Can Technology Undermine Macroprudential Regulation?

Evidence from Marketplace Credit in China

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This paper…

A study on online marketplace lending…

….its relationships with households leverage

… and regulation

- How far can it fuel households leverage?
- How much can it interfere with regulatory actions in the credit market?

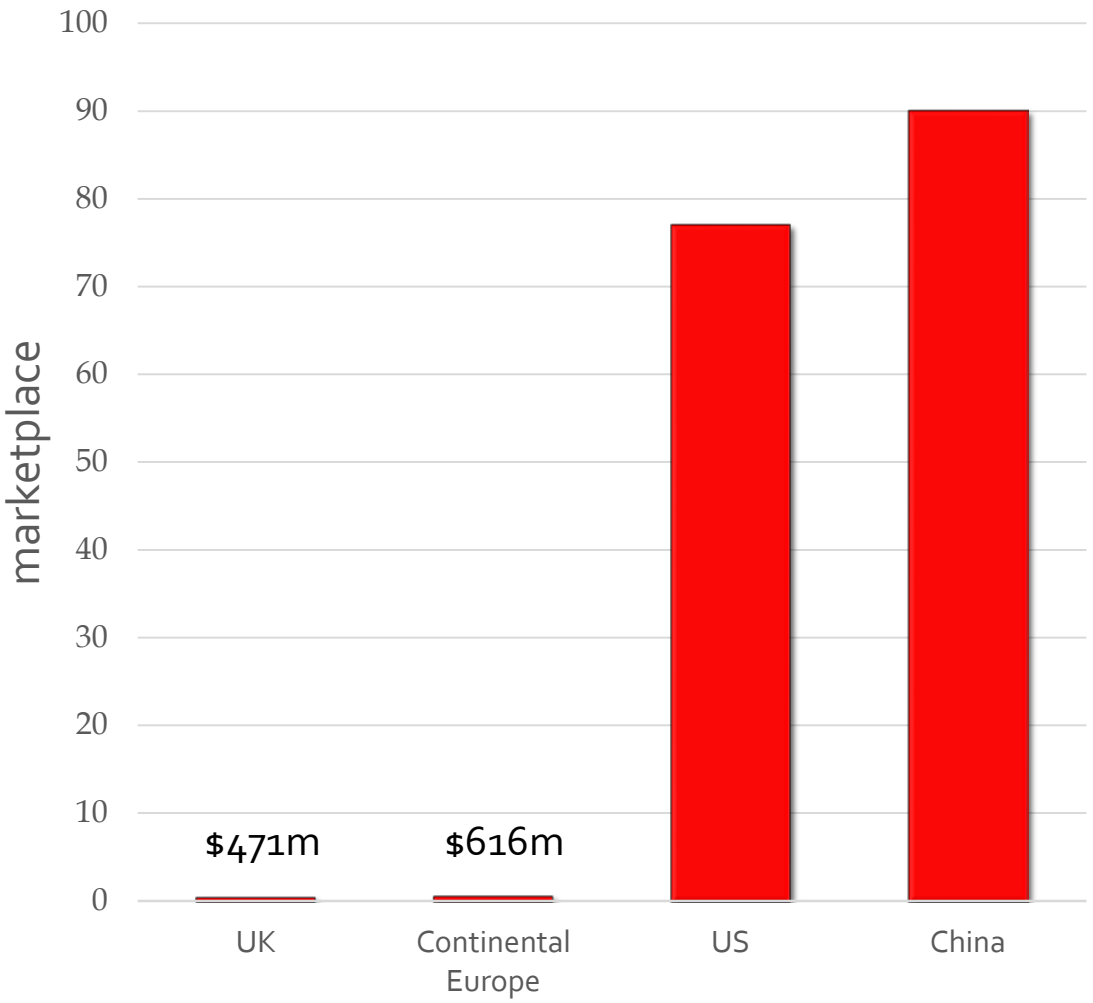
Motivations

- High Levels of Household Leverage predict large falls in Consumption and GDP

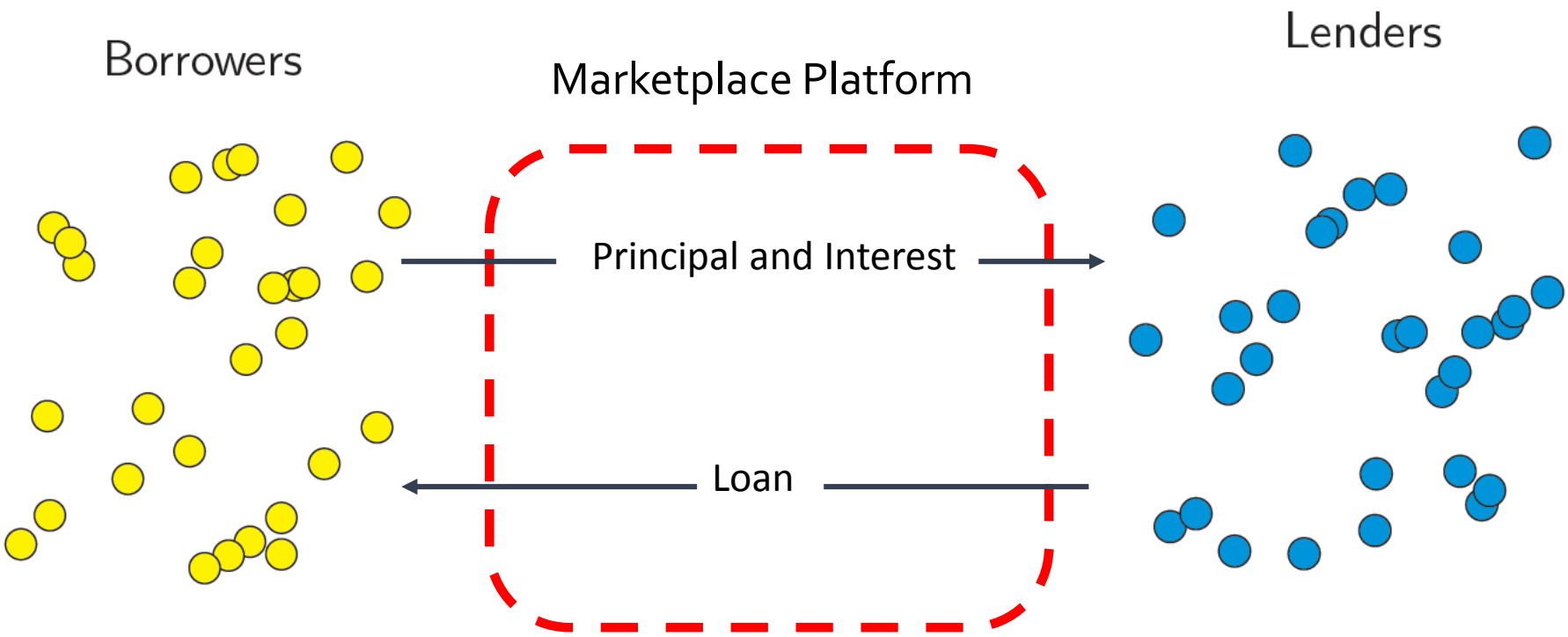
- Macroprudential Policies have been at the core of the efforts intended to limit household leverage
  - **Loan to Value Ratios**

- LTV caps target traditional financial intermediaries…
- … but could be circumvented if households have access to alternative funds

Motivations



- Marketplace lending is a recent innovation in the financial industry
- Increasingly Rivaling Traditional Consumer Credit



Pros:

- ✓ Increase competition
- ✓ Financial Inclusion
- ➢ Relax Credit Constraints

Cons:

