Online Appendix for How Much do Idiosyncratic Bank Shocks Affect Investment? Evidence from Matched Bank-Firm Loan Data

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Contents

1 Overview

This technical appendix contains additional supplementary material for the paper, "How Much do Idiosyncratic Bank Shocks Affect Investment? Evidence from Matched Bank-Firm Loan Data." Here, we consider a number of extensions and robustness checks:

- Section 2 provides economic intuition for the empirical specifications given by equations (1) and (2) in the paper. As Proposition 1 in the paper shows, these two equations yield identical estimates of bank and firm shocks. We show below that these equations can be motivated by three different models:

  - Section 2.1 derives equation (1) from the Khwaja and Mian (2008) model.
  - Section 2.2 derives equation (2) from a more general model featuring loan demand and supply equations.
  - Section 2.3 derives equation (2) from the Paravisini, Rappoport, and Schnabl (2015) model

- Section 3 provides another way of examining the plausibility of our bank shock estimates by examining whether there were news events associated with the institutions that experienced extreme bank shocks. Obviously, there are too many bank shocks to discuss each in detail, but in this section we document what events preceded the largest contributors to the granular bank shock.

- Section 4 provides a series of supplemental results

  - Figure 1 shows that the residuals obtained from estimating equation (1) using OLS are uncorrelated. The plot of the residual on its lag also shows no relationship.
  - Table A2 shows the impact on the baseline coefficient estimates of different clustering procedures, adding a lagged bank shock to the specification, excluding loans from government banks, and with bank shocks using WLS based on Proposition 2.
  - Tables A3 and A4 replicate all of our firm-level investment regressions using no firm or year fixed effects.
  - Table A5 shows that bank shocks matter for understanding firm-level employment and sales.
  - Table A6 replicates the aggregate effects defining the common shock based on the mean bank shock instead of the median. The table shows that this does not substantively affect the results.
  - Table A7 shows that bank shocks obtained from the Proposition 2 WLS methodology do not produce estimates of granular bank shocks that explain nearly as much of the aggregate lending and investment activity as granular bank shocks produced using the Proposition 4 methodology. These results establish the empirical superiority of using bank shocks estimated using lending data that includes new loan activity.

2 Economic Foundations

In this section we demonstrate that our framework can be motivated by several economic models. In particular, we show that our approach nests that of Khwaja and Mian (2008) in Section 2.1 a supply and demand setup in which borrower demand and loan supply differ depending on firm-bank interactions, and a specification suggested by Paravisini, Rappoport, and Schnabl (2015).

2.1 Deriving Equation (1) from the Khwaja and Mian (2008) Model

Khwaja and Mian (2008) develop a structural model to obtain an estimating equation that is a special case of our baseline specification:[1]

$$D\left(L_{fbt}/L_{fb,t-1}\right) = \alpha_{ft} + \beta_{bt} + \varepsilon_{fbt}$$

In their model, the marginal cost of a bank raising financing (α_L) is positive and the firm's marginal return on capital (α_B) is a decreasing function of borrowing. They use this to derive their econometric specification (equation (2) in their paper), which in our notation becomes

$$D\left(L_{fbt}/L_{fb,t-1}\right) = \frac{1}{\alpha_L + \alpha_B}\left(\bar{\eta}_t + \eta_{ft}\right) + \frac{\alpha_B}{\alpha_L + \alpha_B}\left(\bar{\delta}_t + \delta_{bt}\right),$$

where $D\left(L_{fbt}/L_{fb,t-1}\right)$ is defined to be a log change, $\left(\bar{\eta}_t + \eta_{ft}\right)$ denotes the economy-wide and firm-specific productivity shocks and $\left(\bar{\delta}_t + \delta_{bt}\right)$ denotes the economy-wide and bank-specific credit-supply shocks. Note that this is isomorphic to our specification in which the firm shock (α_{ft}) is defined to be equal to the first term and the bank shock (β_{bt}) equals the second term.

Khwaja and Mian (2008)'s estimating equation (rewritten in our notation) is therefore $D\left(L_{fbt}/L_{fb,t-1}\right) = \alpha_{ft} + \beta \Delta DEP_{bt} + \varepsilon_{fbt}$, where ΔDEP_{bt} is the bank-specific change in deposits (and is assumed to be uncorrelated with ϵ_{fbt}). Note that this equation is a special case of our baseline equation in which all bank shocks that are independent of the change in deposits have been relegated to the error term.

