Can Technology Undermine Macroprudential Regulation?

Evidence from Peer-to-Peer Credit in China

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This paper…

A study on P2P lending…

….its relationships with households leverage

… and regulation effectiveness

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A study on P2P lending…

….its relationships with households leverage

… and regulation effectiveness

- How far can it fuel households leverage?

- How much can it undermines regulatory action?

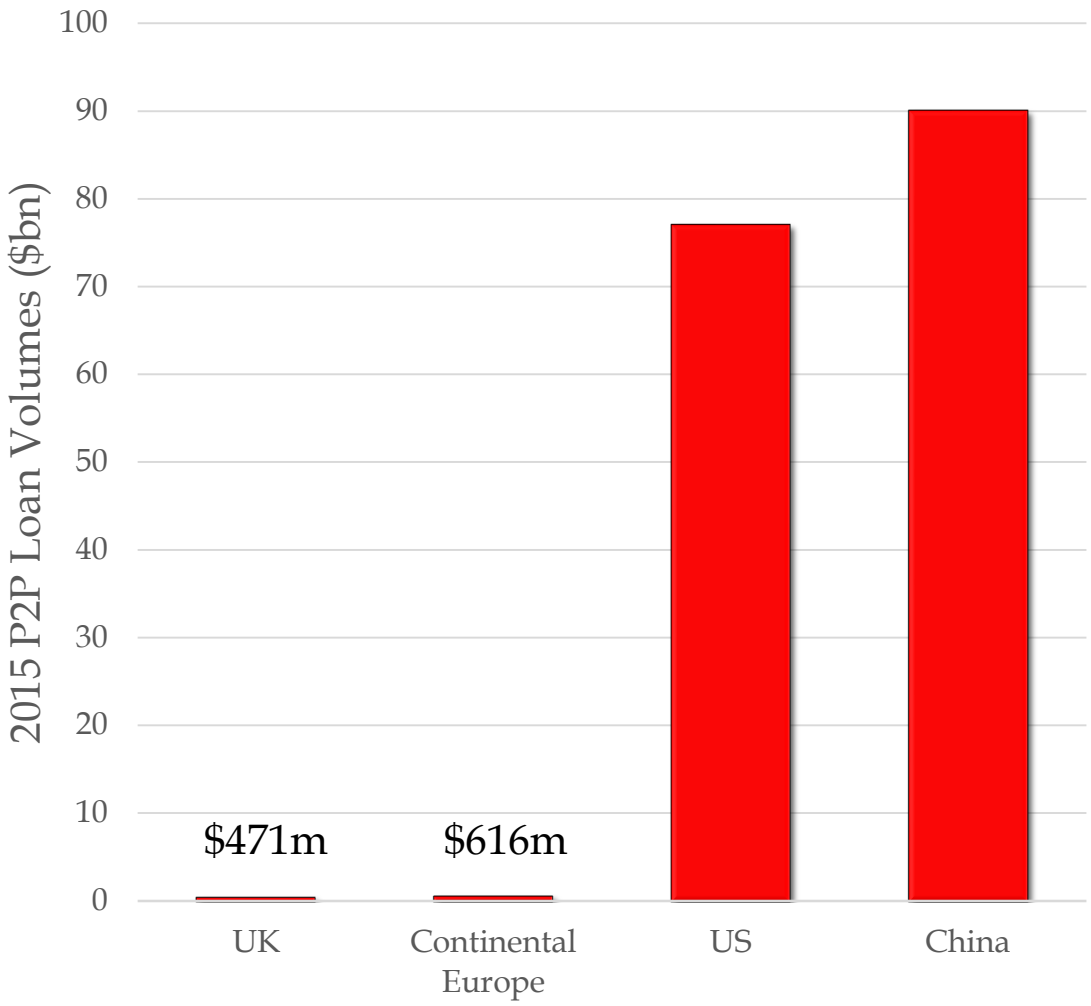
Motivations

- The Great Recession was preceded by a rapid expansion of credit that ended with
  - collapse of house prices
  - fall in consumption

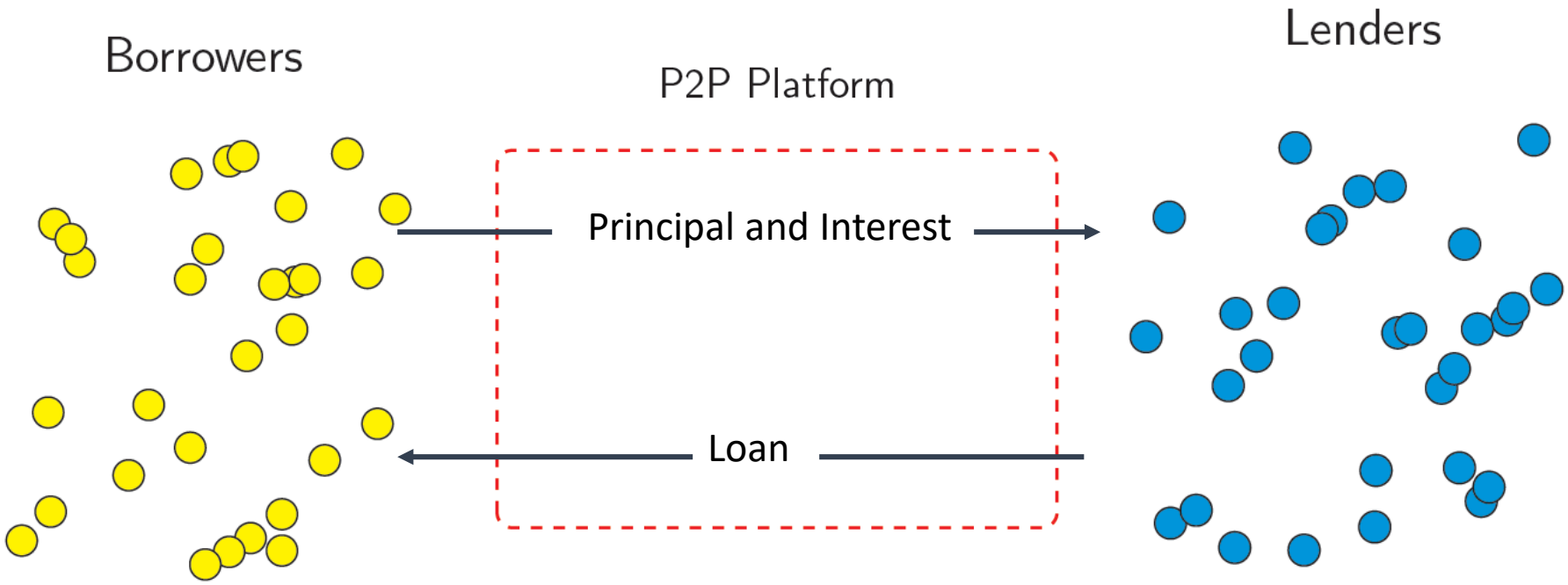
- Macroprudential tools can be used to limit household leverage
  - **Loan to Value Ratios (LTV)**

- Because of specific target, LTV caps open to circumvention
  - Here: P2P credit channel

Motivations



- P2P lending is a recent innovation in the financial industry
- Increasingly rivaling traditional consumer credit (Morse (2015))



A channel to circumvent LTV caps because:

- "Anonymity"
- Unprecedentedly large potential funding pool

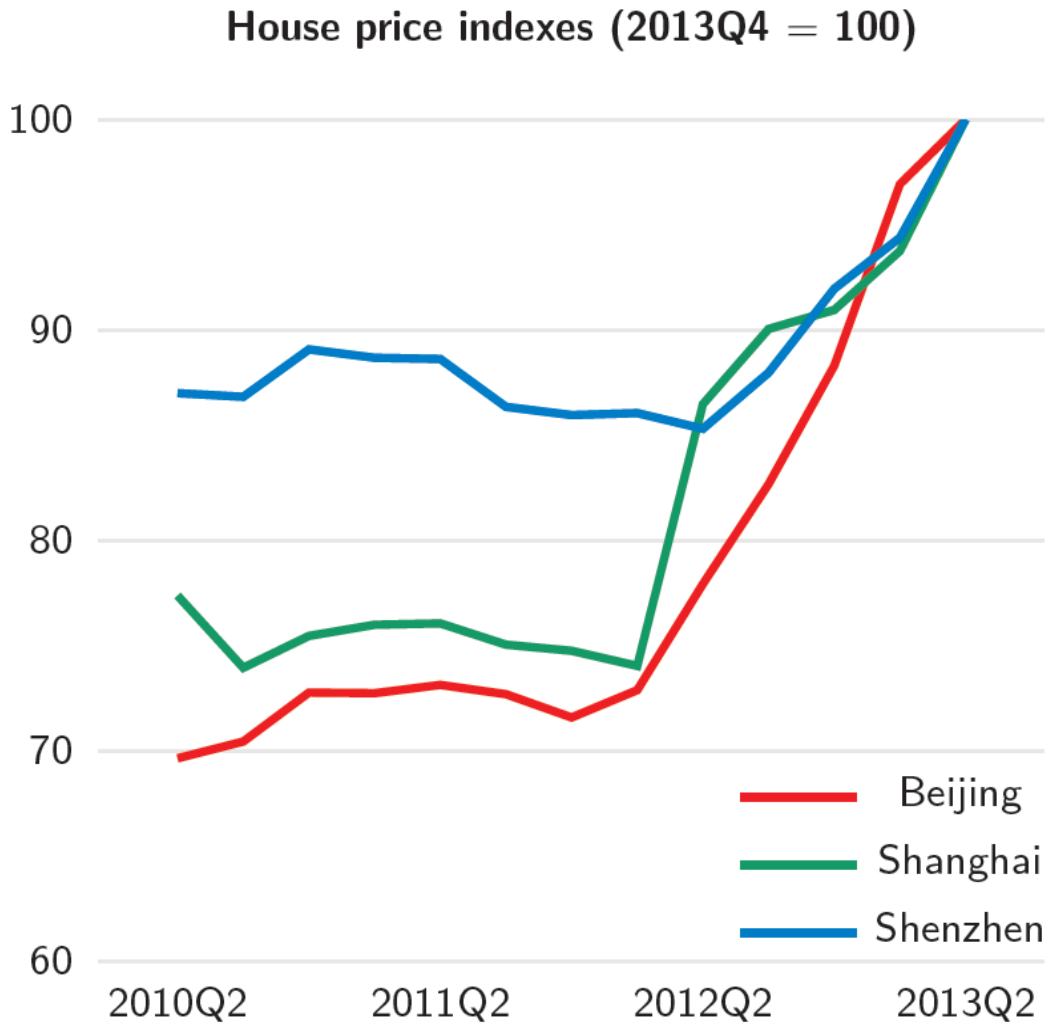
Preview of the findings

- Use shock to P2P credit demand driven by regulation in the real estate market

- We find that:
  - P2P channel can generate large credit volumes. . .

  - . . . . and facilitate circumventing LTV caps

2013 Credit demand shock

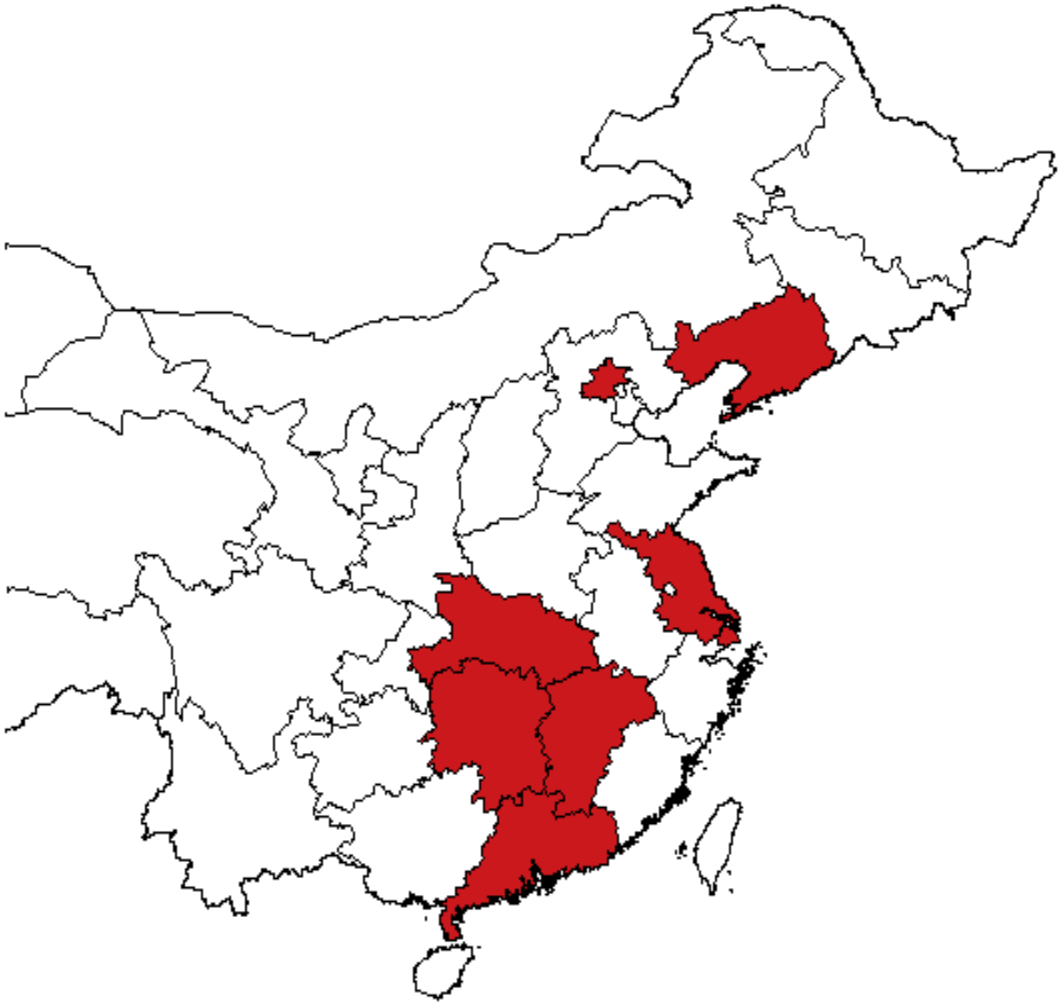


- **November 2013:**

16.7% rise (from 60 to 70%) in mortgage down-payment requirements for second homes:

- Beijing, Changsha, Guangzhou, Hangzhou, Nanjing, Nanchang, Shanghai, Shenyang, Shenzhen, Wuhan

2013 Credit demand shock



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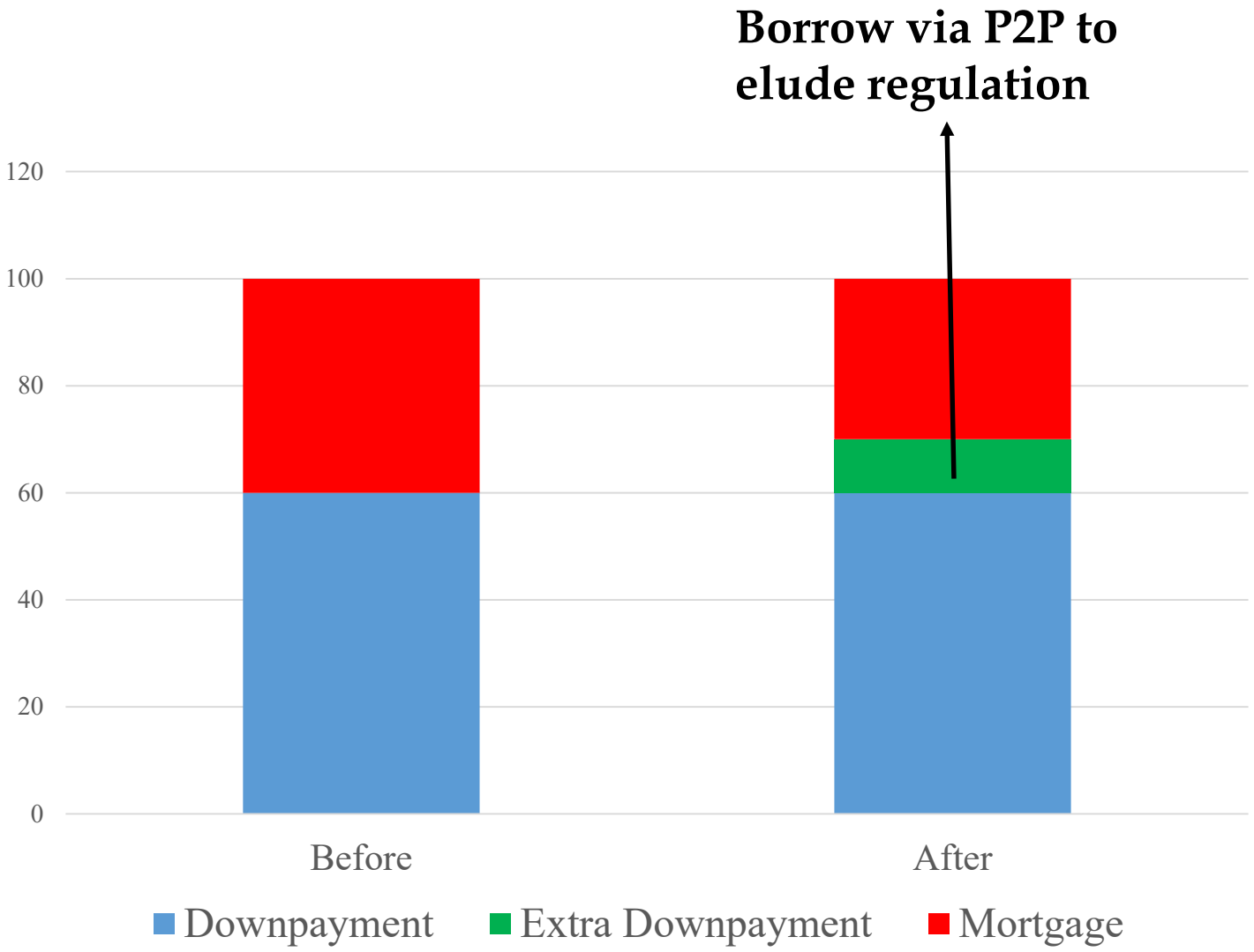


Chinese Economy

China steps up battle against runaway property prices

Banks ordered to clamp down on use of credit for mortgage downpayments

apartment buildings in Shenzhen, which is among the jurisdictions that have launched a clampdown © Bloomberg

OCTOBER 1, 2017 by Xinning Liu in Beijing and Gabriel Wildau in Shanghai

Chinese banking regulators have told lenders to crack down on the use of consumer loans to finance home purchases, the latest effort to cool down the overheated property market and rein in financial risk.