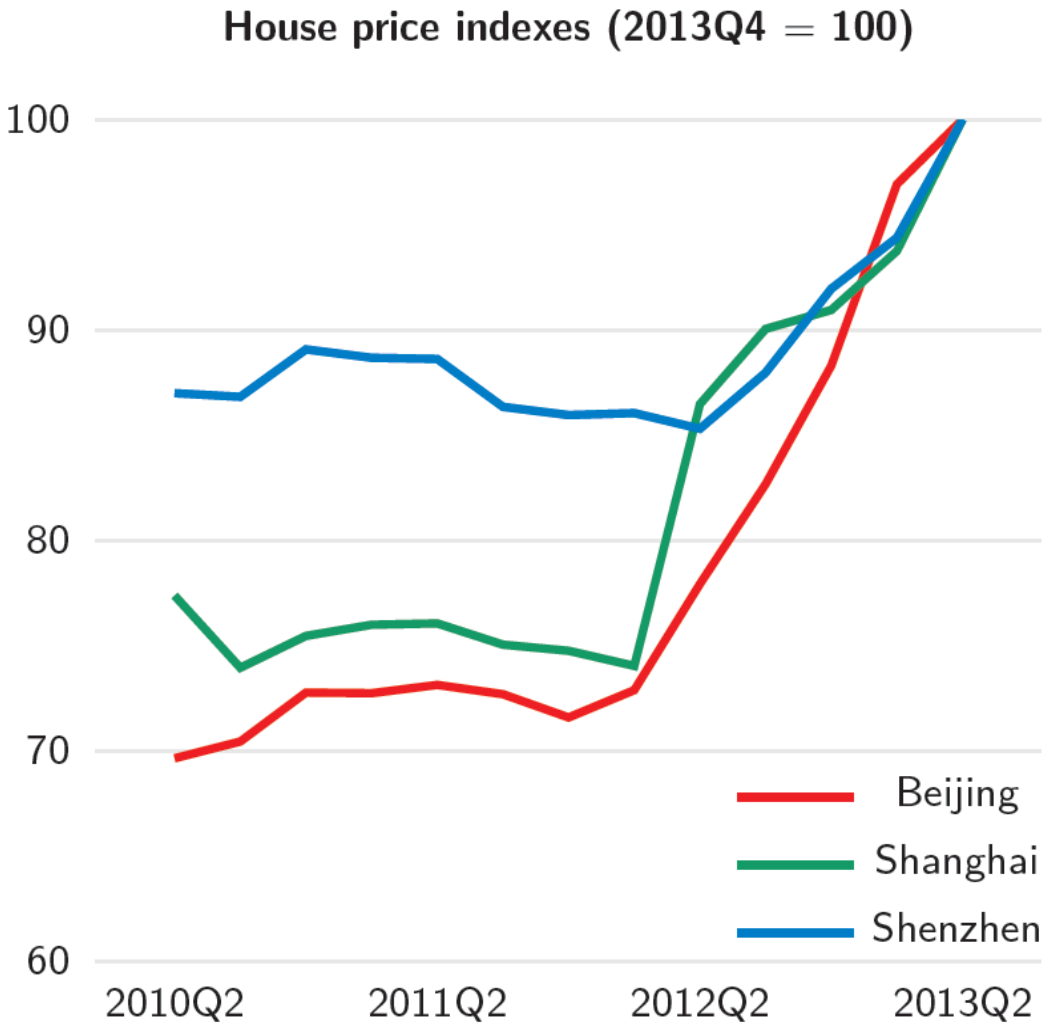
- × Poorer Screening and Monitoring
- × Vehicle for Regulatory Elusion

Preview of the Findings

- Use shock to marketplace lending demand driven by regulation in the real estate market

- We find that:
  - Marketplace channel can generate large credit volumes. . .
  - . . . . and interfere with regulatory action in credit markets

Experiment: 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, Ningbo, Shanghai, Shenzhen, Suzhou, Wuhan