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[1] Other examples of specifications that can be nested in this framework include Chava and Purnanandam (2011) and Greenstone and Mas (2012).

2.2 Deriving Equation (2) from a Structural Model with Bank-Firm Interactions

Suppose that the change in loan demand and loan supply are linearly related to the change in the cost of capital. Specifically, let firm f's demand for loans from bank b be

$$D\left(L_{fbt}/L_{fb,t-1}\right) = \gamma^{D}_{fbt} - \delta_f D\left(p_{fbt}/p_{fb,t-1}\right) \tag{1}$$

where $D\left(p_{fbt}/p_{fb,t-1}\right)$ is the log or percentage change in the cost of capital (p_{fbt}) for firm f when borrowing from bank b; γ^{D}_{fbt} is a bank-firm specific demand shifter; δ_f is the firm's elasticity of demand. This kind of loan supply could arise in the presence of costly external finance or internal bank risk management constraints. Similarly, suppose bank b's supply of loans to firm f is

$$D\left(L_{fbt}/L_{fb,t-1}\right) = \gamma^{S}_{fbt} + \eta_b D\left(p_{fbt}/p_{fb,t-1}\right) \tag{2}$$

where γ^{S}_{fbt} is a bank-firm specific supply shifter; η_b is the bank's elasticity of supply. Then the equilibrium quantity is given by

$$D\left(L_{fbt}/L_{fb,t-1}\right) = \frac{\eta_b}{\delta_f + \eta_b}\gamma^{D}_{fbt} + \frac{\delta_f}{\delta_f + \eta_b}\gamma^{S}_{fbt} \tag{3}$$

This equation can be rewritten as

$$D\left(L_{fbt}/L_{fb,t-1}\right) = \alpha_{ft} + \beta_{bt} + \left(\frac{\eta_b}{\delta_f + \eta_b}\gamma^{D}_{fbt} - \alpha_{ft}\right) + \left(\frac{\delta_f}{\delta_f + \eta_b}\gamma^{S}_{fbt} - \beta_{bt}\right) \tag{4}$$

where α_{ft} is the component of the demand shifter that causes the firm to demand more from all banks (i.e., "the firm borrowing channel") and β_{bt} is the component of the supply shifter that affects all borrowers (i.e., "the bank lending channel"). The terms in parenthesis, then, constitute the differential components of lending and borrowing that arise because of bank specialization or other bank-firm interactions. However, if we summarize both of these terms by an interaction term, γ_{fbt}, we obtain equation (2) in the paper. Moreover, we know by Proposition 1 that we can consistently estimate α_{ft} and β_{bt} even if we do not observe any of the variables relevant to the terms in parentheses.

2.3 Deriving Equation (1) from a Model of Loan Levels

Paravisini, Rappoport, and Schnabl (2015) model loan demand by starting with constant elasticity of substitution firm production function in which each loan constitutes a differentiated input. We can generalize their model by allowing for time-varying productivity shocks and loan demand shocks by specifying the production function as

$$Q_{fbt} = A_{ft} \left(\sum_b \left(\Gamma_{fbt} L_{fbt} \right)^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \tag{5}$$

where A_{ft} is a firm-time varying variable that captures the impact of firm productivity and other inputs on production; Γ_{fbt} is a demand shifter that specifies the idiosyncratic demand for lending from each bank; and $\sigma$is the elasticity of substitution among different sources of finance. If all sources of capital are perfect substitutes, then $\sigma = \infty$, but in general we would expect that $\sigma > 1$.

The firm's cost of capital can then be written as the unit cost function for capital:

$$P_{ft} = \left[\sum_b \left(\frac{p_{fbt}}{\Gamma_{fbt}} \right)^{1-\sigma} \right]^{\frac{1}{1-\sigma}} \tag{6}$$

Applying Shepard's lemma to the unit cost function yields the familiar CES demand equation for a given loan:

$$S_{fbt} \equiv \frac{p_{fbt} L_{fbt}}{\sum\limits_b p_{fbt} L_{fbt}} = \frac{\left(p_{fbt} / \Gamma_{fbt} \right)^{1-\sigma}}{\sum\limits_b \left(\frac{p_{fbt}}{\Gamma_{fbt}} \right)^{1-\sigma}} \tag{7}$$

