharp for client firms that are credit-constrained. Firms are not able to compensate for the reduced credit supply from the main bank, so overall growth in firm borrowing also declines. Zombie firms, which enjoy significantly higher

credit supply from their main bank, are, nonetheless, disproportionately affected. Following an announcement of a bank merger by the main bank, zombie firms experience a particularly sharp decline in total firm borrowing. Credit-constrained and zombie firms also experience a sharp decline in distance to default and firm investment following a bank merger announcement by their main bank.

The rest of this paper is organised as follows. The next section describes the data set and Section 3 explains the empirical methodology. Section 4 presents our main results: the effect of bank merger announcements on the supply of credit from individual banks to affiliated client firms. Section 5 considers the effects on other long-term firm outcomes: growth in total borrowing, distance to default and firm investment. Section 6 concludes.

2. Data

In this study, bank–firm relationships are defined using the *Japan Company Handbook* survey data which asks firms to identify a "main bank" with which the firm has a special relationship. There is no legal definition of a main bank, but nearly every Japanese company reports having one.[1] In our sample of 5,102 publicly-listed firms in Japan, 97% declare a main bank in every year of the sample. Bank–firm relationships are usually very stable. After controlling for the effect of mergers, most of the firms in our sample stayed with the same main bank for all 23 years of the sample.

The bank–firm relationship data from the *Japan Company Handbook* is matched with data on bank merger announcements, loans between each bank–firm pair, and financial statements for both banks and client firms. Bank merger announcements over the sample period 1990–2012 are identified using Nikkei Telecom 21, an archive of Japan's leading newspapers. The sample is restricted to merger announcements that were completed. Firms' outstanding loans with each individual bank and annual financial statements are from the *Nikkei NEEDS* database.

The final data set yields 367,307 total observations of individual loans between bank–firm pairs over the period 1990–2012. The individual loans are then matched up with data on the firms receiving the loans and the lending banks, as well as announcements of bank mergers during the sample period. Summary statistics for the full sample of banks, client firms and merger events are presented in Table 1.

As reported in Table 1, of the 161 banks in the sample, 64 banks have experienced a merger during the sample period. The median bank that merges does so only once, although there is one bank that was involved in four mergers.

Of the 4,450 firms in the sample, 2,177 firms, are credit-constrained (working capital ratio in the bottom 25% of the sample in any given year) at some point in the sample. A total of 1,012 firms are not only credit-constrained, but qualify as sick "zombie" firms at some point in the sample period. We adopt Peek and Rosengren's (2005) definition of credit-constrained and sick firms. Credit-constrained firms have a working capital ratio in the bottom 25% of the sample in any given year. Sick firms are credit-constrained firms that also have a return on assets in the bottom 25% of the sample in

[1] Aoki *et al.* (1995, p. 5) report that "according to a survey of some 110,000 companies with annual sales of 1 billion yen or more…. almost every Japanese company has what it calls a main bank relationship".

TABLE 1
Summary statistics for banks, client firms and mergers, 1990–2012 (23 years)

	n	Number of observations, *n*	Mean	Median	1st percentile	99th percentile
Banks	161					
Total assets, trillion yen		3,128	5.9	2.0	0.2	74.2
Regulatory capital ratio surplus, %		2,508	4.6%	4.5%	0.1%	12.9%
ROA, %		3,127	−0.1%	0.1%	−4.0%	1.2%
Merged banks	64					
Total assets, trillion yen		1,111	11.3	2.7	0.2	111.1
Regulatory capital ratio surplus, %		888	4.1%	3.4%	0.0%	22.4%
ROA, %		1,111	−0.1%	0.1%	−4.0%	2.4%
Merger events, number		102	1.6	1	1	4
Client firms	4,450					
Sales, billion yen		63,373	128	27	1	1,873
ROA, %		63,352	3.9%	3.3%	−8.2%	17.5%
Working capital ratio, %		63,376	16.2%	15.8%	−29.1%	62.5%
Credit-constrained firms	2,177					
Sales, billion yen		15,847	148	29	1	2,122
ROA, %		15,844	2.8%	2.5%	−8.5%	14.3%
Working capital ratio, %		15,850	−9.1%	−7.0%	−34.3%	3.8%
Zombie firms	1,012					
Sales, billion yen		1,960	131	24	0.4	2,680
ROA, %		1,961	−1.3%	−0.2%	−12.0%	2.8%
Working capital ratio, %		1,961	−9.8%	−7.5%	−34.7%	3.6%
Mergers	46					
Size of the deal, trillion yen			28.3	6.3	1.1	184.0
Number of merged banks		53	2	2	0	3
Number of merged banks' client firms		2,883	140	15	0	937

