



Digital Technology, Legal Reforms, and Bank Lending

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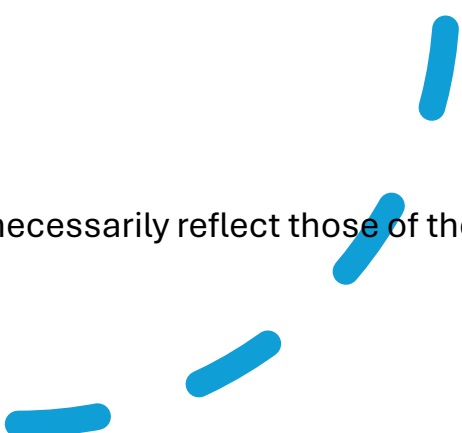
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Bank financing is dominant in many economies, the literature says that collaterals are important

- **Laws that facilitate collateral lodging promote bank loans**
 - **Bankruptcy law reforms:** Chemin (2012) in India, Rodano et al. (2016) in Italy; Ponticelli and Alencar (2018) in Brazil; Brown et al. (2017), Iverson (2018) and Muller (2022) in the US; Favara et al. (2017); Li and Ponticelli (2022) and Li et al. (2023) in China
 - **Collateral law matters more than bankruptcy law for credit market development.** (Hasemann, Pistor, and Vig, RFS 2010)
 - **A reform that expedites creditors' liquidation of defaulting firms' collateral could benefit borrowers who are financially constrained and unable to borrow.** (Vig, JF 2013)
- **Points:**
 - **Improving property rights facilitates the use of fixed assets as collaterals.**
 - **Raising the rights of secured creditors is a double-edged sword:**
 - increasing the liquidation value of collateral increases borrowing capacity
 - raises lenders' market power.
- **Changes in collateral law matter more than changes in bankruptcy law.**
 - The former enhances the likelihood that creditors can realize their claims against delinquent debtors
 - The latter ensures an orderly process for resolving multiple and often conflicting claims after debts have become delinquent.
- **Improvements in court efficiency enhance credit availability and stimulate business investment**

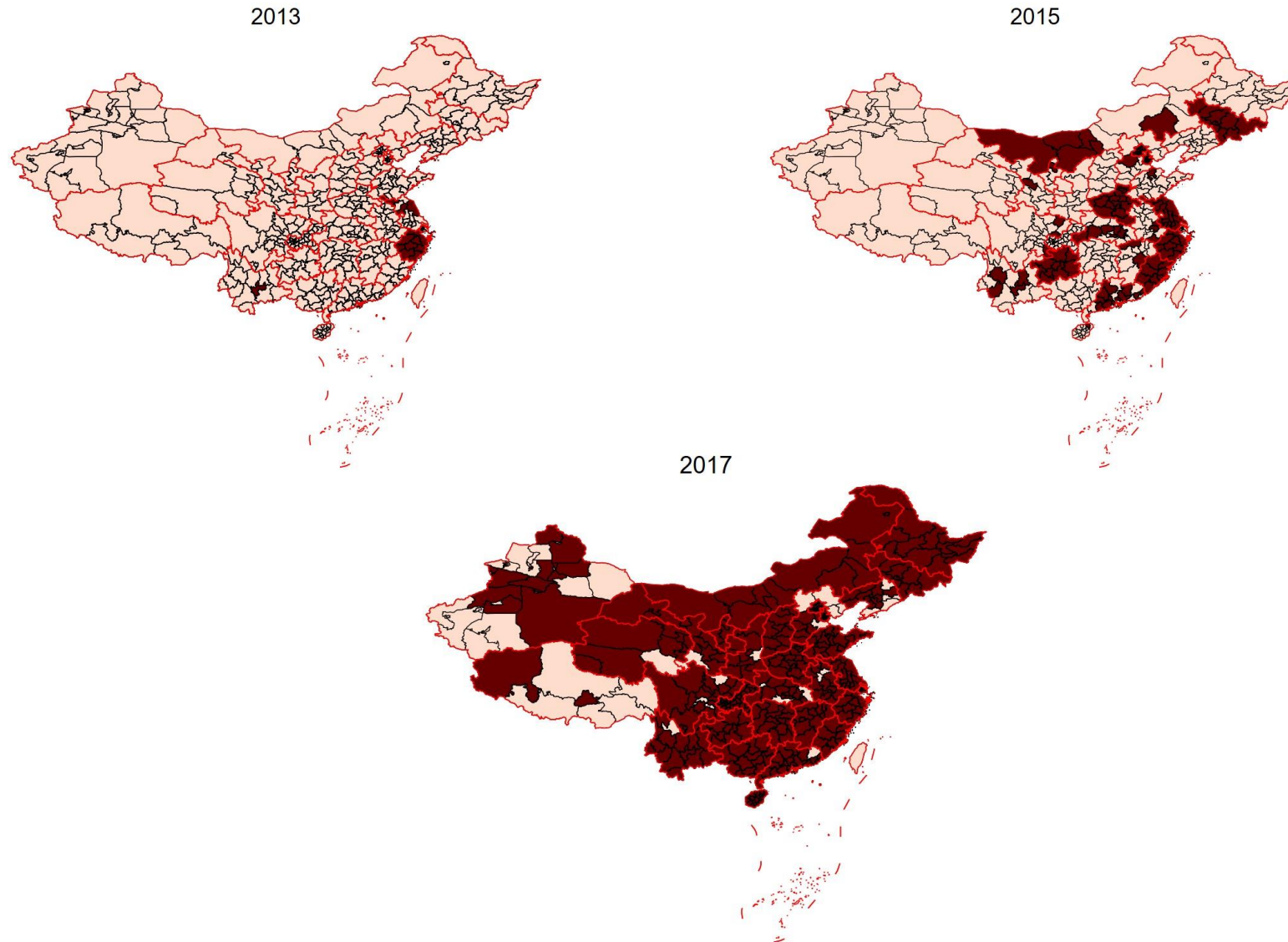
Our Paper's objective:

- **Adopting online auctions of collateral:**
 - A simple, easy improvement without other changes in the laws
 - Technology allows speedy, large-scale competitive bidding and low transaction cost
 - Bypasses tedious and time-consuming bankruptcy procedures
 - avoids expensive competition between parties of conflicting interests in co-opting judges and bankruptcy committee members
 - Ex-post efficiency resolution can elevate the ex-ante value of secured loans and change the lending landscape.
- **Prevalent in the US, UK, Germany, India, China**
- **Less in emerging economies – need infrastructure investments and a simple legal change**
- **Our objective is to use a staggered DID to trace through the effects of adopting online auctions in China**
 - Loan distribution and interest rate spreads
 - Heterogenous impacts on lenders and borrowers

Online Auction Reform in China since 2012

- **Traditional judicial auction:**
 - Courts would delegate the auction process to a third-party auction company: (i) an asset value appraisal and (ii) auctions.
 - Drawbacks: limited public participation, low transparency, and vulnerable to corruption.
- **Online Auction Reform:**
 - In July 2012, the Primary People's Court of two districts in Ningbo (Zhejiang Province) partnered with Alibaba Group to conduct the **first online auction** via the Taobao platform.
 - Fully transparent
 - No commission fee
 - Wide participation, anywhere, anytime
 - In August 2012, the Civil Procedure Law was revised
 - prioritize the use of auctions to enforce civil cases
 - courts directly and independently organize auctions
 - Judges like the expediency – handle more cases, lower backlog cases, less blame
- **The successful experiment led to adoption across Zhejiang, Jiangsu, and nationwide roll-out.**

The reform expanded to the whole country in a few years



Given that adopting auctions allows speedy and cost-effective conversion of pledged assets to lenders' compensation, our research questions:

- **For the lender:**
 - Raise the post-bankruptcy value
→ raise the ex-ante value of secured loans
- **For the borrowers:**
 - Greater access to secured loans, and thus greater demand at a lower interest spread
- **Our empirical questions:**
 - Substitute away from non-secured loans?
 - Impact on interest rates? Default risks?
 - How do lenders (banks) and borrowers fair?