This expression can be rewritten as

$$L_{fbt} = \frac{E_{ft} \Gamma_{fbt}^{\sigma-1}}{P_{ft}^{1-\sigma}} p_{fbt}^{-\sigma} \tag{8}$$

where E_{ft} is total capital expenditures ($\sum_b p_{fbt} L_{fbt}$). If we take logs of both sides and rearrange terms we obtain

$$\ln L_{fbt} = \ln E_{ft} - \left[\sigma \ln p_{fbt} - (\sigma - 1) \ln P_{ft} \right] + (\sigma - 1) \ln \Gamma_{fbt} \tag{9}$$

which we can rewrite as

$$\ln L_{fbt} = \ln \left(E_{ft} / P_{ft} \right) - \left[\sigma \ln \left(\frac{p_{fbt}}{P_{ft}} \right) \right] + (\sigma - 1) \ln \Gamma_{fbt} \tag{10}$$

Intuitively, the first term equals the log of real capital expenditures and captures the firm-demand for loans holding fixed the cost of capital. It is the obvious theoretical counterpart of a firm demand shock. Cost of capital effects are captured in the term in square brackets.

Loan demand from bank b is falling in price for a loan charged by a particular bank (p_{fbt}) relative to the overall cost of capital (P_{ft}). Finally, loan demand from a particular bank is rising the firm's idiosyncratic demand for capital from that institution (Γ_{fbt}). It is useful to decompose the price charged by the bank to a firm into a common component charged by the bank to all customers P_{bt} and the differential component charged to any particular firm ($\tilde{p}_{fbt}$) where we define $p_{fbt} \equiv \tilde{p}_{fbt} P_{bt}$. This lets us rewrite the loan demand equation as

$$\ln L_{fbt} = \ln\left(E_{ft}/P_{ft}\right) - \sigma \ln P_{bt} - \left[\sigma \ln \frac{\tilde{p}_{fbt}}{P_{ft}} - (\sigma - 1) \ln \Gamma_{fbt}\right] \tag{11}$$

We now have the basic loan demand decomposition given by three terms. The first term captures the firm-borrowing channel, defined as the firm total demand for real capital expenditures. The second term captures the bank-lending channel, which here we define to be the cost of capital charged to all customers. Finally, the term in square brackets captures the differential supply and demand shocks hitting the firm. These contain two components. The first is the "differential supply shock" which can be defined as the difference between the interest rate charged by bank b to the firm relative to what the bank b usually charges and relative to what all institutions are charging the firm (P_{ft}). The second term contains the "differential demand shock," which captures relative shifts in demand for loans from different institutions.

In order to simplify the notation, we can refer to the term in square brackets as the firm demand shifter, a_{ft}, the bank supply shifter (β'_{bt}) and the idiosyncratic firm-bank interactions. Taking first differences of this equation produces

$$\Delta \ln L_{fbt} = \alpha_{ft} + \beta_{bt} - \sigma \left(\Delta \ln \frac{\tilde{p}_{fbt}}{P_{ft}}\right) + (\sigma - 1) \Delta \ln \Gamma_{fbt}, \tag{12}$$

where $\alpha_{ft} \equiv \Delta \ln\left(E_{ft}/P_{ft}\right)$ and $\beta_{bt} \equiv -\sigma \Delta \ln P_{bt}$, and we know that $\sum_b \Delta \ln \Gamma_{fbt} = 0$ because the share equations must be homogeneous of degree zero in demand shifters. If we now define the terms following α_{ft} and β_{bt} as ϵ_{fbt} or $\gamma_t Z_{fbt}$, we obtain equations (1) or (2) in the paper. Similarly the percentage change specification can be derived by noting that $\frac{L_{fbt} - L_{fb,t-1}}{L_{fb,t-1}} = \Delta \ln L_{fbt} + \nu_{fbt}$, where ν_{fbt} captures the second and higher order terms associated with replacing a percentage change with its first-order approximation. This yields the percentage change specification given by

$$\frac{L_{fbt} - L_{fb,t-1}}{L_{fb,t-1}} = \alpha_{ft} + \beta_{bt} - \sigma \left(\Delta \ln \frac{\tilde{p}_{fbt}}{P_{ft}}\right) + (\sigma - 1) \Delta \ln \Gamma_{fbt} - \nu_{fbt} \tag{13}$$

This establishes that our specification arises naturally from a a standard model of loan demand.