Note: ROA, return on assets.

any given year and annual stock returns in the bottom one-third of the sample in any given year. The idea is that firms with low working capital may face temporary liquidity shortages and difficulty paying short-term debts. These firms are credit-constrained and presumably bank-dependent, but are not necessarily fundamentally unsound. Sick firms, in contrast, are not only credit-constrained, but also fundamentally unsound. Evidence that these kinds of firms are more likely to receive additional or cheaper bank credit (Peek and Rosengren, 2005), a practice that keeps otherwise insolvent borrowers alive, has led them to be called "zombie" firms (Caballero *et al.*, 2008). Note that the credit-constrained and zombie firms are not necessarily small firms and, in fact, on average have higher annual sales than the other firms in the sample. There is evidence that forbearance lending to zombie firms has brought enormous economic costs to the Japanese economy (Caballero *et al.*, 2008).

3. Empirical methodology

3.1 Isolating credit supply

The final data set described above has three dimensions: individual banks *b*, individual client firms *i*, and time *t*. It is this rich, three-dimensional panel that allows us to isolate the supply of credit from firm demand for loans. The three dimensions to the data mean that in regression analysis the researcher can potentially control for two out of three

dimensions to the data: bank fixed effects, $Bank_b$, firm fixed effects, $Firm_i$, or time fixed effects, $Year_t$. Following an approach first proposed by Khwaja and Mian (2008) in a natural experimental setting and then later adopted by Giannetti and Simonov (2013) in a non-experimental setting, we create an interaction term between firm fixed effects and time fixed effects: $Firm_i \times Year_t$. This firm–year fixed effect adds a unique intercept for each firm-year, controlling for all firm-side factors, even those that may vary by year, such as demand for loans.

Having controlled for any omitted firm-side factors, we can then use the growth in lending from individual banks to individual firms in each time period to capture the supply of credit from bank b to firm i in period t. In the credit supply analysis, we are also able to include bank fixed effects, $Bank_b$, to investigate within-bank variation in credit supply before and after merger events.

3.2 Difference-in-difference analysis

Although our main analysis is on a three-dimensional data set, most of the empirical analysis to follow uses some variant of difference-in-difference techniques. Difference-in-difference analysis is often used for policy evaluation, to track the effect of individuals potentially affected by the policy by comparing changes in outcomes for those receiving the policy intervention, the "treated" group, to a control group that does not. Here, the "treatment" or "policy intervention" of interest is an announcement of a bank merger, in particular an announcement of a merger by a client firm's main bank. The individuals potentially affected by the policy intervention (the bank merger) are the client firms of the banks announcing the merger.

Measurement of the effect of treatment on the outcome variable may be confounded in two ways: by changes in the response over time for reasons unrelated to the policy change and by pre-existing trends in the outcome of interest that may be different for "treated" individuals receiving the policy intervention, as compared to the "control" group of individuals not receiving the policy intervention. Difference-in-difference analysis isolates the policy effect from effects of unrelated events and pre-existing trend differentials in the treated and control groups by including dummy variables identifying the post-intervention period, $Post_t$, and individuals receiving intervention, $Treatment_b$.