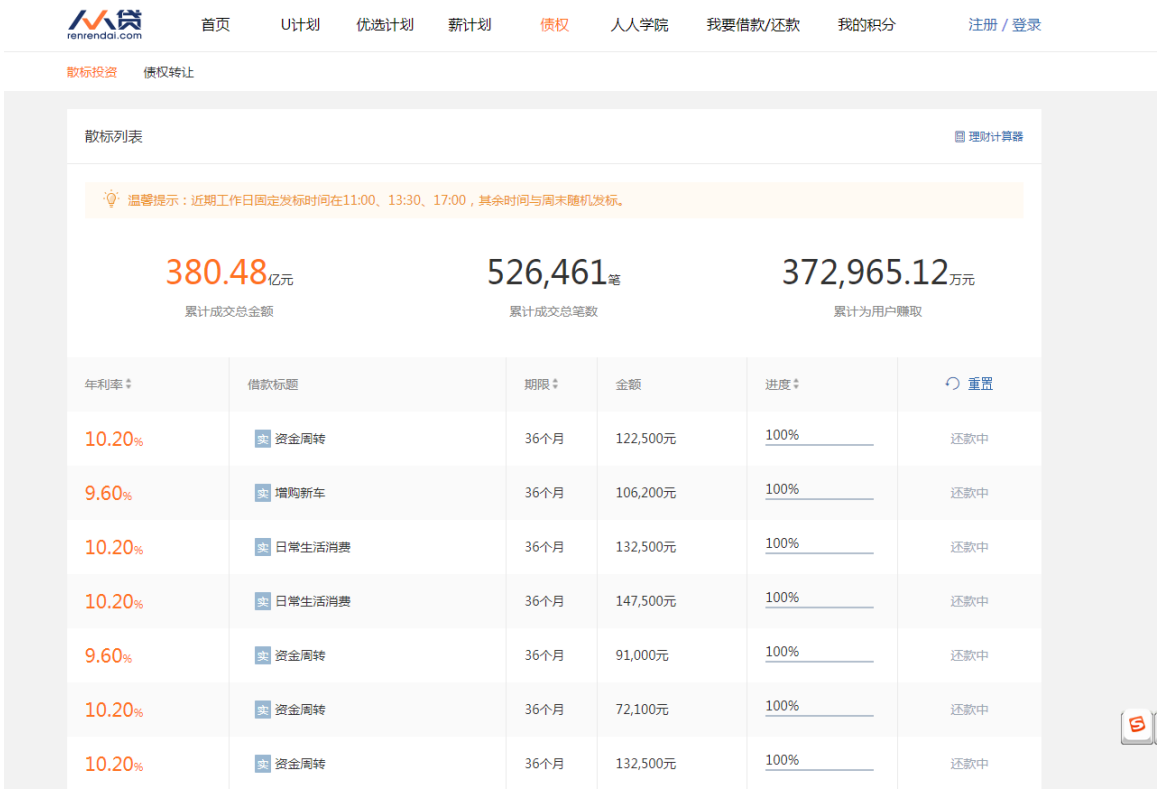
2015 Credit demand shock

- **Sept 2015-Feb 2016:**

16.7% drop in mortgage down-payment requirements for 1st and 2nd homes

All Chinese cities except:
Beijing, Guangzhou, Sanya, Shanghai, Shenzhen

Reduce P2P borrowing



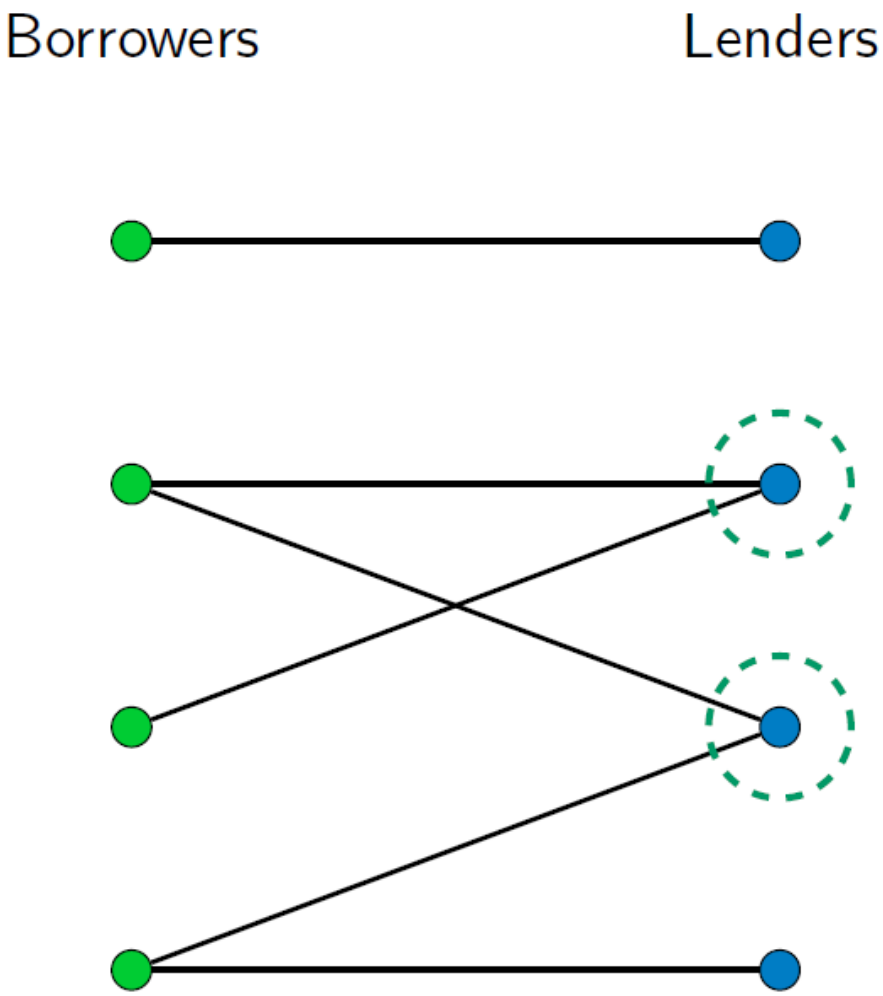
人人贷
renrendai.com

- Leading platform with over 3 million accounts
- In 2013, cumulative turnover since launch: $3.7bn
- Ranking in top percentile of Chinese P2P platforms

We observe ALL lenders and borrowers transactions:

- 24,000,000 transactions
- involving about 700,000 borrowers

Identification



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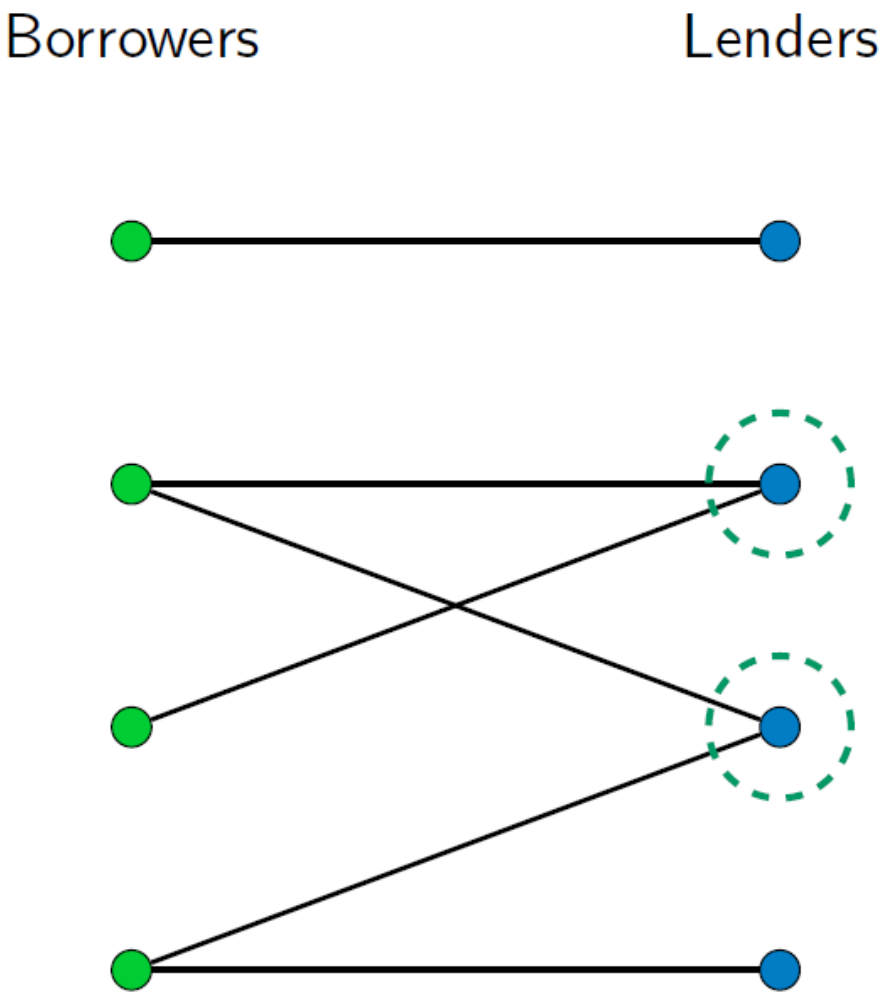