Identification strategy

- **The decision to adopt online judicial auctions at the prefecture-level city level is exogenous to the region's current and anticipated future economic conditions.**
 - A part of broader judicial reforms the central government mandates.
 - Interprovincial Circuit Tribunals – senior judicial officials drive reforms at the provincial level (High People's Court) or the national level (Supreme People's Court)
 - Deepen legal reforms and promote the construction of a law-based China
 - Promote judicial independence: legal decisions made based on the rule of law and merits rather than being influenced by local interests
 - No explicit economic considerations cited as a determining factor
- **Exogeneity is supported by Zhao et al. (2022) – the judicial reform shows no correlation with local economic indicators such as GDP per capita or the ratio of government expenditure to GDP.**

Data

- **Loan-level data:**

- One of China's five major state-owned commercial banks, with loan issuance spanning from 2011 to 2017. (10 percent sample of the bank's manufacturing loans)
- Cover firms in **all thirty-one provinces** of different sizes, ownerships, and industries.
- Detailed information on each loan, including loan type, credit spread, loan amount, loan maturity, default status, and the borrowing firms' name, location, and credit ratings.

- **Firm-level data:**

- Merge the bank loan data with the Annual Survey of Industrial Firms (**ASIF**).
- Detailed information, including ownership structure, employment, gross output, industry, and firm identification (e.g., company name and organization code), as well as information on the three primary accounting statements (i.e., balance sheets, profit and loss accounts, and cash flow statements).

- **Online reform auctions data:**

- Manually collected from the Taobao court auction platform.

Definition of Variables

Variable	Definition
Panel A: Loan-level samples	
<i>Spread</i>	Loan rate minus benchmark interest rate set by the People's Bank of China (in %).
<i>Log(Amount)</i>	Logarithm of the loan amount (in millions).
<i>Log(Maturity)</i>	Logarithm of the maturity time (in months).
<i>NPL</i>	A dummy variable equals to one if the loan was classified as “special mention”, “substandard”, “doubtful” or “loss” at the end of issue year and 0 otherwise.
<i>Online</i>	A dummy variable equals to 1 if the online auction reform is implemented, and 0 otherwise.
<i>Secured</i>	A dummy variable equals 1 for mortgage and pledge-type loans, and 0 for credit loans.
<i>SOE</i>	A dummy variable equals 1 if the firm is a state-owned enterprise, and 0 otherwise.
<i>Fixed Asset Ratio</i>	Fixed asset / Total asset.
<i>Creditrating</i>	Credit rating, 1 is the lowest rating for firms classified as B; 2 is for BB; 3 is for BBB-; 4 is for BBB; 5 is for BBB+, 6 is for A-, 7 is for A, 8 is for A+, 9 is for AA-, 10 is for AA, 11 is for AA+, and 12 is for AAA.
<i>Dependence</i>	The external financing dependence is measured as “capital expenditures minus own funds” / capital expenditures.
<i>Bank Competition</i>	The level of bank competition at the branch's location is measured by the number of commercial bank branches within a 5-kilometer radius, and then normalized.