A standard difference-in-difference estimation equation on a three-dimensional panel such as ours would be something like Equation (1):

$$y_{i,b,t} = \beta_0 + \beta_1 Treatment_b + \beta_2 Post_t + \beta_3 Treatment_b \times Post_t + \varepsilon_{i,b,t}, \tag{1}$$

where subscripts i, b and t stand for the client firm, its main bank and the year, respectively. $y_{i,b,t}$ is the outcome variable of interest. $Treatment_b$ is a dummy variable indicating that a bank b announced a merger during the sample period. $Post_t$ is a dummy variable that takes a value of one in the periods following treatment, the announcement of a bank merger.

The parameter of interest in difference-in-difference analysis is the coefficient estimate on the interaction term of the two dummy variables, $Treatment_b \times Post_t$. The parameter estimate on the difference-in-difference term, β_3 in Equation (1), captures the average effect of treatment, a main bank merger announcement, isolated from unrelated changes

over time and any differentials in preexisting trends for the treatment and control groups.

Two assumptions are required for difference-in-difference analysis to be valid. First, treatment, whether a bank merges, must not be systematically related to other factors that affect the outcome variable of interest. There must not be any omitted variable that simultaneously affects whether a main bank merges and the outcome variable. Second, counterfactual trend behaviour for the treated and control groups must be the same. Under the counterfactual of no bank merger, underlying trends in the outcome variable must be the same for both the treated (firms whose main bank merges) and the control (firms whose main bank does not merge) groups. In other words, any observed differences in the trend of the outcome variable between the treated and the control groups should be due *only* to treatment, the fact that the main bank announced a merger.

The first condition for unbiased difference-in-difference estimation is addressed by including time fixed effects and bank–firm pair fixed effects, an interaction term of bank fixed effects and firm fixed effects. It is unlikely that a single client firm outcome affects its main bank's decision to merge once unobserved time-varying factors such as macroeconomic conditions are taken into account through the inclusion of time fixed effects. Although it is possible that client firm outcomes are correlated to the banks' tendency to merge at the formation of the bank–firm relationship, the inclusion of bank–firm pair fixed effects accounts for this and any other potential endogeneity in bank–firm matching.[2] The inclusion of bank–firm fixed effects effectively isolates within bank–firm pair variation, allowing comparison of the same bank–firm pair in events in which the main bank merges and events in which the main bank does not merge.

The second condition for unbiased difference-in-difference estimation is met through something similar to sampling with replacement: the "treated" group of client firms of merged banks is replaced in the sample as part of the control group once the effects of a merger announcement have passed, which we assume to be 3 years after the announcement. This strategy has been used in other policy intervention studies (e.g. Bertrand and Mullainathan, 2003). Because client firms move in and out of the treated and control group for each bank merger announcement event, the treated and control group are quite homogeneous. Thus, any observed differences in outcome variables following bank merger announcements can plausibly be attributed to the announcement of the merger.

3.3 Distance to default

In examining the effect of bank mergers on firm outcomes other than the supply of credit from the main bank, we include the firm's distance to default. A firm's distance to default shows how far the firm is from the default point at which the firm cannot repay its debts without rolling them over. It is an application of the Black–Scholes options pricing model due to Black and Scholes (1973) and Merton (1974)

[2] Note that matching endogeneity can be more complex than simply the case of weak firms pairing with weak banks, as is often assumed in the literature (Gan, 2007; Chodorow-Reich, 2014). Bank–firm pair fixed effects capture the effects of any unobserved factors, including geographic and corporate cultural proximity between banks and client firms, and banks' specialisation in the client firm business.

and is widely used in the industry (Crosbie and Bohn, 2003) as well as in academia (Gropp and Moerman, 2004; Gropp *et al.*, 2006; Duffie *et al.*, 2007; Harada and Ito, 2011).

For a given firm, the distance to default is defined as follows:

$$DD_t = \frac{\log(V_t/D_t) + (\mu - 0.5\sigma^2)T}{\sigma\sqrt{T}}, \tag{2}$$

where subscript t stands for year, and V_t is market value of total assets, D_t is book value of total debts, μ is the mean growth rate of V_t, σ is the standard deviation of the growth rate of V_t, and T is the time to maturity of currently outstanding debts, which is usually assumed to be 1 year.

