Online Appendix for

The Informational Role of Ownership Networks in Bank Lending

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This table shows robustness checks for the predictability of initial loan ratings on subsequent delinquency with the linear probability model (LPM). The sample period is from January 2007 to June 2013. The dependent variable in all specifications is an indicator variable, DELINQUENCY, which equals one if the borrower of the loan has missed the loan payments after the due dates, and zero otherwise. The key independent variable, RATING, is the initial loan rating at issuance, which equals the categorical internal loan rating levels from 1 to 4 (i.e., 1 is "normal", 2 is for "special mentioned", 3 is for "substandard", and 4 is for "doubtful"). We conduct a horse race between the subsample of connected borrowers' loans (i.e., CONNECTION=1) in column 1 and the subsample of unconnected borrowers' loans (i.e., CONNECTION=0) in column 2. CONNECTION equals one if the borrower has any sibling firms, subsidiaries, and shareholders in the same city as the bank, which have also borrowed from this bank, and zero otherwise. See Appendix A for detailed variable definitions. Columns 1 and 2 include the firm-, year-, and bank-fixed effects. Columns 3 and 4 include the firm×year and bank-fixed effects. Other settings are aligned with those in Table 2. The constants and fixed effect estimates are omitted for brevity. The *t*-statistics based on White heteroskedasticity robust standard errors are reported below the parameter estimates in parenthesis. Adjusted-R^2 is also reported to show model performance. *, **, and *** indicate the significance at 10%, 5%, and 1% levels, respectively.

	Dependent Variable: DELINQUENCY			
	1	2	3	4
	CONNECTION=		CONNECTION=	
	1	0	1	0
RATING	0.101***	0.088***	0.099***	0.087***
	(13.72)	(12.73)	(13.51)	(12.46)
GUARANTEED	0.003	0.008***	0.003	0.008**
	(0.98)	(2.63)	(0.94)	(2.50)
Log(LOANSIZE)	0.004***	0.006***	0.004***	0.005***
	(15.03)	(13.84)	(14.07)	(12.04)
Log(MATURITY)	-0.024***	-0.031***	-0.023***	-0.029***
	(-18.43)	(-13.07)	(-17.90)	(-12.14)
Log(ASSETS)	-0.000	-0.000	-0.003***	-0.003***
	(-0.36)	(-0.15)	(-3.43)	(-2.94)
LEVERAGE	-0.003	-0.001	-0.006	0.001
	(-0.79)	(-0.22)	(-1.48)	(0.12)
Log(DISTANCE)	-0.001	0.004	-0.001	0.005
	(-0.60)	(1.08)	(-0.53)	(1.19)
RELATIONSHIP	-0.006***	-0.004**	-0.005***	-0.001
	(-4.01)	(-2.04)	(-3.06)	(-0.65)
Firm fixed effects	Yes	Yes	No	No
Year fixed effects	Yes	Yes	No	No
Firm×Year fixed effects	No	No	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Observations	2,650,008	1,914,178	2,650,008	1,914,178
Adjusted-R^2	0.032	0.022	0.128	0.026

Table A.2: Information Role of Ownership Network in Loan Screening
(Rating Dummies OLS)

This table shows robustness checks for the predictability of initial loan ratings on subsequent delinquency with the linear probability model (LPM). The sample period is from January 2007 to June 2013. The dependent variable in all specifications is an indicator variable, DELINQUENCY, which equals one if the borrower of the loan has missed the loan payments after the due dates, and zero otherwise. The key independent variables, RATING_1, RATING_2, RATING_3, and RATING_4 are indicator variables denoting initial internal loan rating levels at issuance of 1 (normal), 2 (special mentioned), 3 (substandard), and 4 (doubtful), respectively. RATING_1 is the baseline category in all specifications. We conduct a horse race between the subsample of connected borrowers' loans (i.e., CONNECTION=1) in columns 1 and 3 and the subsample of unconnected borrowers' loans (i.e., CONNECTION=0) in columns 2 and 4. CONNECTION equals one if the borrower has any sibling firms, subsidiaries, and shareholders in the same city as the bank, which have also borrowed from this bank, and zero otherwise. Columns 1 and 2 include the firm-, year-, and bank-fixed effects. Columns 3 and 4 include the Firm×Year and bank-fixed effects. Other settings are aligned with those in Table 3. Control variables GUARANTEED, Log(LOANSIZE), Log(MATURITY), Log(ASSETS), LEVERAGE, Log(DISTANCE), and RELATIONSHIP are included. See Appendix A for detailed variable definitions. The constants and fixed effect estimates are omitted for brevity. The t-statistics based on White heteroskedasticity robust standard errors are reported below the parameter estimates in parenthesis. Adjusted-R^2 is also reported to show model performance. *, **, and *** indicate the significance at 10%, 5%, and 1% levels, respectively.