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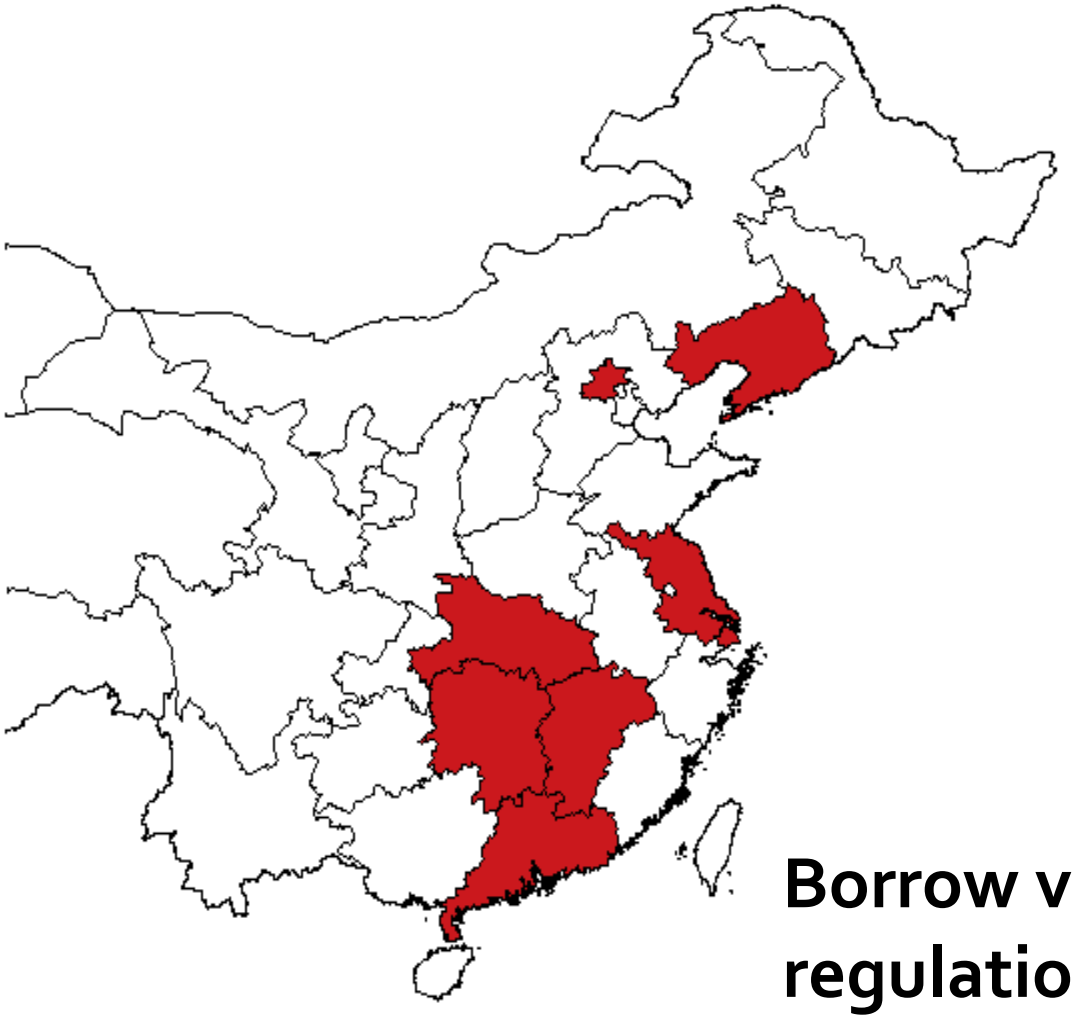

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16.7% rise (from 60 to 70%) in mortgage