3 Examples of Extreme Shocks

Table A1 reports the bank shocks that were the the largest contributors to the granular bank shock. A financial institution's contribution to this channel is $w_{b,t-1}\tilde{\beta}_{bt}$ (see equation (11) in the main text), which weights each bank's shock by its lagged share in lending. The ten largest of these (in absolute value) were clearly preceded by newsworthy events that are likely to have caused them, which we discuss below.

Table A1: Ten Largest Contributors to Granular Shocks

Bank Name	Year	Reason	Contribution to Aggregate Lending
Nippon Life	2008	The Japanese Financial Services Agency found that these four insurance companies had illegally denied 40 billion yen in benefits and payments to policyholders.	-0.0328
Meiji Yasuda Life Insurance Co.	2008		-0.0316
Sumitomo Life Insurance Co.	2008		-0.0246
Dai-ichi Mutual Life Insurance Co.	2008		-0.0189
Dai-ichi Mutual Life Insurance Co.	2006	It was realized that a computer error had withheld payments from 47,000 policyholders for the last two decades.	-0.0186
Mitsubishi-UFJ	2005	In the process of a large, tumultuous merger, FSA revealed that the UFJ had a less healthy balance sheet than previously thought.	-0.0237
Mizuho Financial Group	2002	After it acknowledged a large number of non-performing loans on its balance sheet, the bank's share price dropped 63 percent. Later that year, the banks ATM system collapsed.	-0.0181
Mizuho Financial Group	2003	The bank posted "the biggest loss in Japanese corporate history".	-0.0224
Mizuho Financial Group	2005	A trader, intending to sell one share at 610,000 yen, mistyped and sold 610,000 shares for 1 yen.	-0.0132
Industrial Bank of Japan	1999	After all other long term credit banks failed, this bank was given a large capital injection.	0.0128

Our estimates indicate that some of the largest bank-supply shocks to hit the Japanese economy occurred in 2008 and were experienced by Nippon Life, Sumitomo Life Insurance Co., Meiji Yasuda Life Insurance Co., and Dai-ichi Mutual Life Insurance Co. The timing of these shocks hardly appears coincidental—these shocks immediately followed the announcement of a widely reported investigation by the Japanese Financial Services Agency (FSA) that found that these four leading insurance companies had illegally denied ¥40 billion worth of benefits and payments in 700,000 cases.[2] Following this disclosure, new premium income fell 25 percent at Nippon Life, 14 percent at Sumitomo Life, 2.3 percent at Meiji Yasuda,[3]

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[2] *The Japan Times.* "Insurance Scandal Toll to Exceed ¥40 billion," September 30, 2007.

[3] Although Meiji's decline following this revelation was small, the company was already in serious

and 22 percent at Dai-ichi Mutual. The lack of new insurance premiums may have resulted in less money available for investment. Another insurance company, Dai-Ichi Mutual Life Insurance in 2006, was also responsible for one of the largest shocks, which occurred following a revelation that a computer error had resulted in the insurer failing to pay out dividends to 47,000 policyholders between 1984 and 2005.[4]

Bank holding companies were also major contributors to the top ten bank shocks. The negative shock in Japan's largest financial group, Mitsubishi-UFJ, in 2005 immediately followed what was a stormy merger between Japan's second and fourth largest banks. In the final stages of the merger negotiations, the Financial Services Agency charged one of the merger parties with obstructing FSA inspections by concealing documents that showed UFJ's nonperforming loan situation was worse than had been disclosed. This revelation on top of UFJ's losses of 403 billion yen the year before resulted in the FSA issuing UFJ four business improvement orders in the middle of the merger.[5] To make matters worse, Mitsubishi was forced to pay more money for UFJ than it had initially anticipated because Sumitomo Mitsui Financial Group attempted to disrupt the takeover by initiating its own hostile takeover bid.[6]

Mizuho Holdings, which started out as the world's largest bank in terms of assets, also appears to have major idiosyncratic impacts on the supply of credit in the years 2002, 2003, and 2005.[7] The events preceding these negative shocks were marked by enormous stresses placed on the bank. In late 2001, tighter reporting standards forced Mizuho to acknowledge twice the level of nonperforming loans that it had earlier revealed, which contributed to a 63 percent drop in its share price.[8] In 2002, Mizuho's share prices fell another 64 percent following a computer glitch that caused the bank's ATM system to collapse, rejecting millions of transactions and double-charging some of its customers. And in early 2003, Mizuho announced, according to *The New York Times,* that it was going to post "the biggest loss in Japanese corporate history."[9] The final shock in 2005 followed one of the most spectacular