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- In 2013, cumulative turnover since launch: $3.7bn
- Ranking in top percentile of Chinese P2P platforms
- Allows us to control lender × date fixed effects to control changes in credit supply

How do transactions take place?

- Borrower fills out an application
- Borrower receives a credit score based on the information provided
- Borrower decides the amount, interest rate and maturity of the loan
- Lender observes the borrower's offer and decides whether to bid

	Mean	St. dev.	Min	Median	Max	N
A. Loan characteristics						
Loan amount (RMB)	59,674	53,816	3,000	52,900	3,000,000	107,502
Interest rate (%)	12.49	1.01	7	12.6	24.4	107,502
Interest rate spread (%)	7.78	1.07	2.89	7.84	19.81	107,502
Duration (months)	27.06	9.78	1	24	36	107,502
On-site verification (Y/N)	0.77	0.42	0	1	1	107,457
Borrower credit score	171.82	29.71	0	180	181	107,339
Proportion of months delinquent (%)	1.96	11.35	0	0	100	107,502
Default (0/1)	0.02	0.14	0	0	1	78,289
B. Borrower characteristics						
Income (monthly RMB)	11,334	13,254	0	5,000	50,000	107,494
Age	37.74	8.41	23	36	56	107,502
College degree (0/1)	0.52	0.5	0	1	1	107,498
Male (0/1)	0.64	0.48	0	1	1	107,502
Married (0/1)	0.71	0.45	0	1	1	107,502
Home owner (0/1)	0.5	0.5	0	1	1	107,502
Number of applications since registration	1.35	3.54	1	1	148	107,502
Total amount borrowed since registration (RMB)	66,079	99,927	3,000	53,600	9,000,000	107,502
Number of lenders per loan	44.87	55.06	1	30	1,841	107,457

Loan to Annual Income: 44% - US: 20% (Balyuk, 2016)

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Loan to Annual Income: 44% - US: 20% (Balyuk, 2016)

Interest to Monthly Income: 6% - US: 7.5% (Morse, 2015)

Default Rate: 2.3% - US: 2.5% (Morse, 2016)

Questions:

- Do P2P lenders supply the extra credit?
- Do they adjust loan prices and/or duration?
- Do they increase screening?
- Are new P2P borrowers riskier?

Empirical strategy

$$L_{lbt} = \alpha_b + \alpha_l + \alpha_t + \alpha_l \times Post_t + \beta Post_t \times Treated_b + \gamma' x_{bt} + \varepsilon_{lbt}$$

$$Post_t = \begin{cases} 1 \; if \; date \geq December \; 2013 \\ 0 \quad Otherwise \end{cases}$$

$$Treated_b = \begin{cases} 1 \; if \; borrower \; lives \; in \; a \; city \; that \; changed \; down - payment \; requirements \\ 0 \quad Otherwise \end{cases}$$

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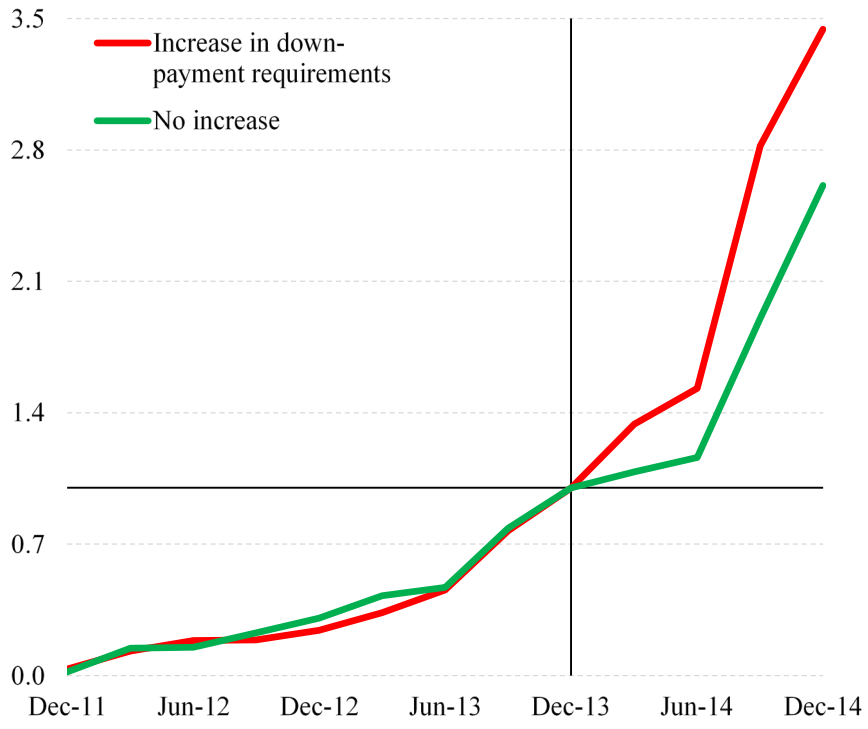
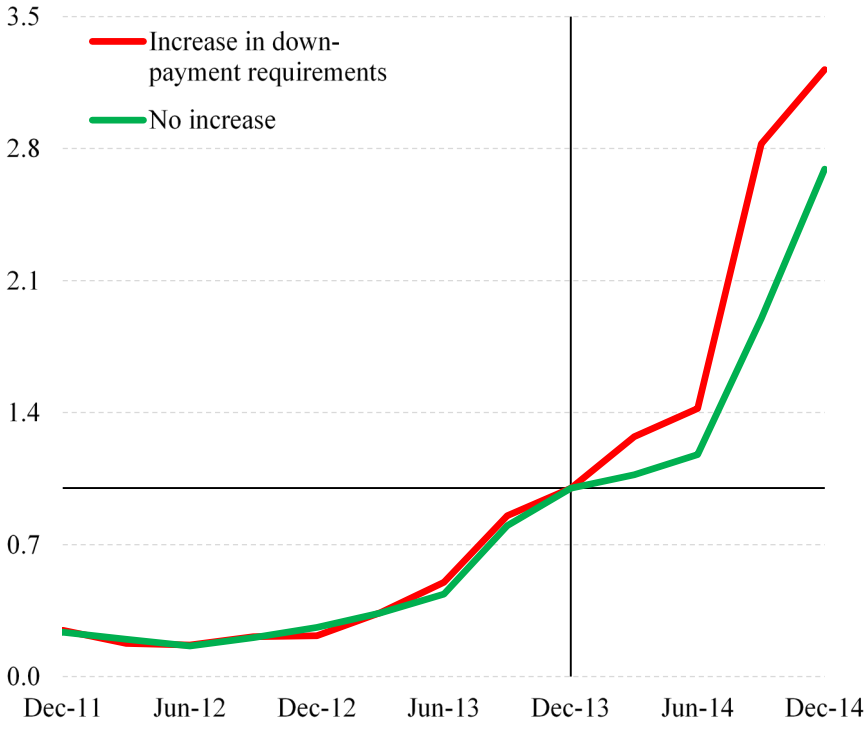
To take into account serial correlation of the standard errors, we collapse and take first differences before and after the shock (Bertrand, Duflo, and Mullainathan (2004))

$$\Delta L_{lb} = \alpha_l + \beta Treated_b + \gamma' \Delta x_b + \varepsilon_{lb}$$

A. RMB volumes



B. Number of loans



Results – Loan volume

- Borrower-lender level

$$\Delta L_{lb} = \alpha_l + \beta Treated_b + \gamma' \Delta x_b + \varepsilon_{lb}$$