down-payment requirements for second homes:

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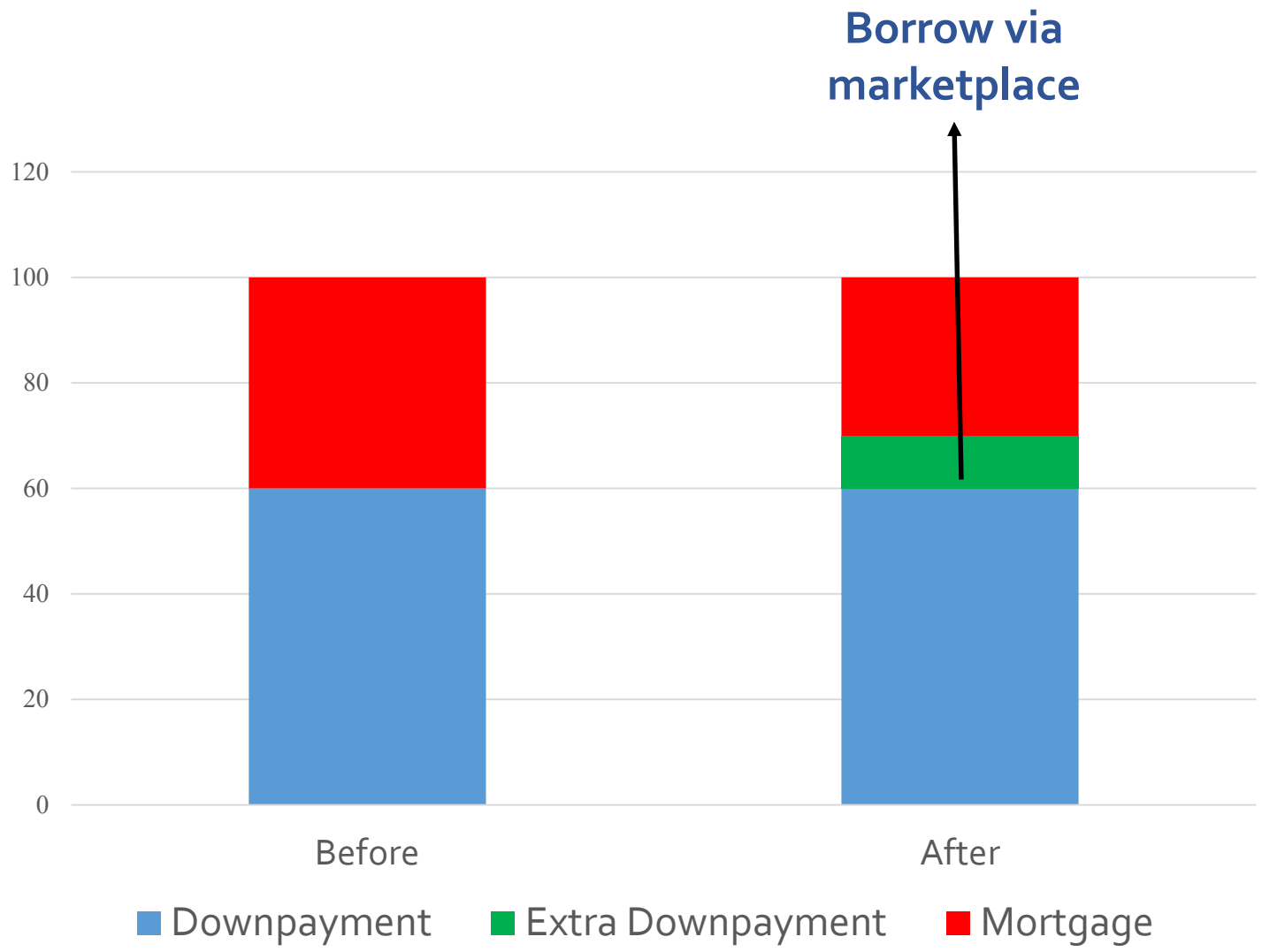
Borrow via marketplace to elude regulation