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trouble following an earlier disclosure that had resulted in a 28 percent decline in new insurance contracts. The cumulative impact of these disclosures resulted in Meiji Yasuda pushing back its decision to list its shares. See http://www.japantimes.co.jp/news/2005/10/29/national/fsa-punishes-meiji-yasuda-once-again-for-unpaid-claims/#.VSqHGM5Kg_8 and http://www.reuters.com/article/2008/02/14/meiji-yasuda-idUST7029020080214.

[4] "Dai-ichi Life failed to pay 115 million yen," *The Japan Times,* June 25, 2006

[5] Uranaka, Taiga. *The Japan Times.* "Misconduct, Bad Fortunes Hit: Investors Vent Spleen on Execs at UFJ Holdings, June 26, 2004.

[6] Zaun, Todd. "A Bank Takeover in Japan Breaks Tradition," *The New York Times.* August 25, 2004.

[7] Belson, Ken. "Mizuho Holdings Projects Biggest Loss Ever in Japan," *The New York Times,* January 21, 2003.

[8] "World Business Briefing | Asia: Japan: Bad Loans Reportedly Rising," *The New York Times,* November 8, 2001.

[9] Belson, Ken. "Mizuho Holdings Projects Biggest Loss Ever in Japan," *The New York Times,* January

idiosyncratic errors in the history of finance: a trader at Mizuho intended to sell one share at ¥610, 000 but mistyped the order and accidentally sold 610,000 shares at ¥1![10]

Finally, the tenth largest bank shock affecting Japan differed from the other shocks in that it was positive. We estimate that the magnitude of Industrial Bank of Japan's positive shock raised aggregate Japanese lending 1.3 percent in 1999. Once again, this was a remarkable year for the bank following tremendous positive news for the institution. For much of the postwar period, Japanese regulations protected long-term credit banks from competition in the long-term lending market, but deregulation eliminated this protected status, resulting in the failures of every long-term credit bank except IBJ in the financial crisis of 1997–8. The troubled IBJ was only able to survive the crisis after receiving a large capital injection in 1998. It is hardly surprising that the year after receiving a large capital injection, the bank could once again begin lending more aggressively.

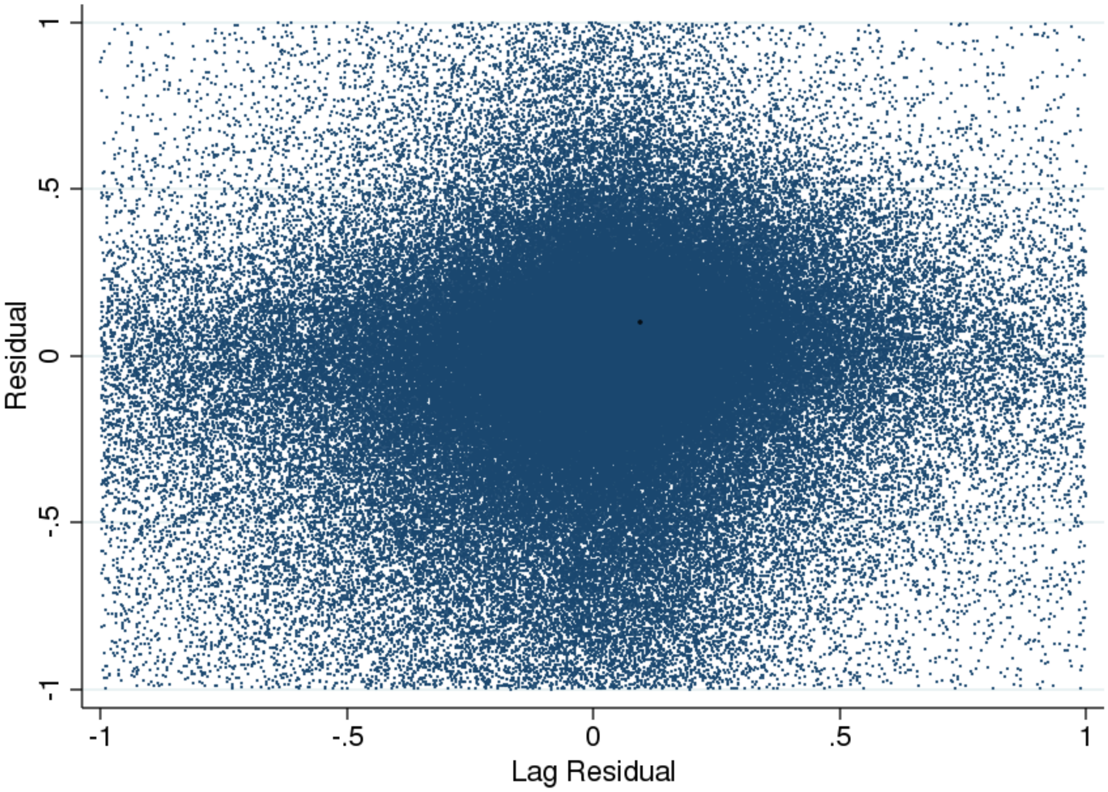
The point of these examples is that the major bank shocks that we estimate were typically preceded by major idiosyncratic events that could not easily be characterized as aggregate shocks. The results of FSA investigations into illegal activities, computer programming errors, capital injections, and rogue traders rocked major Japanese financial institutions. Moreover, the fact that our estimated extreme shocks followed these events, which really were some of the most memorable events in modern Japanese financial history, suggests that we are correctly identifying factors that moved financial institution's loan supply.