Variable	Definition
Panel B: Branch–level samples	
<i>Secured loan amount/Total loan amount</i>	The secured loan amount issued by the branch in a given year / the total loan amount.
<i>POE Secured loan amount/Total loan amount</i>	The secured loan amount issued by the branch to POEs in a given year / the total loan amount.
<i>POE Unsecured loan amount/Total loan amount</i>	The unsecured loan amount issued by the branch to POEs in a given year / the total loan amount.
<i>SOE Secured loan amount/Total loan amount</i>	The secured loan amount issued by the branch to SOEs in a given year / the total loan amount.
<i>SOE Unsecured loan amount/Total loan amount</i>	The unsecured loan amount issued by the branch to SOEs in a given year / the total loan amount.
<i>Log(Total loan amount)</i>	Logarithm of the total loan amount issued by the branch in a given year (in millions).
<i>Log(Secured loan amount)</i>	Logarithm of the secured loan amount issued by the branch in a given year (in millions).
<i>Log(Unsecured loan amount)</i>	Logarithm of the unsecured loan amount issued by the branch in a given year (in millions).
<i>Log(Average loan size)</i>	Logarithm of the average loan amount issued by the branch. (in millions)
<i>Log(Average secured loan size)</i>	Logarithm of the average secured loan amount issued by the branch. (in millions)
<i>Log(Average unsecured loan size)</i>	Logarithm of the average unsecured loan amount issued by the branch. (in millions)
<i>Average Rate</i>	The amount-weighted average loan interest rate.
<i>Average Secured Rate</i>	The amount-weighted average interest rate of secured loans.
<i>Average Unsecured Rate</i>	The amount-weighted average interest rate of unsecured loans.
<i>Log(Interest Income)</i>	Logarithm of the sum of the loan amounts multiplied by their respective interest rates.
<i>Log(Interest Income from Secured Loans)</i>	Logarithm of the sum of the secured loan amounts multiplied by their respective interest rates.
<i>Log(Interest Income from Unsecured Loans)</i>	Logarithm of the sum of the unsecured loan amounts multiplied by their respective interest rates.
<i>Log(Secured loan amount for POE Firms with High Fixed Asset Ratio)</i>	Logarithm of secured loan amounts to high-fixed-asset POEs (top one-third).
<i>Log(Secured loan amount for POE Firms with Low Fixed Asset Ratio)</i>	Logarithm of secured loan amounts to low-fixed-asset POEs (bottom one-third)
<i>Log(Secured loan amount for High-Rated POE Firms)</i>	Logarithm of secured loan amounts to high-rated POE firms (AA- and above).
<i>Log(Secured loan amount for Low-Rated POE Firms)</i>	Logarithm of secured loan amounts to low-rated POE firms (BBB+ and below).
<i>Log(Secured loan amount for POE Firms with High External Financing Dependence)</i>	Logarithm of the secured loan amount provided to POEs in the top third of industries with the highest external financing dependence.
<i>Log(Secured loan amount for POE Firms with Low External Financing Dependence)</i>	Logarithm of the secured loan amount provided to POEs in the bottom third of industries with the lowest external financing dependence.

Summary Statistics

Panel A: Loan Level						
	Obs.	Mean	SD	P25	Median	P75
<i>Online</i>	173614	0.441	0.497	0.000	0.000	1.000
<i>Spread</i>	173614	0.610	0.670	0.031	0.560	0.915
<i>Log(Amount)</i>	173614	1.171	1.314	0.560	1.281	1.902
<i>Log(Maturity)</i>	173614	2.304	0.346	2.197	2.485	2.485
<i>Secured</i>	173614	0.888	0.315	1.000	1.000	1.000
<i>NPL</i>	173614	0.040	0.196	0.000	0.000	0.000
<i>SOE</i>	173614	0.096	0.294	0.000	0.000	0.000
<i>Credit Rating</i>	133531	6.637	3.000	5.000	8.000	9.000
<i>Fixed Asset Ratio</i>	173614	0.333	0.191	0.191	0.303	0.446
<i>External Finance Dependence</i>	96952	70.451	6.398	66.943	70.178	74.863
<i>Bank Competition</i>	170621	0.108	0.137	0.031	0.067	0.130