	Full Sample			
	(1)	(2)	(3)	(4)
Treated	0.023*	0.035***	0.034**	0.045**
	(0.013)	(0.012)	(0.013)	(0.022)
Controls:				
Growth	Y	Y	Y	Y
Levels and Labor market	N	Y	Y	Y
Household finance	N	N	Y	Y
Region FE	Y	Y	Y	Y
Lender FE	Y	Y	Y	N
R^2	0.38	0.39	0.39	0.050
N	4,677,495	4,677,495	4,677,495	4,690,509

Economic effects

- Implied Increase in P2P borrowing: **61%** over 18 months
- Avg P2P Loan Rmb. 60,000:
  - Extra Rmb. 36,720 = (60,000 × 0.034 × 18)
- 2013 price of 70 square meters home in Nanjing: Rmb. 875,000
- Increase in Down-payment Requirement: Rmb. 87,500
- We explain about 41% = (36,720/87,500)
- Likely to be a lower bound if borrowers access more P2P platforms

Results – Loan volume

- Borrower-lender level

$$\Delta L_{lb} = \alpha_l + \beta Treated_b + \gamma' \Delta x_b + \varepsilon_{lb}$$

	Treated city:		**Pre-2013 active lenders:**		**Additional controls:**	
	Tier 1	**Tier 2**	**Registered**	**Lent**	**City Controls**	**Controls Interacted**
	(1)	(2)	(3)	(4)	(5)	(6)
Treated	0.117*	0.024**	0.061***	0.067***	0.037***	0.034***
	(0.068)	(0.011)	(0.021)	(0.022)	(0.010)	(0.012)
Controls:						
Growth	Y	Y	Y	Y	Y	Y
Levels and Labor market	Y	Y	Y	Y	Y	Y
Household finance	Y	Y	Y	Y	Y	Y
Region FE	Y	Y	Y	Y	Y	Y
Lender FE	Y	Y	Y	Y	Y	Y
R^2	0.39	0.37	0.267	0.24	0.39	0.39
N	3,772,547	4,049,120	2,673,671	2,457,154	4,677,495	4,677,495

Results – Loan volume

- Borrower-lender level

$$\Delta L_{lb} = \alpha_l + \beta Treated_b + \gamma' \Delta x_b + \varepsilon_{lb}$$

	Borrower home owner		**Borrower city house prices growth forecast**	
	Yes	**No**	**High**	**Low**
	(1)	(2)	(3)	(4)
Treated	0.052***	-0.002	0.077***	0.022***
	(0.011)	(0.020)	(0.024)	(0.008)
Controls:				
Province	Y	Y	Y	Y
Labor market	Y	Y	Y	Y
Household finance	Y	Y	Y	Y
Region FE	Y	Y	Y	Y
Lender FE	Y	Y	Y	Y
R^2	0.36	0.40	0.39	0.37
N	3,865,736	3,955,877	3,888,534	3,933,161
F test (p-value)	9.00*** (0.018)		5.25** (0.024)	

Questions:

- Do P2P lenders supply the extra credit? **Yes**
- Do they adjust loan prices and/or duration?
- Do they increase screening?
- Are new P2P borrowers riskier?

Results – Loan terms

- Borrower level

$$Y_{bt} = \alpha + \beta Treated_b + \gamma Post_t + \delta(Treated_b \times Post_t) + \mu' x_{bt} + \varepsilon_{bt}$$

	On-site Verification	Credit Score	Spread	Duration
	(1)	(2)	(3)	(4)
$Treated \times Post$	-0.047	-0.008	0.000	0.003
	(0.052)	(0.031)	(0.001)	(0.021)
Controls	Y	Y	Y	Y
City FE	Y	Y	Y	Y
Month FE	Y	Y	Y	Y
Region × Month FE	Y	Y	Y	Y
R^2	0.58	0.23	0.53	0.53
N	103,181	103,062	103,225	103,225

Questions:

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Results – Ex-post performance

- Borrower level

			Loss given default	
	Delinquency	**Default**	**Loan size**	**Outstanding loan amount**
	(1)	(2)	(3)	(4)
$Treated \times Post$	0.011***	0.006*	3.573***	0.291***
	(0.004)	(0.003)	(0.748)	(0.078)
Controls	Y	Y	Y	Y
City FE	Y	Y	Y	Y
Month FE	Y	Y	Y	Y
Region × Month FE	Y	Y	Y	Y
R^2	0.22	0.13	0.22	0.16
N	103,225	91,836	1,429	1,429

Results – Ex-post performance

- Delinquencies
  - **Delayed Repayments increase of about 50%**

- Defaults
  - **Defaults on the platform increase of 30%**
  - **Size of the defaulted loans is three times larger**
  - **Size of the outstanding loan amount is 30% larger**

    - **Results driven by new borrowers in cities that changed down-payment requirements**

Questions:

- Do P2P lenders supply the extra credit? **Yes**
- Do they adjust loan prices and/or duration? **No**
- Do they increase screening? **No**
- Are new P2P borrowers riskier? **Yes**

2015 Experiment

- **Sept 2015-Feb 2016:**

16.7% drop in mortgage down-payment requirements for first & second homes

All Chinese cities except:
Beijing, Guangzhou, Sanya, Shanghai, Shenzhen

We find:

- A reduction of amount lent via P2P of about 60%
- Loan conditions basically unaltered
- Slight decline in defaults

Policy implications

- Macroprudential tools (e.g. LTV caps) aim to contain household leverage

- Our findings: LTV caps prone to circumvention via P2P

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Solution not trivial:

- Broaden scope, e.g. to debt-to-income ratios:
  - Monitor entire debt of the borrower
  - Intrusive policy that prevents consumption smoothing
  - Erode the flexibility that makes P2P viable
  - Very tight DTI ratios may exacerbate business cycle fluctuations

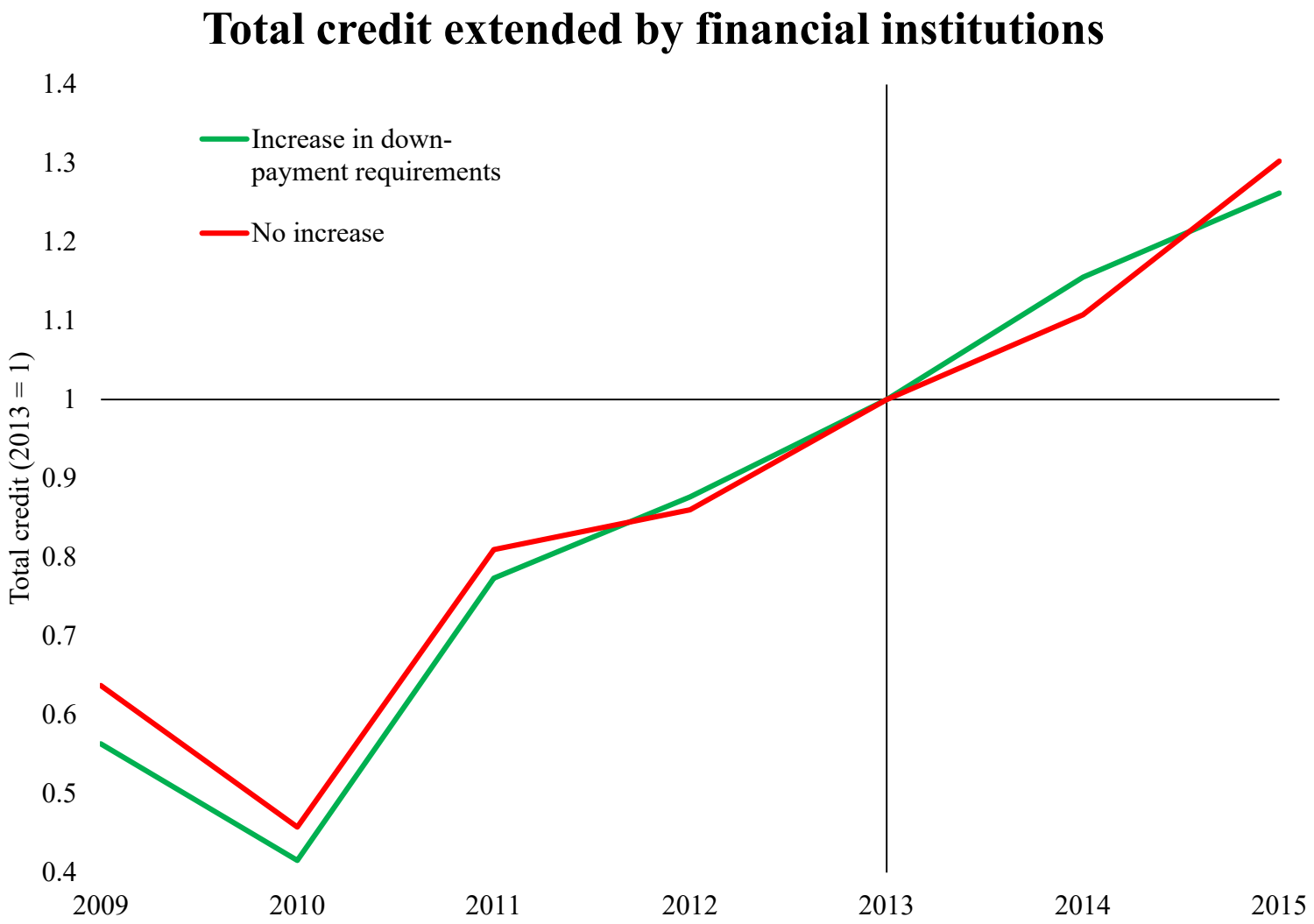
Wrap up

- P2P credit: a channel to elude LTV caps?
- We rely on two demand shocks (in 2013 and 2015)
- P2P channel can generate large credit volumes…
- … and undermines regulatory action