21, 2003.

[10] "Botched stock trade costs Japan firm $225M," http://www.nbcnews.com/id/10394551/#.Ub9VMRZ1W5Q.

4 Alternative Specifications

Figure 1: Residuals from Equation (1) and their lags



Note: This plots the residuals, ϵ_{fbt} from estimation equation (1) on the lagged residuals $\epsilon_{fb,t-1}$.

Table A2: Robustness Checks for Firm-Level Regressions

Dependent Variable: Investment$_{f,t}$ /Capital$_{f,t-1}$	(1) large bank clustering	(2) lagged bank shock	(3) drop govt loan obs	(4) drop govt loan firms	(5) with WLS shocks
Cash Flow$_{f,t}$ /Capital$_{f,t-1}$	0.048***	0.045***	0.048***	0.045***	0.050***
	(0.009)	(0.007)	(0.007)	(0.007)	(0.007)
Market-to-Book Value$_{f,t-1}$	0.012***	0.013***	0.013***	0.013***	0.012***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Bank Shock$_{f,t}$	-0.110***	-0.109**	-0.114**	-0.106**	-0.093*
	(0.039)	(0.046)	(0.047)	(0.052)	(0.049)
(Bank Shock$_{f,t}$) x	0.809***	0.743***	0.776***	0.741***	0.750***
(Mean Loan-to-Asset Ratio$_f$)	(0.174)	(0.204)	(0.204)	(0.228)	(0.208)
Bank Shock$_{f,t-1}$		-0.051			
		(0.045)			
(Bank Shock$_{f,t-1}$) x		0.394**			
(Mean Loan-to-Asset Ratio$_f$)		(0.187)			
Firm Shock$_{f,t}$	0.013***	0.014**	0.017***	0.017***	0.011
	(0.005)	(0.006)	(0.006)	(0.006)	(0.007)
(Firm Shock$_{f,t}$) x	0.245***	0.246***	0.219***	0.245***	0.322***
(Mean Loan-to-Asset Ratio$_f$)	(0.038)	(0.041)	(0.040)	(0.045)	(0.045)
Industry Shock$_{f,t}$	0.067***	0.075***	0.064***	0.064***	0.070***
	(0.018)	(0.021)	(0.019)	(0.021)	(0.018)
Fixed Effects					
Year	yes	yes	yes	yes	yes
Firm	yes	yes	yes	yes	yes
Observations	21,701	18,656	18,808	15,613	21,689
R^2	0.323	0.307	0.331	0.330	0.328

Notes: The first column clusters the standard errors by large bank. The subsequent columns cluster by firm. The second column adds a lagged bank shock to the specification. The third column omits all loans from government banks. The fourth column drops all firms that borrowed from government banks. The fifth column presents results in which we estimate bank shocks using WLS based on Proposition 2.