Go to marketplace to obtain the required down-payment

Experiment: Credit Demand Shock



Experiment

But the peer-to-peer companies — loosely regulated financiers that match cash from investors with borrowers online — have helped buyers circumvent such controls. About 15 large peer-to-peer money lenders with products concentrated in Shenzhen, Beijing and Shanghai have granted unsecured loans that allow customers to pay deposits

"China to crack down on P2P lenders", FT(March 3, 2016)

More Experiments

- **March 2015:**

33% drop (from 60 to 40%)
in mortgage down-payment
requirements for second homes in every Chinese city

- **Feb 2016:**

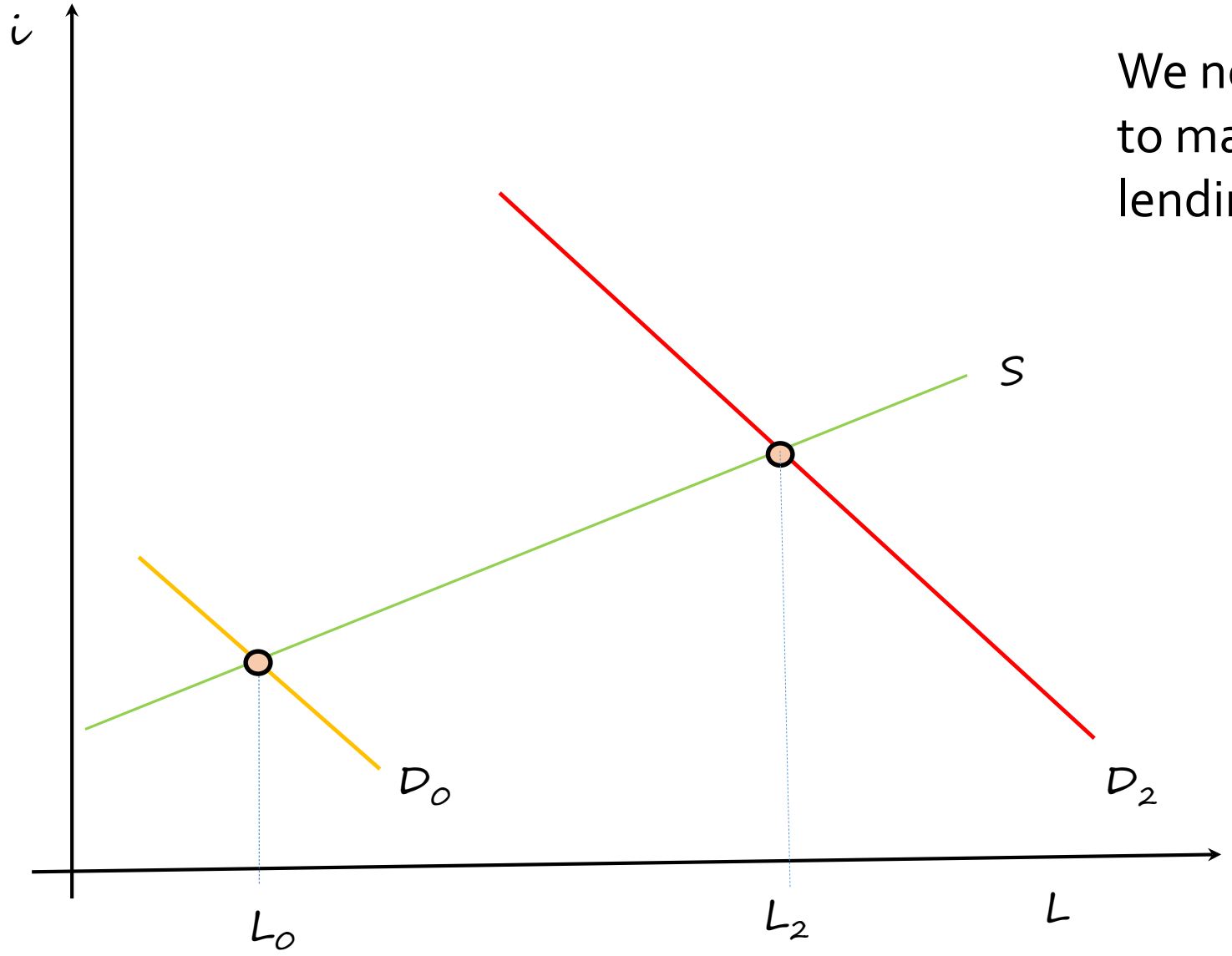
First Houses: 20% drop (from 25 to 20%)
Second Houses : 25% drop (from 40 to 30%)

in mortgage down-payment
requirements for first homes

Every Chinese city except:
Beijing, Guanzhou, Sanya, Shanghai, Shenzhen

In both cases we expect a reduction of online marketplace borrowing

Identification



We need a shock to marketplace lending demand

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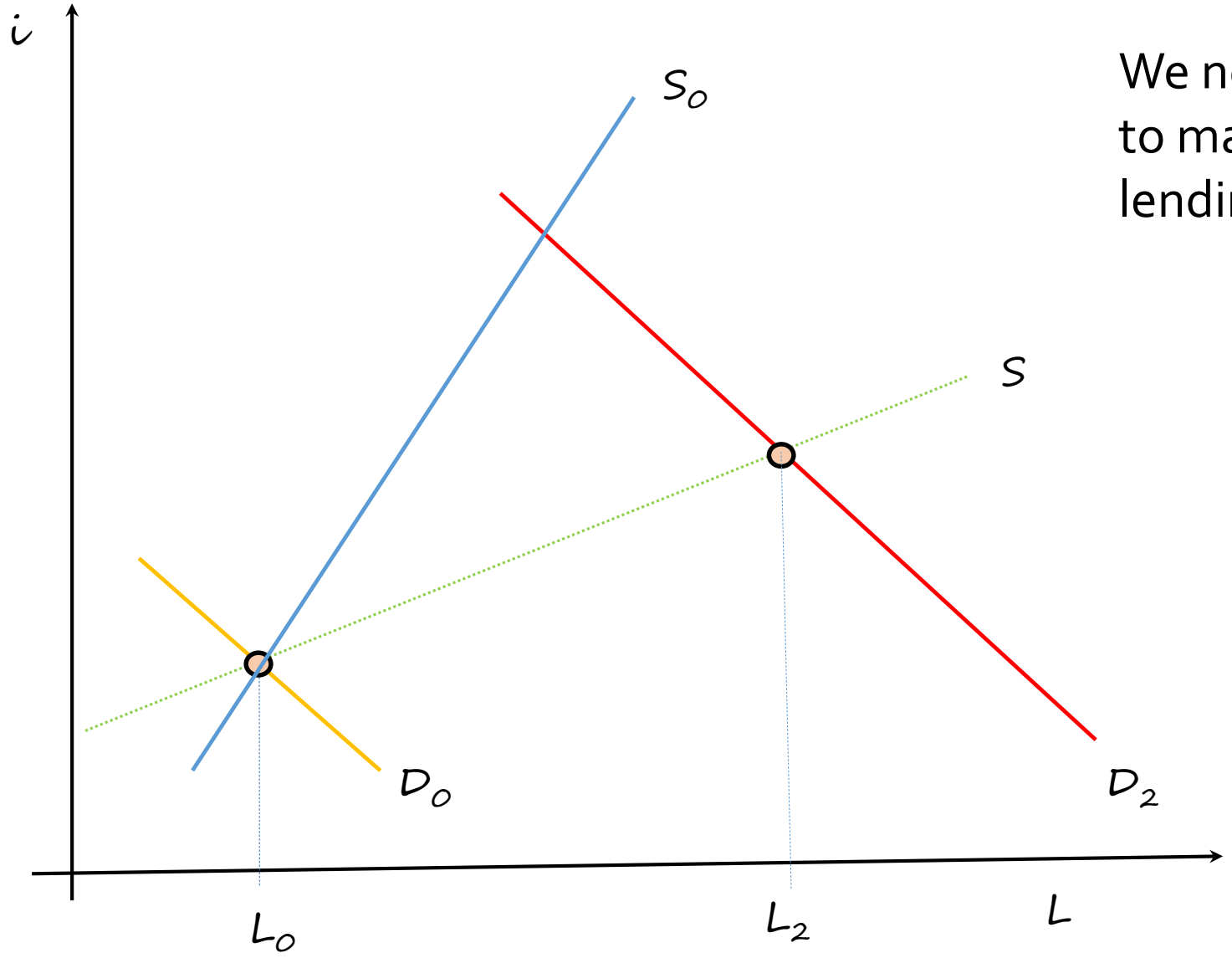