	Dependent Variable: DELINQUENCY			
	1	2	3	4
	CONNECTION=		CONNECTION=	
	1	0	1	0
RATING_2	0.055***	0.052***	0.053***	0.051***
	(35.78)	(29.36)	(34.49)	(28.66)
RATING_3	0.469***	0.373***	0.466***	0.369***
	(41.18)	(29.98)	(40.51)	(29.26)
RATING_4	0.627***	0.416***	0.629***	0.415***
	(24.40)	(14.22)	(24.07)	(13.98)
Controls	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	No	No
Year fixed effects	Yes	Yes	No	No
Firm×Year fixed effects	No	No	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Observations	2,650,008	1,914,178	2,650,008	1,914,178
Adjusted-R^2	0.041	0.030	0.039	0.025

Table A.3: Information Role of Ownership Network in Loan Screening
(Interaction Analysis OLS)

This table shows robustness checks for the predictability of initial loan ratings on subsequent delinquency with the linear probability model (LPM). The sample period is from January 2007 to June 2013. CONNECTION equals one if the borrower has any sibling firms, subsidiaries, and shareholders that are in the same city as the bank and that also have borrowed from this bank and zero otherwise. In columns 1 and 2, RATING is the initial loan rating at issuance, which equals the categorical internal loan rating levels from 1 to 4 (i.e., 1 is "normal", 2 is for "special mentioned", 3 is for "substandard", and 4 is for "doubtful"). In columns 3 and 4, the key independent variables, RATING_1, RATING_2, RATING_3, and RATING_4 are indicator variables denoting initial internal loan rating levels at issuance of 1 (normal), 2 (special mentioned), 3 (substandard), and 4 (doubtful), respectively. RATING_1 is the baseline category. Columns 1 and 3 include the firm-, year-, and bank-fixed effects. Columns 2 and 4 include the Firm×Year and bank-fixed effects. Control variables GUARANTEED, Log(LOANSIZE), Log(MATURITY), Log(ASSETS), LEVERAGE, Log(DISTANCE), and RELATIONSHIP are included. See Appendix A for detailed variable definitions. The constants and fixed effect estimates are omitted for brevity. The t-statistics based on White heteroskedasticity robust standard errors are reported below the parameter estimates in parenthesis. Adjusted-R^2 is also reported to show model performance. *, **, and *** indicate the significance at 10%, 5%, and 1% levels, respectively.

	Dependent Variable: DELINQUENCY			
	1	2	3	4
RATING×CONNECTION	0.050***	0.049***		
	(3.93)	(3.81)		
CONNECTION	0.001	-0.002		
	(0.87)	(-1.61)		
RATING	0.094***	0.093***		
	(18.28)	(17.98)		
RATING_2×CONNECTION			0.020***	0.023***
			(5.25)	(5.88)
RATING_3×CONNECTION			0.151***	0.137***
			(6.02)	(5.55)
RATING_4×CONNECTION			0.363***	0.359***
			(4.67)	(4.77)
CONNECTION			-0.002***	0.001***
			(-8.76)	(4.03)
RATING_2			0.052***	0.053***
			(44.59)	(46.06)
RATING_3			0.412***	0.416***
			(48.07)	(49.03)
RATING_4			0.498***	0.497***
			(24.10)	(24.26)
Controls	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	No	Yes	No
Year fixed effects	Yes	No	Yes	No
Firm×Year fixed effects	No	Yes	No	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Observations	4,564,186	4,564,186	4,564,186	4,564,186
Adjusted-R^2	0.029	0.026	0.032	0.035

Table A.4: Information Role of Ownership Network in Loan Monitoring
(SMEs 25% quantile)