Panel B: Branch Level

	Obs.	Mean	SD	P25	Median	P75
<i>Secured loan amount/Total loan amount</i>	2027	0.707	0.323	0.506	0.832	1.000
<i>POE Secured loan amount/Total loan amount</i>	2027	0.629	0.325	0.388	0.701	0.927
<i>POE Unsecured loan amount/Total loan amount</i>	2027	0.192	0.259	0.000	0.078	0.295
<i>SOE Secured loan amount/Total loan amount</i>	2027	0.078	0.153	0.000	0.008	0.085
<i>SOE Unsecured loan amount/Total loan amount</i>	2027	0.101	0.234	0.000	0.000	0.045
<i>Log(Total loan amount)</i>	2027	5.610	1.493	4.762	5.740	6.633
<i>Log(Secured loan amount)</i>	2027	4.978	1.649	4.108	5.181	6.077
<i>Log(Unsecured loan amount)</i>	2027	3.435	2.552	0.000	3.932	5.535
<i>Log(Average loan size)</i>	2027	2.229	0.915	1.612	2.090	2.741
<i>Log(Average secured loan size)</i>	1984	1.880	0.768	1.406	1.811	2.261
<i>Log(Average unsecured loan size)</i>	1459	2.878	1.176	2.069	2.896	3.754
<i>Average Rate</i>	2027	5.911	1.056	4.829	6.168	6.735
<i>Average Secured Rate</i>	1984	6.061	1.083	4.988	6.354	6.885
<i>Average Unsecured Rate</i>	1459	5.664	1.008	4.558	5.883	6.405
<i>Log(Interest Income)</i>	2027	2.912	1.274	2.053	2.925	3.809
<i>Log(Interest Income from Secured Loans)</i>	2027	2.424	1.276	1.517	2.445	3.278
<i>Log(Interest Income from Unsecured Loans)</i>	2027	1.571	1.441	0.000	1.386	2.699
<i>Log(Secured loan amount for POE Firms with High Fixed Asset Ratio)</i>	2027	3.542	1.925	2.468	3.932	4.991
<i>Log(Secured loan amount for POE Firms with Low Fixed Asset Ratio)</i>	2027	2.970	2.150	0.000	3.325	4.595
<i>Log(Secured loan amount for High-Rated POE Firms)</i>	2027	3.786	1.953	2.684	4.114	5.179
<i>Log(Secured loan amount for Low-Rated POE Firms)</i>	2027	2.819	2.147	0.000	3.178	4.548
<i>Log(Secured loan amount for POE Firms with High External Finance Dependence)</i>	2027	2.678	2.020	0.000	2.990	4.331
<i>Log(Secured loan amount for POE Firms with Low External Finance Dependence)</i>	2027	2.431	2.044	0.000	2.747	4.029

I. Loan composition

- ❑ After adopting online auctions, **banks issue more secured loans**, especially for POE.
- ❑ Lending **shifts** towards secured loans **from unsecured** loans.

VARIABLES	(1) <i>Secured loan amount /Total loan amount</i>	(2) <i>POE Secured loan amount /Total loan amount</i>	(3) <i>POE Unsecured loan amount /Total loan amount</i>	(4) <i>SOE Secured loan amount /Total loan amount</i>	(5) <i>SOE Unsecured loan amount /Total loan amount</i>
<i>Online</i>	0.056** (0.016)	0.045** (0.016)	-0.042** (0.017)	0.011 (0.006)	-0.014 (0.014)
Controls (Branch Size)	Yes	Yes	Yes	Yes	Yes
Observations	2,022	2,022	2,022	2,022	2,022
Adjusted R-squared	0.623	0.642	0.554	0.485	0.650
Cluster at City and Year	Yes	Yes	Yes	Yes	Yes
Branch FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Notes: Controls includes Branch Size measured by log of total loan amount, standard errors clustered at City and Year

II A. Δ in Loan Interest Rate Spread

□ The interest rate spread increases for unsecured loans and stays the same for secured loans.

VARIABLES	Full Sample				SOE	POE
	(1) Spread	(2) Spread	(3) Spread	(4) Spread	(5) Spread	(6) Spread
Online	0.198** (0.080)	0.206** (0.078)	0.191** (0.058)	0.172** (0.054)	0.180** (0.062)	0.144** (0.055)
Online * Secured	-0.210** (0.080)	-0.221** (0.078)	-0.170** (0.052)	-0.193** (0.059)	-0.269*** (0.067)	-0.155** (0.056)
Log(Amount)		-0.130*** (0.019)	-0.015* (0.007)	-0.015* (0.007)	0.003 (0.008)	-0.017* (0.008)
Log(Maturity)		0.094* (0.039)	0.014 (0.025)	0.006 (0.025)	0.004 (0.036)	0.008 (0.026)
Observations	177,700	177,135	173,689	173,614	16,594	156,997
Adjusted R-squared	0.295	0.344	0.582	0.577	0.559	0.574
Secured FE	Yes	Yes	Yes	Yes	Yes	Yes
City FE	Yes	Yes	—	—	—	—
Year FE	Yes	Yes	Yes	—	—	—
Firm FE	No	No	Yes	Yes	Yes	Yes
Sub-branch FE	No	No	Yes	Yes	Yes	Yes
Initial*Year FE	No	No	No	Yes	Yes	Yes
Test of Row1 + Row2	0.809	0.772	0.641	0.692	0.300	0.825

II.B Factors that drives the Δ interest rate spreads (focus on POEs)

- Borrower factors?
 - High vs. low fixed assets
 - High vs. low finance dependence industries
 - High vs. low credit ratings
- Competition in supply (lots vs only a few other banks' branches in a 5km radius)?