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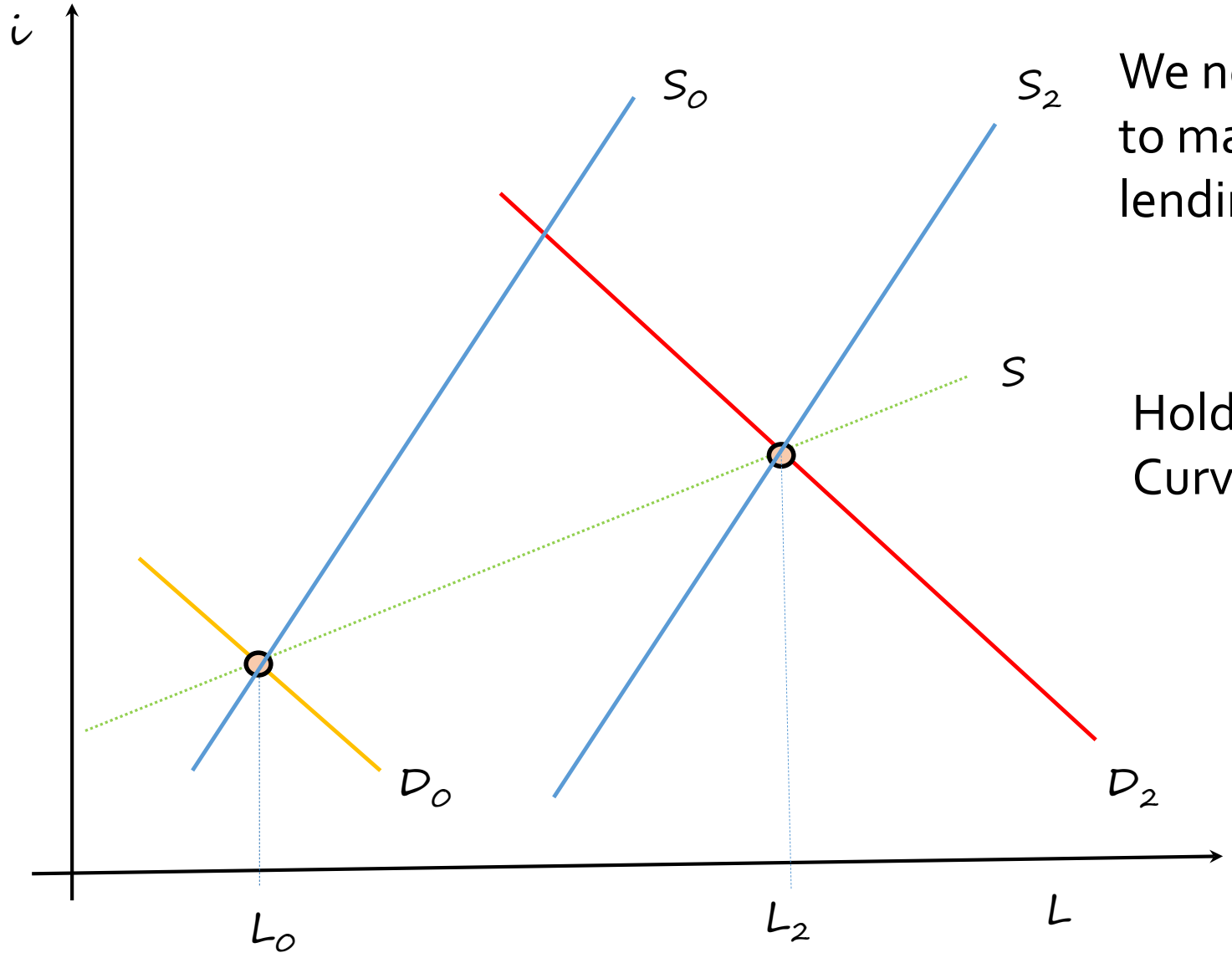