Table A3: Baseline Firm-Level Regressions Without Year and Firm Fixed Effects

Dependent Variable: Investment$_{f,t}$/Capital$_{f,t\text{-}1}$	(1)	(2)	(3)	(4)	(5)	(6)
Cash Flow$_{f,t}$/Capital$_{f,t\text{-}1}$	0.036***	0.036***	0.036***	0.036***	0.036***	0.036***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Market-to-Book Value$_{f,t\text{-}1}$	0.025***	0.025***	0.025***	0.025***	0.025***	0.025***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Bank Shock$_{f,t}$			-0.156***	-0.135***	-0.143***	
			(0.038)	(0.043)	(0.037)	
(Bank Shock$_{f,t}$) x			1.139***	1.123***	1.265***	
(Mean Loan-to-Asset Ratio$_f$)			(0.189)	(0.189)	(0.186)	
(Bank Shock$_{f,t}$) x						0.175***
(Bin1$_{f,t}$)						(0.032)
(Bank Shock$_{f,t}$) x						0.056
(Bin2$_{f,t}$)						(0.040)
(Bank Shock$_{f,t}$) x						-0.081**
(Bin3$_{f,t}$)						(0.041)
(Bank Shock$_{f,t}$) x				-0.405		
(Mean Bond-to-Asset Ratio$_f$)				(0.396)		
Firm Shock$_{f,t}$					0.011*	0.012*
					(0.006)	(0.006)
(Firm Shock$_{f,t}$) x					0.302***	0.294***
(Mean Loan-to-Asset Ratio$_f$)					(0.045)	(0.045)
Industry Shock$_{f,t}$		0.116***	0.118***	0.118***	0.115***	0.060***
		(0.019)	(0.019)	(0.019)	(0.020)	(0.002)
Fixed Effects						
Year	no	no	no	no	no	no
Firm	no	no	no	no	no	no
Observations	21,701	21,701	21,701	21,701	21,701	21,701
R^2	0.076	0.079	0.081	0.081	0.103	0.102

Notes: All of these specifications are the same as Table 2 without firm and year fixed effects.

Table A4: Alternative Specifications Without Year and Firm Fixed Effects

Dependent Variable: Investment$_{f,t}$ /Capital$_{f,t-1}$	(1) lagged firm shock	(2) only bank shock	(3) with crisis interaction	(4) 1991-2000	(5) 2001-2010	(6) ever-greening
Cash Flow$_{f,t}$ /Capital$_{f,t-1}$	0.038***		0.037***	0.075***	0.033***	0.036***
	(0.006)		(0.004)	(0.016)	(0.005)	(0.004)
Market-to-Book Value$_{f,t-1}$	0.021***		0.025***	0.023***	0.015***	0.025***
	(0.001)		(0.001)	(0.001)	(0.002)	(0.001)
Bank Shock$_{f,t}$	-0.142***	-0.159***	-0.066*	-0.314***	-0.071	-0.124***
	(0.038)	(0.039)	(0.040)	(0.052)	(0.054)	(0.035)
(Bank Shock$_{f,t}$) x	1.202***	1.037***	1.276***	0.965***	1.117***	1.030***
(Mean Loan-to-Asset Ratio$_{f}$)	(0.192)	(0.191)	(0.202)	(0.280)	(0.247)	(0.173)
Crisis x (Bank Shock$_{f,t}$)			-0.401***			
			(0.098)			
Crisis x (Bank Shock$_{f,t}$) x			0.009			
(Mean Loan-to-Asset Ratio$_{f}$)			(0.487)			
Firm Shock$_{f,t}$	0.015**		0.011*	-0.011	0.015*	0.010
	(0.007)		(0.006)	(0.010)	(0.008)	(0.006)
Firm Shock$_{f,t-1}$	0.014***					
	(0.003)					
(Firm Shock$_{f,t}$) x	0.270***		0.300***	0.496***	0.290***	0.301***
(Mean Loan-to-Asset Ratio$_{f}$)	(0.046)		(0.045)	(0.077)	(0.052)	(0.045)
Industry Shock$_{f,t}$	0.132***	0.127***	0.113***	0.083**	0.121***	0.114***
	(0.021)	(0.019)	(0.020)	(0.038)	(0.025)	(0.020)
Fixed Effects						
Year	no	no	no	no	no	no
Firm	no	no	no	no	no	no
Observations	18,656	21,701	21,701	9,595	12,106	21,681
R^2	0.080	0.005	0.106	0.119	0.085	0.102

Notes: All of these specifications are the same as Table 3 without firm and year fixed effects.