II.B Results (focus on POEs)

- Factors that drive the changes in spreads (up in unsecured and down in secured loans)
 - High vs. low fixed assets
 - High vs. low finance dependence industries
 - High vs. low credit ratings
 - High vs low bank competition



II.C. Lending Market Competition and Δ in Default Risk

2. Bank competition on change in default risk (POEs)

VARIABLES	(1) Full Samples NPL	(2) High Bank Competition NPL	(3) Low Bank Competition NPL
Online	-0.034** (0.011)	-0.042* (0.018)	-0.008 (0.020)
Online * Secured	0.040** (0.013)	0.046* (0.020)	0.021 (0.023)
Log(Amount)	0.001 (0.002)	0.003 (0.002)	0.005 (0.003)
Log(Maturity)	-0.025*** (0.006)	-0.017* (0.008)	-0.028** (0.010)
Spread	0.005* (0.002)	-0.001 (0.006)	0.007 (0.005)
Observations	156,997	36,870	48,817
Adjusted R-squared	0.413	0.415	0.392
Secured FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Sub-branch FE	Yes	Yes	Yes
Initial*Year FE	Yes	Yes	Yes
Test of Row1 + Row2	0.305	0.593	0.224

❑ Significant **decrease** in the probability of default for unsecured loans following the reform.

❑ But no significant change in the probability of default for secured loans. **Why?**

❑ Increase in loan amount / pledged assets? Check the loan amount per deal?

III. The reform's effect on branch characteristics

- **Change in loan characteristics**
 - Volume
 - Size
 - Interest earnings
 - Driven by secured lending
 - And lending to POEs with high fixed assets and credit ratings



III.A Effect of the reform on Branches' loan characteristics

□ Greater overall lending, larger per deal, and driven by secured loans.

Panel A: The total loan amount issued by the branch			
VARIABLES	(1) <i>Log(Total loan amount)</i>	(2) <i>Log(Secured loan amount)</i>	(3) <i>Log(Unsecured loan amount)</i>
<i>Online</i>	0.169** (0.061)	0.242** (0.075)	-0.106 (0.108)
Observations	2,022	2,022	2,022
Adjusted R-squared	0.825	0.790	0.665
Panel B: The average loan amount per loan			
VARIABLES	<i>Log(Average loan size)</i>	<i>Log(Average secured loan amount)</i>	<i>Log(Average unsecured loan amount)</i>
<i>Online</i>	0.116* (0.050)	0.121** (0.047)	-0.035 (0.069)
Observations	2,022	1,981	1,439
Adjusted R-squared	0.679	0.542	0.618
Cluster at City and Year	Yes	Yes	Yes
Branch FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

III.A Effect of the reform on Branches' loan characteristics

- Increase in interest income driven by larger and more secured loans

Panel C: The interest income of the branch			
VARIABLES	<i>Log(Interest Income)</i>	<i>Log(Interest Income from Secured Loans)</i>	<i>Log(Interest Income from Unsecured Loans)</i>
<i>Online</i>	0.134** (0.043)	0.140** (0.041)	-0.005 (0.054)
Observations	2,022	2,022	2,022
Adjusted R-squared	0.850	0.852	0.731
Cluster at City and Year	Yes	Yes	Yes
Branch FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

III.B Which POEs get more secured loans? POEs with high credit ratings

□ Aggregated secured loan volume across different types of POE firms.