Treated cities vs. control cities

	Treated	Control	Difference	t-statistic
A. Borrower characteristics				
Income (RMB)	11,216	11,873	656.27	0.731
Age	39.18	38.73	0.449	1.175
College degree (0/1)	0.51	0.45	0.06	1.695*
Male (0/1)	0.59	0.57	0.02	0.877
Married (0/1)	0.71	0.73	-0.02	-0.988
Home owner (0/1)	0.18	0.27	-0.09	-2.040**
Number of applications since registration	1.51	2.06	-0.56	-0.974
Total amount borrowed since registration (RMB)	69,501	65,005	4,494	0.536
Number of lenders per loan	33.37	33.81	-0.44	-0.272
B. Lender characteristics				
Portfolio size (RMB)	464,976	488,243	-23,266	-0.826
Portfolio size (nr. loans)	262.7	269.9	-7.173	-0.573
Uplan lending (% of RMB)	68.88	71.57	-2.698	-0.637
Uplan lending (% of loans made)	72.72	75.51	-2.790	-0.652
Experience (months since first loan)	5.505	5.410	0.094	-0.433
C. Macroeconomic characteristics				
Province GDP per capita (RMB)	60,301	46,991	13,310	1.060
Province population (× 10,000)	5,251	6,249	-998	-0.649
Province annual GDP per capita growth (%)	8.16	11.20	-0.03	-1.336
Province annual population growth (%)	1.04	0.76	0.28	0.690
House price index	0.20	0.15	0.05	0.874
% change in house prices (past 6 months)	17.67	17.62	0.05	0.104
Household net debt-to-income	-0.745	-0.422	-0.323	-1.299
Real wage index	1.425	1.613	-0.188	-0.826
Annual real wage growth (%)	0.4	0.7	-0.3	-0.912
Unemployment rate (%)	13.4	14.5	1.5	0.544
RenrenDai penetration (applications per 10,000 inhabitants)	1.725	1.411	0.314	0.773

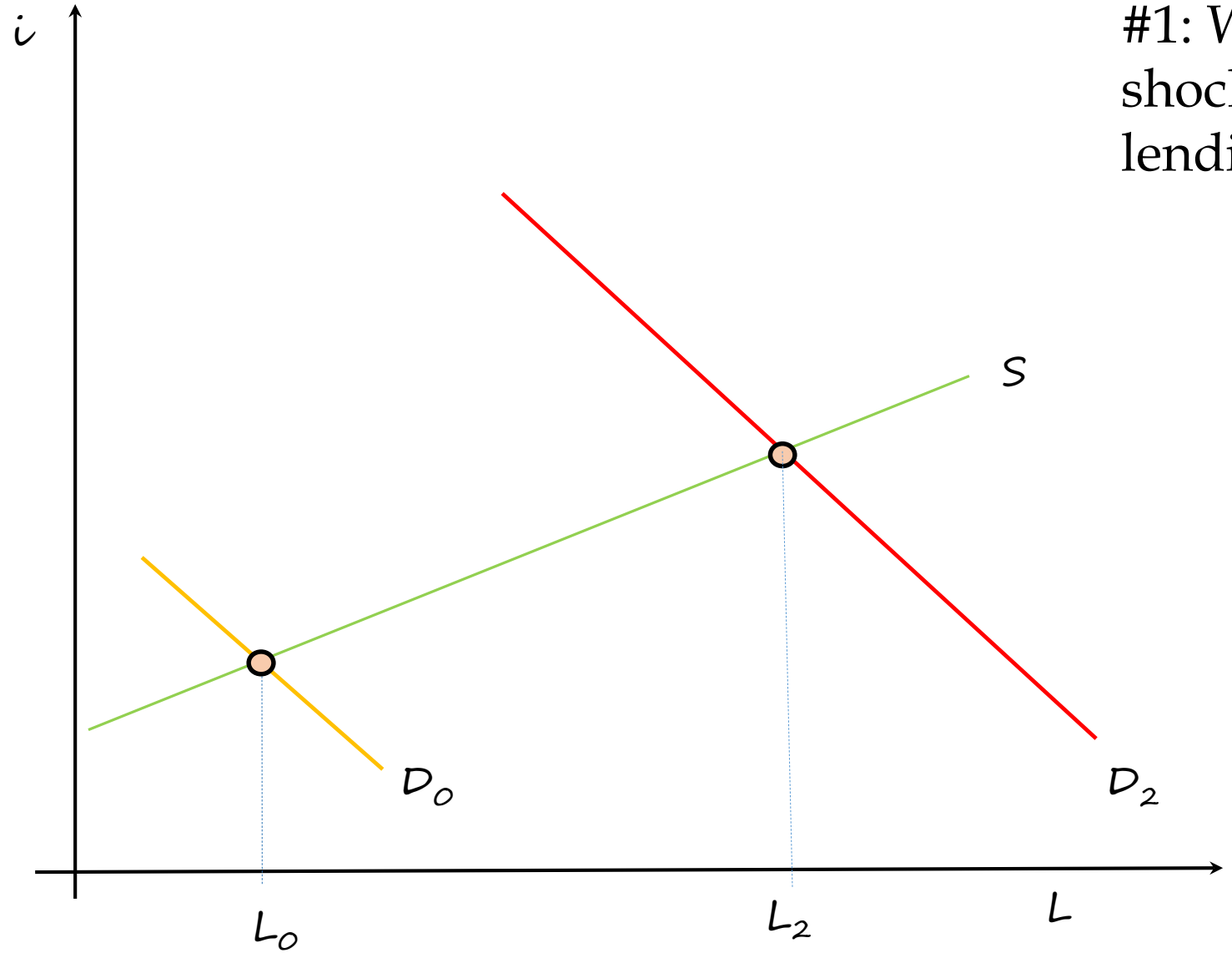
Treated cities vs. control cities



City Level Regressions

	Credit volumes					
	Applications		Loans		House prices growth	
	(1)	(2)	(3)	(4)	(5)	(6)
Treated	0.086***	0.062***	0.027*	0.031**	0.001	0.003
	(0.016)	(0.016)	(0.016)	(0.015)	(0.003)	(0.003)
Controls	N	Y	N	Y	N	Y
R^2	0.40	0.60	0.29	0.56	0.10	0.29
N	52	52	52	52	51	51