Table A5: Alternative Firm-Level Dependent Variables

Dependent Variable:	ln(Employment$_t$)	ln(Sales$_t$)
	(1)	(2)
Cash Flow$_{f,t}$/Capital$_{f,t-1}$	-0.047***	0.054***
	(0.011)	(0.011)
Market-to-Book Value$_{f,t-1}$	-0.007**	0.012***
	(0.003)	(0.003)
Bank Shock$_{f,t}$	-0.026	-0.075
	(0.091)	(0.089)
(Bank Shock$_{f,t}$) x	1.361***	0.922**
(Mean Loan-to-Asset Ratio$_f$)	(0.407)	(0.376)
Firm Shock$_{f,t}$	-0.032***	-0.031***
	(0.010)	(0.010)
(Firm Shock$_{f,t}$) x	0.244***	0.217***
(Mean Loan-to-Asset Ratio$_f$)	(0.067)	(0.072)
Industry Shock$_{f,t}$	0.018	0.053
	(0.042)	(0.039)
Fixed Effects		
Year	yes	yes
Firm	yes	yes
Observations	21,700	21,699
R^2	0.949	0.963

Notes: The first column replaces the investment rate with the log of firm employment and the log of firm sales to document that bank shocks have impacts on these variables as well.

Table A6: Aggregate Effects with Common Shocks Based on Mean Bank Shock

Dependent Variable:	Percentage Change in Flow of Funds$_t$			Investment$_t$ /Capital$_{t-1}$		
	(1)	(2)	(3)	(4)	(5)	(6)
Common Shock$_t$	0.449*	1.199***	1.378***	0.215**	0.464***	1.446***
	(0.221)	(0.169)	(0.194)	(0.085)	(0.103)	(0.321)
Industry Shock$_t$	0.493*	1.354***	0.579***	-0.107	0.178	0.207
	(0.268)	(0.247)	(0.106)	(0.152)	(0.174)	(0.203)
Firm Shock$_t$	0.385***	0.318***	0.257***	0.024	0.002	0.004
	(0.102)	(0.094)	(0.076)	(0.063)	(0.054)	(0.118)
Bank Shock$_t$		1.084***	1.034***		0.360***	0.932***
		(0.252)	(0.240)		(0.106)	(0.275)
Constant	-0.025***	-0.005	-0.000	0.072***	0.079***	-0.000
	(0.008)	(0.008)	(0.115)	(0.003)	(0.004)	(0.129)
Standardized Variables	No	No	Yes	No	No	Yes
Observations	20	20	20	20	20	20
R^2	0.493	0.792	0.792	0.493	0.736	0.736

Notes: This table replicates our baseline results with the bank shocks defined as β_{bt} less the mean of β_{bt} in that year instead of relative to the median.

Table A7: Aggregate Effects with Bank Shocks Based on Proposition 2 WLS Estimation

Dependent Variable:	Percentage Change in Flow of Funds$_t$			Investment$_t$ /Capital$_{t-1}$		
	(1)	(2)	(3)	(4)	(5)	(6)
Common Shock$_t$	0.476*	1.010***	1.012***	0.267**	0.416***	1.133***
	(0.242)	(0.211)	(0.211)	(0.112)	(0.118)	(0.321)
Industry Shock$_t$	0.759	1.137**	0.434**	0.085	0.190	0.197
	(0.565)	(0.506)	(0.193)	(0.264)	(0.267)	(0.277)
Firm Shock$_t$	0.493**	0.412*	0.304*	0.046	0.023	0.046
	(0.188)	(0.194)	(0.143)	(0.069)	(0.079)	(0.158)
Bank Shock$_t$		1.085***	0.663***		0.303**	0.502**
		(0.294)	(0.180)		(0.111)	(0.184)
Standardized Variables	No	No	Yes	No	No	Yes
Observations	20	20	20	20	20	20
R^2	0.455	0.660	0.660	0.515	0.633	0.633
Adjusted R^2	0.353	0.569	0.569	0.424	0.535	0.535

Notes: Bank Shocks were estimated using Proposition 2 WLS estimation that does not take into account new lending. All other variables were defined using the same formulas as in the main paper.

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