Panel A: Heterogeneity of Fixed Asset Ratio

VARIABLES	(1) <i>Log(Secured loan amount for POE Firms with High Fixed Asset Ratio)</i>	(2) <i>Log(Secured loan amount for POE Firms with Low Fixed Asset Ratio)</i>
<i>Online</i>	0.225** (0.091)	0.199 (0.115)
Observations	2,022	2,022
Adjusted R-squared	0.729	0.783

Panel B: Heterogeneity of External Finance Dependence

VARIABLES	<i>Log(Secured loan amount for POE Firms with High External Finance Dependence)</i>	<i>Log(Secured loan amount for POE Firms with Low External Finance Dependence)</i>
<i>Online</i>	0.080 (0.084)	0.013 (0.091)
Observations	2,022	2,022
Adjusted R-squared	0.732	0.744

Panel C: Heterogeneity of Credit Rating

VARIABLES	<i>Log(Secured loan amount for High-Rated POE Firms)</i>	<i>Log(Secured loan amount for Low-Rated POE Firms)</i>
<i>Online</i>	0.292** (0.100)	0.032 (0.101)
Observations	2,022	2,022
Adjusted R-squared	0.746	0.774
Cluster at City and Year	Yes	Yes
Branch FE	Yes	Yes
Year FE	Yes	Yes

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Impact on firms (borrowers)

- Whose access to credit goes down?
 - POEs in high external finance-dependent industries with poor credit ratings?
- Firm entry rate?



IV.A The Impact of Online Auction Reforms on Firms' Access to Loan

□ The overall likelihood of obtaining loans increases for all POEs except only those in external finance-dependent industries with low fixed credit ratings. Efficient?

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	LoanDummy	LoanDummy	LoanDummy	LoanDummy	LoanDummy	LoanDummy
Online	0.109*** (0.0311)	0.221*** (0.0296)	0.229*** (0.0325)	0.118*** (0.0329)	0.227*** (0.0310)	0.228*** (0.0344)
Online × LowFA	-0.0301 (0.0382)		-0.0208 (0.0383)	-0.00897 (0.0415)		-0.00346 (0.0416)
Online × LowRating		-0.570*** (0.0453)	-0.570*** (0.0453)		-0.527*** (0.0499)	-0.527*** (0.0499)
Online × HighEFD				-0.0474 (0.0581)	-0.0319 (0.0548)	0.00392 (0.0628)
Online × LowFA × HighEFD				-0.165 (0.106)		-0.131 (0.107)
Online × LowRating × HighEFD					-0.238** (0.120)	-0.229* (0.120)
Observations	77,483	77,483	77,483	77,483	77,483	77,483
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.0527	0.0552	0.0552	0.0528	0.0553	0.0553
Test of Row1 + Row2	0.034		0.000			
Test of Row1 + Row3		0.000	0.000			
Test of Row1 + Row2 + Row4 + Row5				0.225		0.277
Test of Row1 + Row3 + Row4 + Row6					0.000	0.000

IV.B. The Impact of Online Auction Reforms on Firm Registration

- The number of POE firm registrations increased significantly after the online reform, while SOE registrations showed no such change.

DV: Firm Registration	(1) SOE firms	(2) SOE firms	(3) POE firms	(4) POE firms
Online reform	0.00545 (1.16)		3.094** (2.38)	
Online reform (2 year earlier)		-0.00256 (0.44)		0.55 (1.02)
Observations	6754	6754	6754	6754
R-squared	0.419	0.419	0.669	0.668
Cluster at province level	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

A China story: use competitive online auctions to expedite the conversion of collaterals to lender compensations promote secured lending favoring the deserving

- **Examine the impact of the online reform using DiD regressions**
 - Adopting online auctions of bankrupt borrowers raises the ex-ante value of secured → demand and supply shifts in secured and non-secured loans.
- **Loans**
 - Lending shifts towards secured loans from unsecured loans.
 - For retained unsecured loans, higher interest rate spreads and lower default risk
 - For secured loans, there is no significant change in rate spreads and default risks, but a higher loan amount per deal.
 - Driver of the changes:
 - Borrowers with greater fixed assets, better credit ratings, and in more external finance-dependent industries
 - Market competition presses branches to respond to the demand changes
- **Branches driven by secured loans to POEs**
 - More overall lending and a bigger average loan size
 - Higher interest income
- **Economy**
 - Greater access to secured bank loans,
 - only POEs with poor credit ratings in high EFD industries see a drop in the probability of loan access
 - More POE entries



The End