Identification



#1: We need a shock to P2P lending demand

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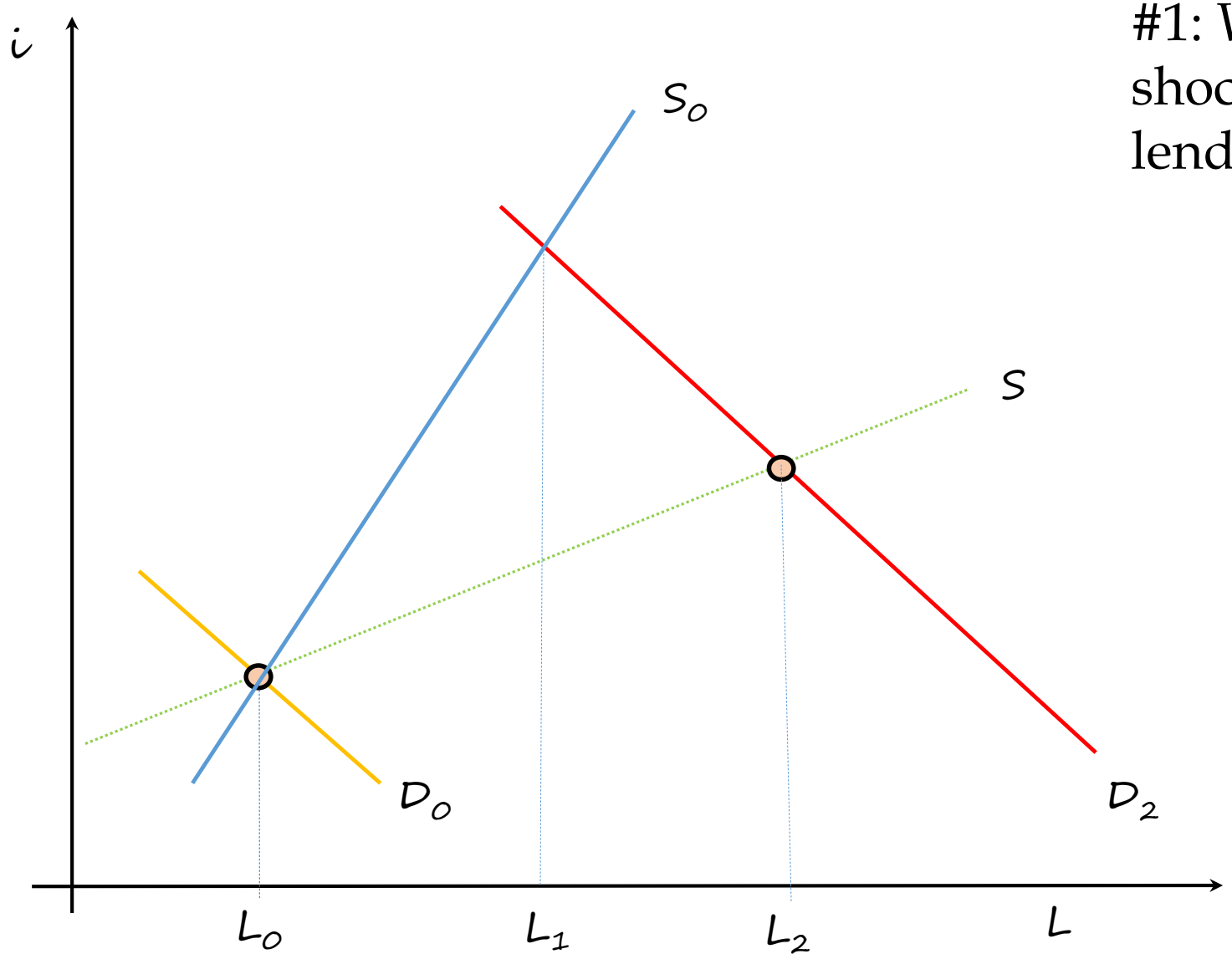
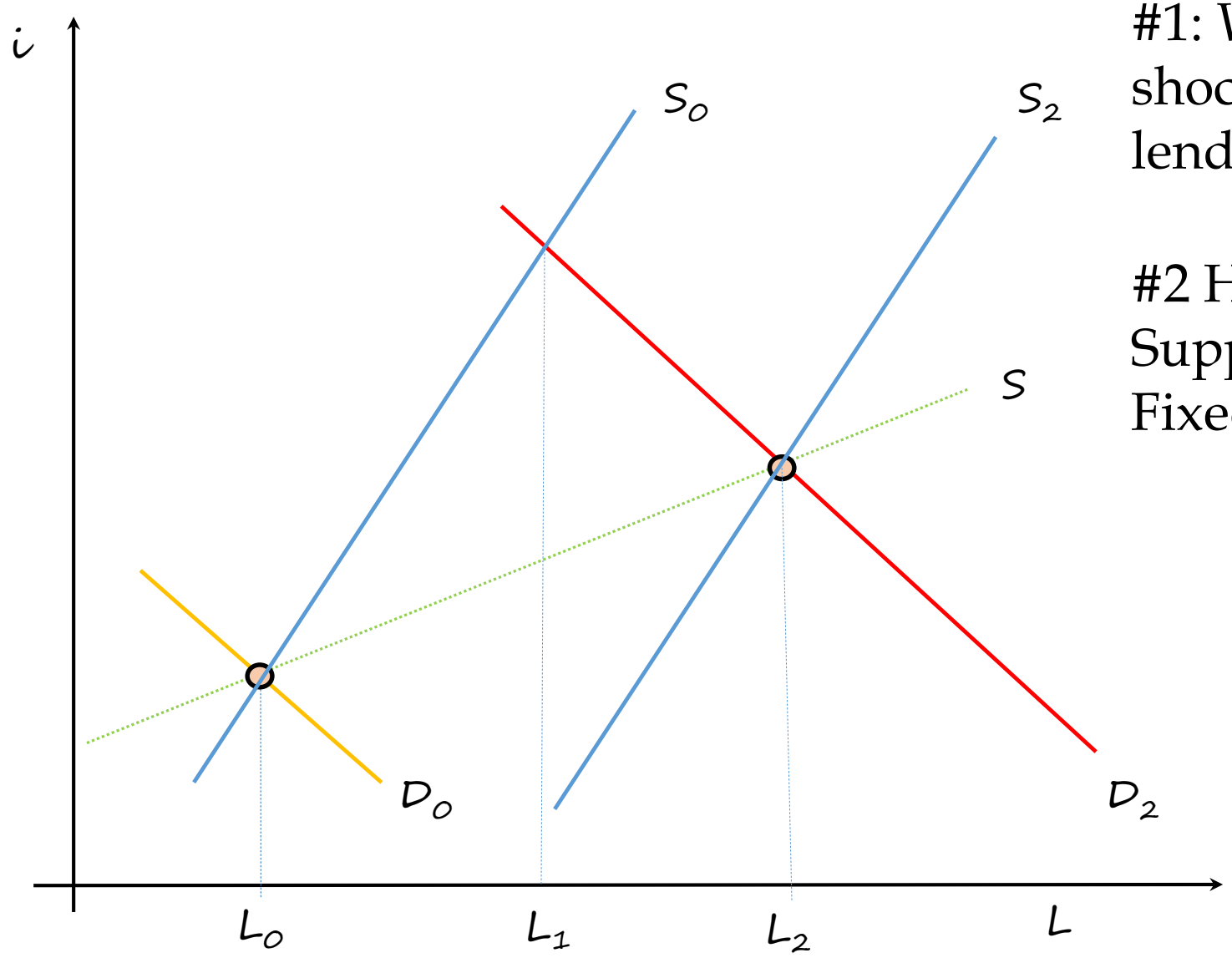


#1: We need a shock to P2P lending demand

Identification



#1: We need a shock to P2P lending demand

#2 Holding Supply Curve Fixed

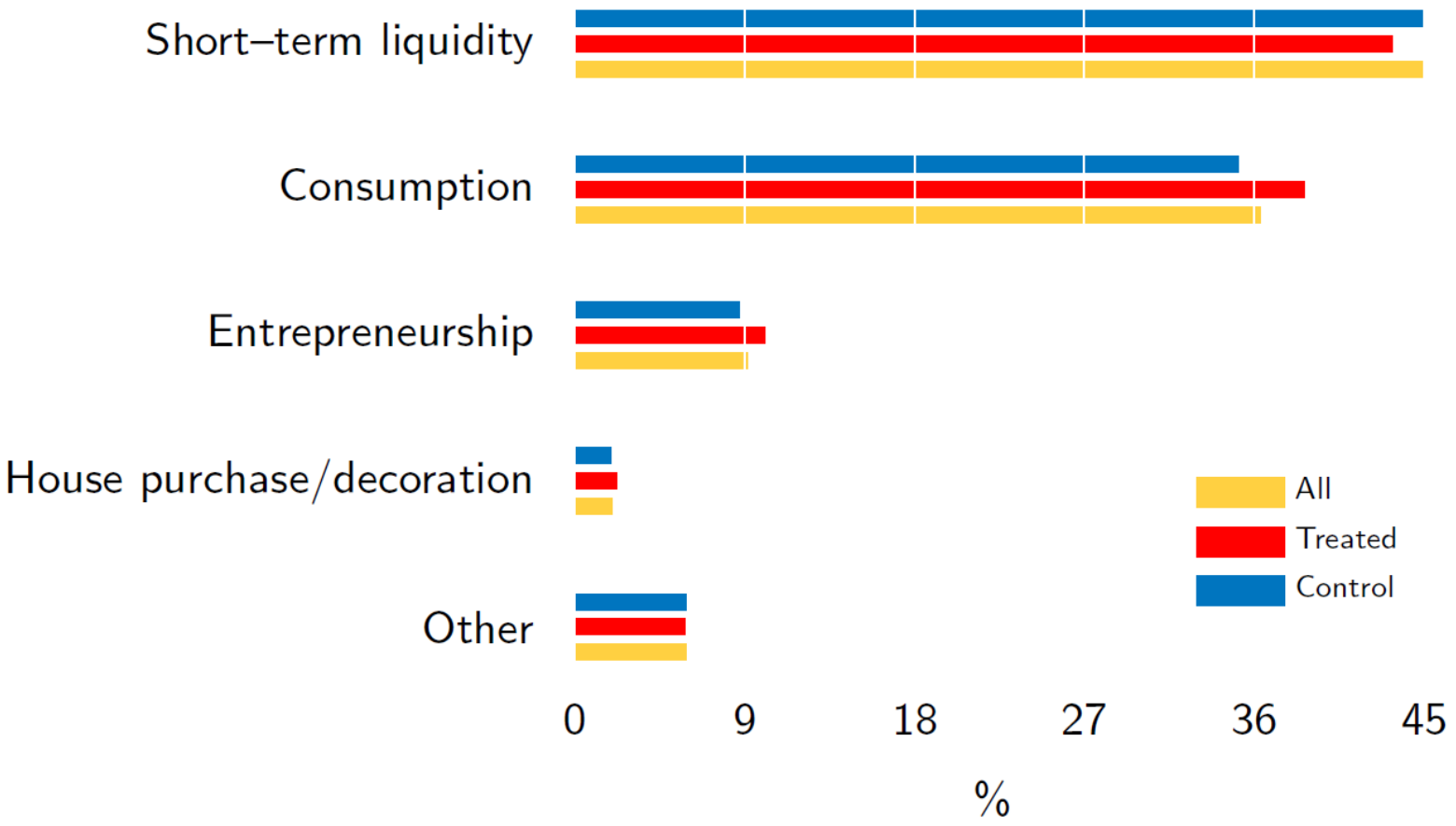
	Mean	St. dev.	Min	Median	Max	N
C. Lender characteristics						
Portfolio size (RMB)	387,978	485,871	4,689	289,434	4,215,150	107,502
Portfolio size (nr. loans)	234.53	156.08	4.00	199.99	1,975	107,502
Uplan lending (% of RMB)	67.18	31.26	0	86.02	100	107,502
Uplan lending (% of loans made)	71.94	30.49	0	91.20	100	107,502
Portfolio concentration (HHI)	0.007	0.019	0	0.001	1	107,502
Experience (months since first loan)	6.86	4.31	0	5.80	37	107,502
Number of lenders per loan	44.87	55.06	1	30	1,841	107,457