This table presents robustness checks of the linear probability model (LPM) regressions of loan rating early downgrade activities during monitoring on the ex-ante predicted probability of delinquency for small and medium enterprises (SMEs). SME is redefined as an indicator variable SME25 that equals one if the borrowers' total assets are below the 25% quantile across all borrowers by year. The sample consists of 86,191 individual delinquent loans with complete monthly rating records in the data from January 2007 to June 2013. In columns 1 and 2, the dependent variable is an indicator variable, EARLY_DOWNGRADE, which equals one if the delinquent loan is downgraded before the delinquent date and zero otherwise. In columns 3 and 4, the dependent variable, Log(MONTH_EARLIER), is the natural logarithm of one plus the number of months between the date of the initial downgrade and the delinquency date. CONNECTION equals one if the borrower has any sibling firms, subsidiaries, and shareholders in the same city as the bank, which have also borrowed from this bank, and zero otherwise. Columns 1 and 3 include the firm-, year-, and bank-fixed effects. Columns 2 and 4 include the Firm×Year and bank-fixed effects. Control variables GUARANTEED, Log(LOANSIZE), Log(MATURITY), Log(ASSETS), LEVERAGE, Log(DISTANCE), and RELATIONSHIP are included. See Appendix A for detailed variable definitions. The constants and fixed effect estimates are omitted for brevity. The t-statistics based on White heteroskedasticity robust standard errors are reported below the parameter estimates in parenthesis. Adjusted-R^2 is also reported to show model performance. *, **, and *** indicate the significance at 10%, 5%, and 1% levels, respectively.

	1	2	3	4
	EARLY DOWNGRADE		Log(MONTH EARLIER)	
SME25×DELINQUENCY×CONNECTION	**0.737***	**0.866***	**0.986***	**1.668***
	(5.40)	**(5.81)**	**(3.11)**	**(5.42)**
SME25×DELINQUENCY	-0.341***	-0.335***	-0.199	-0.386*
	(-2.85)	(-3.12)	(-0.69)	(-1.71)
SME25×CONNECTION	0.075**	0.031	0.153**	0.077
	(2.35)	(0.79)	(2.55)	(1.06)
DELINQUENCY×CONNECTION	-0.374***	-0.528***	-0.474	-1.085***
	(-3.11)	(-4.14)	(-1.61)	(-3.91)
DELINQUENCY	0.628***	0.734***	0.921***	1.206***
	(5.47)	(7.31)	(3.25)	(5.66)
CONNECTION	-0.083***	-0.045	-0.177***	-0.102*
	(-3.25)	(-1.58)	(-3.63)	(-1.76)
Controls	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	No	Yes	No
Year fixed effects	Yes	No	Yes	No
Firm×Year fixed effects	No	Yes	No	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Observations	44,752	44,752	44,752	44,752
Adjusted-R^2	0.819	0.857	0.833	0.876

II. Additional Details of China's Banking System

A. Institutional Background of China's Banking System

The current banking system in China is developed from Deng Xiaoping's economic reform in the 1980s. There are three groups of banks in China: 1) the "big five" commercial banks (i.e., the Industrial and Commercial Bank of China (ICBC), the Agriculture Bank of China (ABC), the Bank of China (BOC), the China Construction Bank (CCB), and the Bank of Communications (BoCom); 2) the 12 joint-equity banks; 3) municipal banks.

Compared to the big five banks, the development of the 12 joint-equity banks has been suppressed due to historical reasons and regulations. First, the big five banks were established earlier and have higher political rankings than joint-equity banks. For example, the big five have priority to open branches across the country. In 2002, the Chinese government announced a plan for reform of the shareholding system of state-owned commercial banks to improve efficiency in the banking system for economic development. Along with this reform, the big five were to open branches to expand their businesses dramatically all over the country. In 2006, the big five bank branches already covered approximately 90% of cities in China, while the twelve joint-equity banks had covered only approximately 7% of cities.

Second, the joint-equity banks' branch openings have been strictly regulated. For example, in 2006, the CBRC announced that all local commercial banks, including the twelve joint-equity banks, could only apply to open one branch in each city.[1] Specifically, joint-equity banks are not allowed to apply for multiple branches in one application. In addition to this

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[1] Please refer to CBRC Order [2006] No. 2 entitled "The implementation of administrative licensing items on Chinese commercial banks".

restriction on numbers, joint-equity banks must first apply to the CBRC's local office for initial approval. Thereafter, they need approval from the CBRC's central office. This dual approval process takes more than a year to finish. The number of branches for all twelve joint-equity banks only increased from 3,351 in 2006 to 4,700 in 2009. By contrast, at the end of 2009, the big five had 52,707 branches in total.