In the Black–Scholes model, the numerator of Equation (2) is the evolution of a firm's market value of assets until the firm's debts mature. Thus, conceptually, distance to default is the number of standard deviations the firm is from default: the point at which $V = D$.

Because the market value of assets cannot be directly observed, we calculate it through the following iterative process:

1. Set initial value of V_t, for which we use the firm's book value of total assets in the previous year.
2. Calculate σ as $sd\left(\log\left(\frac{V_t}{V_{t-1}}\right)\right)$, where sd stands for standard deviation.
3. Update V_t using the following equation:

$$V_t = W_t/\Phi(\mathrm{d}_1) - D_t \exp(-r)\Phi(d_2)/\Phi(d_1), \tag{3}$$

where W_t is the firm's market capitalisation, r is the risk-free rate, the 1-year Japanese government bond yield, Φ is a standard normal cumulative distribution function and d_1 and d_2 are defined as follows:

$$d_1 = \frac{\log(V_t/D_t) + (r + 0.5\sigma^2)}{\sigma} \tag{4}$$

and

$$d_2 = d_1 - \sigma. \tag{5}$$

Here, D_t, the book value of total debt, is defined as the sum of bank loans, corporate bonds and commercial paper.

4. If the updated value of V_t is close enough to the initial value of V_t, use V_t in Equation (2) to calculate distance to default. Otherwise, set the updated value of V_t as the initial value and repeat from step 2.

4. Empirical results: Bank mergers and the supply of credit

Applying the difference-in-difference techniques explained above to analysis of the main bank supply of credit to client firms following the announcement of a bank merger event yields the following specification:

$$\begin{aligned}\frac{\Delta L_{i,b,t}}{L_{i,b,t-1}} =& \beta_0 + \beta_1 Merged_b + \beta_2 Post_t + \beta_3 Merged_b \times Post_t \\ &+ \beta_4 MainBank_{i,b,t-1} \times Merged_b \times Post_t + BankControls_b \\ &+ Firm_i \times Year_t + Bank_b + \varepsilon_{i,b,t},\end{aligned} \tag{6}$$

where $L_{i,b,t}$ is outstanding loans from bank b to firm i in year t and Δ is the first difference operator. $Merged_b$ is a dummy variable indicating "treatment", that a bank b announced a merger during the sample period. $Post_t$ is a dummy variable that takes the value of one in the post-merger period: the year a bank merger is announced or, for evaluation of long-term effects, the year a bank merger is announced and the following 3 years. $MainBank_{i,b,t-1}$ is a dummy variable indicating whether bank b is firm i's main bank in year $t-1$. $BankControls_b$ include the main bank dummy variable, bank size, bank profitability and bank regulatory capital surplus.

As discussed above, the key to isolating supply of credit in the analysis is the $Firm_i \times Year_t$ term, which represents firm–year fixed effects, an interaction term between firm fixed effects and time fixed effects. By adding a unique intercept for each firm-year, this term controls for all firm-side factors, including loan demand. $Bank_b$ is a standard bank fixed effect, which enables us to investigate variation within a given bank before and after the merger by absorbing other cross-sectional variations.

Here, $\varepsilon_{b,t}$ is the error term. Standard errors are clustered at the individual firm level because potential violation of the assumption of an independently and identically distributed error term (iid) is particularly serious in a setting such as this one, where the time dimension is long and the difference-in-difference term is constant during the treatment period.[3] Bertrand *et al.* (2004) have shown that failure to address potential serial correlation within a difference-in-difference framework leads to dramatically underestimated standard errors.