China per-capita yearly income (2016): Rmb 53,817 (USD 8,102)

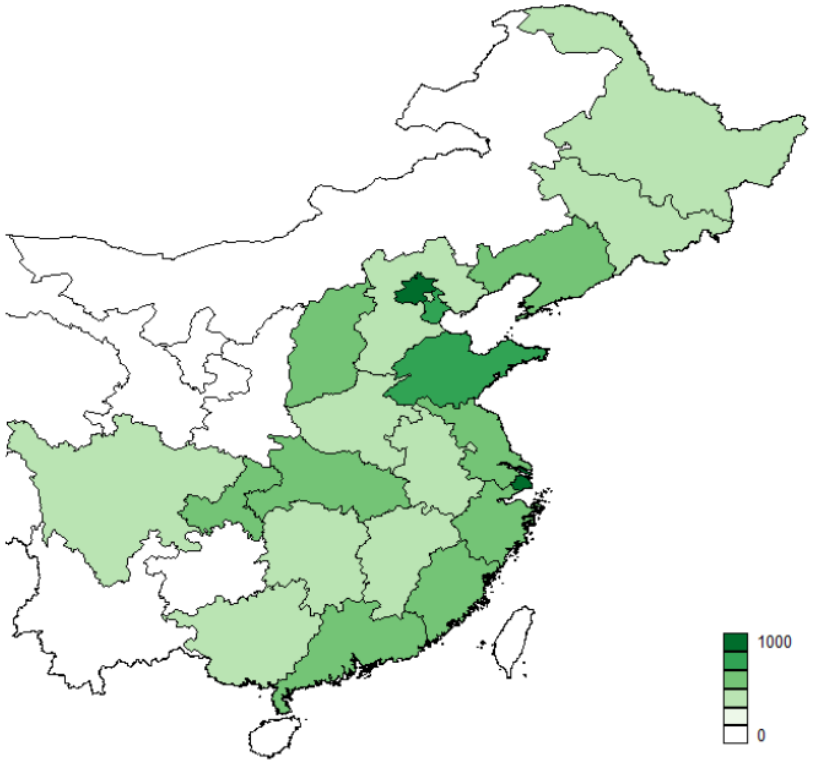
Beijing: Rmb 118,113; Shanghai: Rmb 116,455

Average lender invests: Rmb 387,978

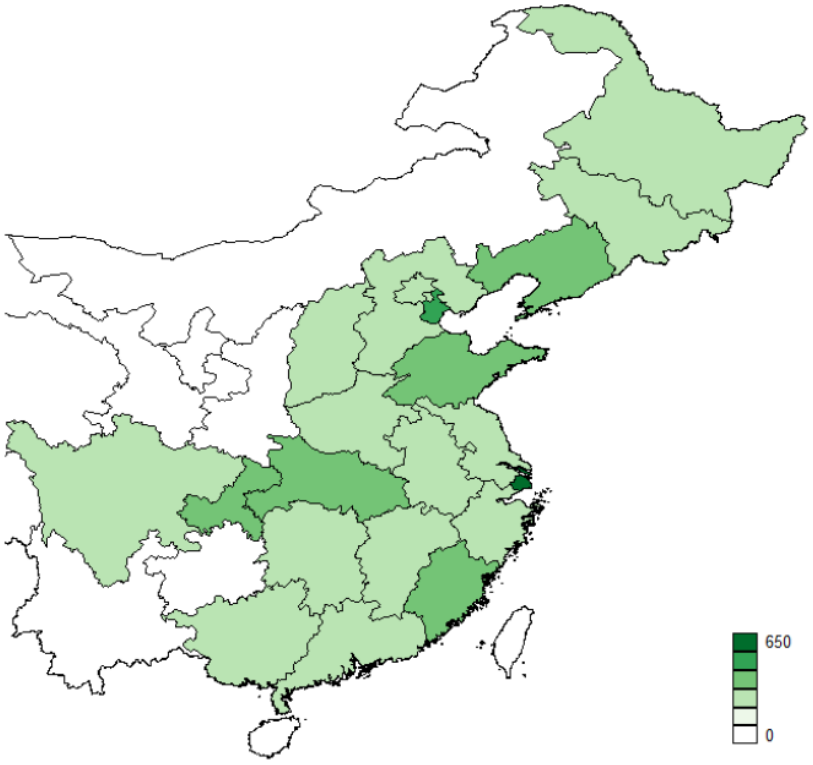
Purpose of the loans



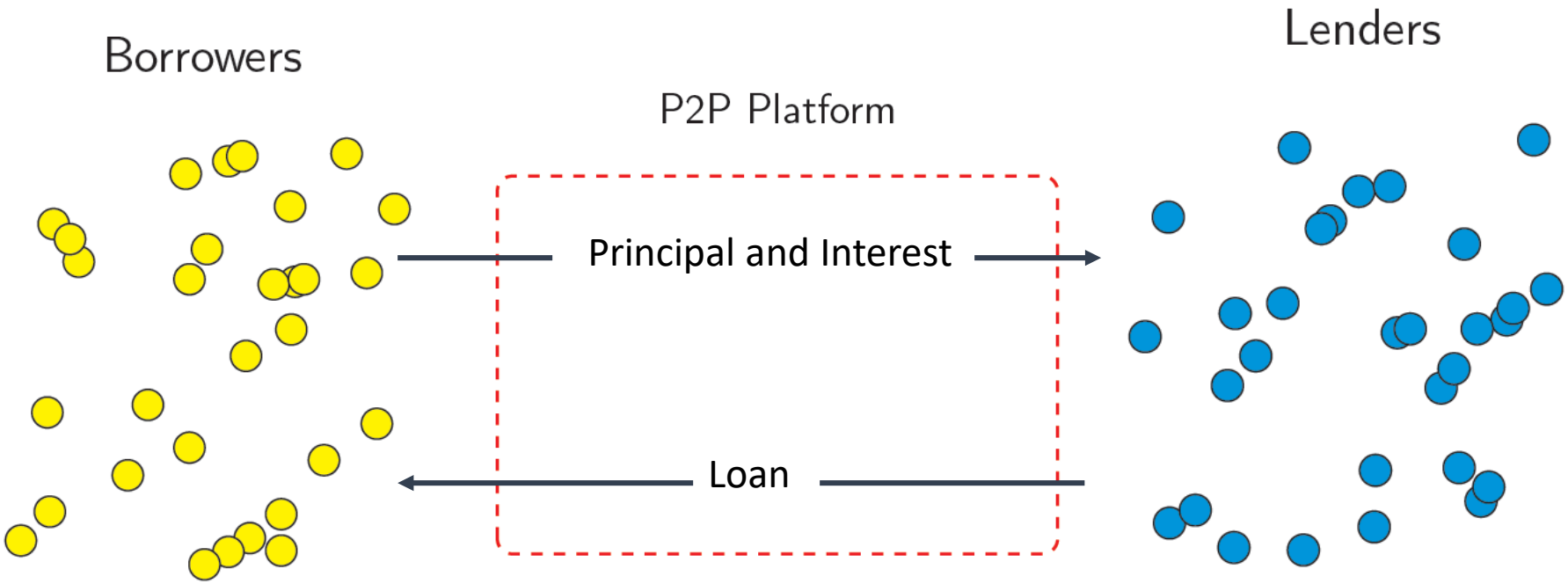
Renrendai Penetration



Applications per 100 inhabitants (Rmb)



Loans per 100 inhabitants (Rmb)



Pros:

✓ Increase competition
✓ Financial Inclusion

➢ Relax Credit Constraints

Cons:

× Poorer Screening and Monitoring
× Vehicle for Regulatory Elusion