In April 2009, "Adjustment comment on the market access policy of setting up branches for small- and medium-sized commercial banks" was introduced by the CBRC as a significant and vital policy deregulating the Chinese banking system.2 This adjustment aimed to free joint-equity banks by allowing them to open new branches in new cities. The deregulation removed the 2006 branch opening restriction in a city when a joint-equity bank had already set up branches in this city. Joint equity banks can also enter all cities of a province freely when they had branches in the capital city of a given province. Explicitly, for these deregulated cities, joint-equity banks could freely open branches without any restrictions on the number of branches opened. Moreover, for each application, joint-equity banks could apply to open multiple branches without approval from the central CBRC office. Banks only needed the local CBRC office's approval, rendering the application process much simpler and more efficient, with a typical turnaround time of four months.

Moreover, no specific requirement on capital amounts for new branches was imposed. However, when a bank did not operate any branches in a city or provincial capital city, it was still strictly regulated under the 2006 entry barrier of the CBRC. Taken together, this bank entry deregulation policy enacted in April 2009 dramatically reduced the cost and waiting periods of

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2 Please refer to CBRC Order [2009] No. 143 entitled "Adjustment comment on the market access policy of setting up branches for small- and medium-sized commercial banks".

new branch entry applications for joint-equity banks. As one senior officer of the CBRC noted, the deregulation shock served as a milestone in commercial banks' development and growing levels of competition in China's banking sector. On October 15, 2013, in CBRC Order [2013] No. 1, an updated version of CBRC Order [2006] No. 2, the CBRC completely lifted entry restrictions placed on all banks. In response to this deregulation, the China Merchants Bank, one of the twelve joint-equity banks, decided to open another 20 new branches by the end of 2009. The Announcement of the 39th Meeting of the Seventh Section of The Board of Directors reported that the China Merchants Bank would expand to Jiangsu, Guangdong, Henan, Sichuan, Shandong, Zhejiang, Jiangxi, Liaoning, Fujian, Yunnan, Hunan, Hubei, Anhui, and Guangxi.

B.   Borrower-Lender Geographic Distance

We obtain bank branch dataset from CBRC, which covers all bank branches in China. Specifically, this population dataset includes over 200 thousand branches of approximately 2,800 banking financial institutions between 1949 and 2016. For each branch, we observe the branch name, ID, hierarchy, detailed address information, and the exact opening and closing dates. Since we have the history of all bank branches in China, we can observe the full dynamics of individual branch openings and closings across the entire country.

For each loan, we can identify the city where the loan was issued and the address information of all branches of the bank in this city, thus allowing us to locate the lending bank branches accurately. For each borrower, we trace the 9-digit firm ID (i.e., the unique identifier for corporations from the General Administration of Quality Supervision, Inspection and Quarantine of China) and manually obtain the exact address of the borrower from the National Company Credit Information System launched by China's State Administration of Industry and

Commerce. We also manually check the location data, covering approximately 99% of the firms in our final data sample.

Next, we use GIS technology to locate the exact longitude and latitude of each borrower and each bank branch on the map. Specifically, we input the detailed information of firm and bank branch locations into the application programming interface (API) of Autonavi (Amap), the leading mapping service provider company in China. The outputs from the API are the geographic coordinates of individual firms and bank branches (i.e., four-digit latitudes and longitudes).

For each loan, we know the bank's ID and the city at the prefectural level of the lending bank branch. Banks usually have multiple branches in a city, so we calculate the distances between the borrower and all branches of the bank in the city where the loan is issued. Specifically, we follow the formula proposed by Coval and Moskowitz (1999) to calculate the distance between a firm and a bank branch monthly.[3] Then, we follow previous studies and choose the shortest one (i.e., the distance between the borrower and the closest bank branch in a given city) as the lender-borrower distance. We also trace the dynamics of branch openings over time and update the lender-borrower distance monthly. In total, there are over five billion lender-borrower distance observations at the loan-branch-month level.

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[3]The formula is as follows: DISTANCE = R × arccos[SIN(FIRMLAT) × SIN(BANKLAT) + COS(FIRMLAT)× COS(BANKLAT) × COS(BANKLON − FIRMLON)], where FIRMLAT and BANKLAT are the latitudes of the firm and the bank branch locations, respectively. FIRMLON and BANKLON are the longitudes of the firm and bank branch locations, respectively. R is the radius of the earth in kilometers (i.e., approximately 6,378 kilometers). Moreover, the latitude and longitude numbers are converted into radians by division by 180/π. This methodology, which is based on spherical law estimations, has been used in many prior studies, such as Baik, Kang, and Kim (2010), Dass and Massa (2011), and Chhaochharia, Kumar, and Niessen-Ruenzi (2012).

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