We also estimate a variation of the above equation that accounts for firm heterogeneity by including some triple-difference and quadruple-difference terms. $CreditContrained_{i,t-1}$, a dummy variable indicating that a client firm is credit-constrained and $Zombie_{i,t-1}$, a dummy variable indicating that a client firm is not only credit-constrained, but a sick, presumably bank-dependent "zombie" firm, are included and interacted with the difference-in-difference term. This yields the following specification:

$$\begin{aligned}\frac{\Delta L_{i,b,t}}{L_{i,b,t-1}} =& \beta_0 + \beta_1 Merged_b + \beta_2 Post_t + \beta_3 Merged_b \times Post_t \\ &+ \beta_4 MainBank_{i,b,t-1} \times Merged_b \times Post_t + \beta_5 CreditContrained_{i,t} \\ &\times MainBank_{i,b,t-1} + \beta_6 CreditContrained_{i,t} \times MainBank_{i,b,t-1} \times Merged_b \\ &\times Post_t + \beta_7 Zombie_{i,t} \times MainBank_{i,b,t-1} + \beta_8 Zombie_{i,t} \\ &\times MainBank_{i,b,t-1} \times Merged_b \times Post_t + BankControls_b + Firm_i \\ &\times Year_t + Bank_b + \varepsilon_{i,b,t}.\end{aligned} \tag{7}$$

Table 2 presents the main results of the estimation of Equations (6) and (7) in two time horizons: the short-to-medium run and the long run.

[3] Consistency of OLS standard error estimates rests on the assumption that the error term is iid, but panel data typically violate the independence assumption due to serial correlation within cross-sectional units (Petersen, 2009).

TABLE 2
The effect of bank merger on the supply of credit to bank client firms

	Short–medium run		Long run	
	Year of merger announcement		Year of merger announcement and the following 3 years	
	(1)	(2)	(3)	(4)
Merged bank × Post-merger	−0.011	−0.005	−0.009	−0.005
	(0.029)	(0.013)	(0.018)	(0.011)
Main bank × Merged bank × Post-merger	−0.017**	−0.006	−0.023***	−0.018***
	(0.008)	(0.019)	(0.005)	(0.007)
Credit-constrained firm × Main bank		0.005		0.010
		(0.006)		(0.005)
Credit-constrained firm × Main bank ×		−0.016*		−0.021**
Merged bank × Post-merger		(0.009)		(0.010)
Zombie firm × Main bank		0.050***		0.057***
		(0.015)		(0.014)
Zombie firm × Main bank ×		−0.040		0.001
Merged bank × Post-merger		(0.021)		(0.019)
Observations	268,450	234,547	303,556	278,153

Note: Standard errors clustered at the individual firm level are reported in parentheses below each coefficient estimate. ***, ** and * indicate statistical significance at the 1, 5 and 10% level, respectively.

Columns 1–2 of Table 2 show the effect of bank merger announcements on banks' supply of credit to their client firms in the year of announcement, while columns 3–4 turn to the longer-term impacts of bank merger announcements on the supply of credit in not only the year of a bank merger announcement, but also the following 3 years. The main takeaway from Table 2 is that the announcement of a merger by a firm's declared main bank on average results in a highly statistically significant cut in the supply of credit from the main bank to the client firm. The cut in credit supply ranges from an estimated −1.7% reduction in the short to medium run to a cumulative −2.3% cut in the long run. Credit-constrained firms are especially hard hit in the long run, experiencing a further −2.1% cut in the supply of credit from the main bank, for a total estimated reduction in credit supply of −3.9%.

Another interesting result that comes out of Table 2 is the empirical support for the "evergreening" theory that Japanese banks keep alive credit-constrained, sick, bank-dependent zombie firms. Estimates of Equation (7), reported in columns 2 and 4 of Table 2, show that zombie firms in general enjoy highly statistically significant higher credit supply from their declared main bank in the order of 5.0–5.7%.

5. Empirical results: Other long-term outcomes

Having established that bank merger announcements result in cuts in the supply of credit from the affiliated firms' main bank, we next investigate whether bank merger announcements affect other long-term outcomes for firms. Applying the difference-in-difference techniques explained in Section 4 above to an analysis of other long-term firm outcomes yields the following specification:

$$y_{i,b,t} = \beta_0 + \beta_1 Merged_b + \beta_2 Post_t + \beta_3 Merged_b \times Post_t + FirmControls_i + Firm_i \times Bank_b + Year_t + \varepsilon_{i,b,t}. \quad (8)$$

In Equation (8), $y_{i,b,t}$ represents various firm outcomes: growth in total firm borrowing, distance to default and investment. Total borrowing is defined as the sum of bank loans (from all banks, not just the declared main bank), corporate bonds and commercial paper outstanding. The calculation of distance to default, how far the firm is from the default point at which the firm cannot repay its debts without rolling them over, is explained above in Section 3. Investment is measured as the growth in tangible assets.

$Merged_b$ and $Post_t$ are defined as above in Equation (7). $Merged_b$ is a dummy variable indicating that a bank b announced a merger during the sample period, while $Post_t$ is a dummy variable that takes the value of one in the post-merger period: the year a bank merger is announced or, for evaluation of long-term effects, the year a bank merger is announced and the following 3 years.

$FirmControls_i$ include firm cash flow, firm size, firm profitability and the firm's working capital ratio. $Firm_i \times Bank_b$, an interaction term between firm fixed effects and bank fixed effects, is included to address any potential endogeneity in bank–firm matching. $Year_t$ is a time fixed effect that absorbs any unobserved time-varying factors that may simultaneously affect the outcome variables and bank mergers, such as macroeconomic conditions. $\varepsilon_{b,t}$ is the error term. As discussed above, standard errors are clustered at the individual firm level to account for potential within-firm serial correlation in the error term.

As in the analysis above, we also estimate a variation of the above equation that includes some triple difference terms:

$$\begin{aligned} y_{i,b,t} = {} & \beta_0 + \beta_1 Merged_b + \beta_2 Post_t + \beta_3 Merged_b \times Post_t \\ & + \beta_4 CreditContrained_{i,t} + \beta_5 CreditContrained_{i,t} \times Merged_b \times Post_t \\ & + \beta_6 Zombie_{i,t} + \beta_7 Zombie_{i,t} \times Merged_b \times Post_t + FirmControls_i \\ & + Firm_i \times Bank_b + Year_t + \varepsilon_{i,b,t}. \end{aligned} \quad (9)$$

In Equation (9), as above, $Merged_b$ is a dummy variable indicating that a bank b announced a merger during the sample period, while $Post_t$ is a dummy variable that takes the value of one in the post-merger period: the year a bank merger is announced or, for evaluation of long-term effects, the year a bank merger is announced and the following 3 years. $CreditContrained_{i,t-1}$ is a dummy variable indicating that a client firm is credit-constrained and $Zombie_{i,t-1}$ is a dummy variable indicating that a client firm is not only credit-constrained, but a sick, presumably bank-dependent "zombie" firm.

The results of the estimation of Equations (8) and (9) are presented in Table 3.

The results in Table 3 show that bank merger announcements have a statistically significant negative impact on the growth of total firm borrowing, firm distance to default, and firm investment. These negative impacts are all statistically and economically significantly larger for credit-constrained firms and larger again for credit-constrained, sick, zombie firms.

TABLE 3
The effect of bank merger on client firm borrowing, distance to default and investment

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Total borrowing growth		Distance to default		Investment	
Main bank merged × Post-merger	−0.028***	−0.029***	0.019	0.196***	−0.007**	0.002
	(0.008)	(0.010)	(0.083)	(0.069)	(0.003)	(0.003)
Credit-constrained firm		−0.018**		0.065		−0.003
		(0.009)		(0.075)		(0.005)
Credit-constrained firm × Main bank merged × Post-merger		0.008		−0.582***		−0.021***
		(0.008)		(0.116)		(0.006)
Zombie firm		0.026***		−0.009		0.012*
		(0.010)		(0.057)		(0.007)
Zombie firm × Main bank merged × Post-merger		−0.050***		−0.466***		−0.029***
		(0.022)		(0.155)		(0.011)
Observations	52,976	46,919	49,390	45,872	61,044	52,871

Note: Standard errors clustered at the individual firm level are reported in parentheses below each coefficient estimate. ***, ** and * indicate statistical significance at the 1, 5 and 10% level, respectively.

5.1 Total borrowing

Columns (1)–(2) of Table 3 report the results of the estimation of Equations (8) and (9) on growth in total borrowing. As reported in column (1), following an announcement of a bank merger by the main bank, growth in total firm borrowing (not just credit supplied by the main bank) to client firms declines on average by a statistically significant −2.8%, more than double the drop in credit supplied from the main bank in Table 2, above. Column (2) illustrates that, while even healthy firms experience a reduction in total firm borrowing, the fall is particularly sharp for zombie firms, which experience an additional −5.0% fall in total borrowing, for a cumulative −7.8% drop.

Combined with the results reported in Table 2, above, the findings reported in Table 3 suggest that after an announcement of a merger by their main bank, even healthy firms are unable to make up for the reduced credit supplied by their main bank by turning to other banks for bank loans or issuing other kinds of debt such as corporate bonds of commercial paper. Zombie firms, which do not seem to suffer disproportionate cuts in credit from their main bank following a bank merger announcement, are much more significantly impacted when total bank loans and other sources of debt financing are taken into account.

5.2 Distance to default

Next, columns (3)–(4) of Table 3 report the effect of bank merger announcements on client firms' distance to default. The average distance to default for the firms included in the analysis is 5.15 standard deviations. Column (3) demonstrates that in the 3 years following a merger announcement by their main bank, the distance to default of most of the firms in the sample is unaffected by the announcement of a merger by their main bank. However, column (4) shows the effects to be heterogeneous. The distance to default for healthy firms actually rises by 0.196 following an announcement of a bank merger by the firms' main bank. However, for credit-constrained firms, the distance to default falls by a highly statistically significant −0.582. For credit-constrained, sick,

zombie firms, which have a lower distance to default to begin with of 1.83 standard deviations, the distance to default falls by an additional −0.466. Because zombie firms are a subset of credit-constrained firms, that implies a total reduction of −1.048 for zombie firms, which puts the average zombie firm less than one standard deviation away from default following a merger announcement by its main bank.

5.3 Firm investment

Finally, columns (5)–(6) of Table 3 reveal the effect of bank merger announcements on client firm investment. The average rate of investment for the firms in the sample is 3.8%. As reported in column (5), in the 3 years following the announcement of a merger by their main bank, investment falls on average by a statistically significant but relatively small amount: −0.7%. Column (4) sheds further light on firm investment, however, indicating that the decline in firm investment following a merger announcement by the main bank is concentrated in credit-constrained firms, which experience a −2.1% decline in firm investment. Investment by zombie firms falls an additional −2.9%, for a total decline in investment of −5.0%. Note that a decline in investment of that scale is economically as well as statistically significant because it is greater than the average firms' total investment for 1 year over the sample period.

6. Conclusions

The focus of this study is the effect of bank merger announcements on the client firms of those banks. First, the effect of bank merger announcements on the supply of credit from the merging main bank to the client firm is examined. Then the analysis turns to other long-term outcomes: growth in total firm borrowing, distance to default and firm investment. Two main conclusions emerge.

In general, client firms of banks that announce a merger experience a significant reduction in the supply of credit from the merged main bank. Even though the firms analysed in this study are publicly listed and presumably have access to other forms of financing, firms are unable to hedge against this fall in credit availability from the main bank and experience a similar and statistically significant reduction in total firm borrowing.

However, the effect of bank merger announcements on client firms exhibits substantial heterogeneity. There is evidence that credit-constrained, sick, zombie firms benefit from evergreening of loans from their main bank throughout the sample period, but zombie firms find it especially difficult to hedge against the fall in credit supplied by the main bank following a bank merger announcement. Thus, the zombie firms experience a precipitous drop in total firm borrowing following the announcement of a merger by their main bank. In addition, all credit-constrained firms, but especially zombie firms, experience significantly shorter distance to default and lower firm investment following a merger announcement by their main bank.

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