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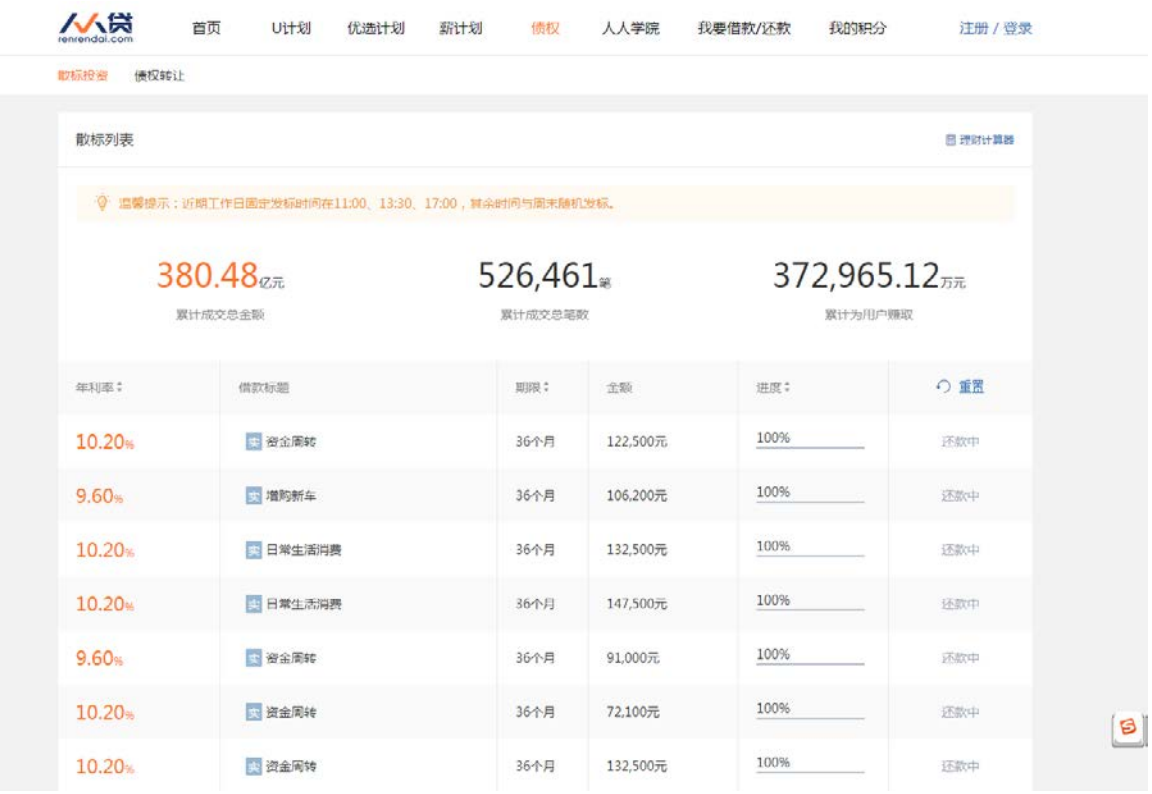
Holding Supply Curve Fixed



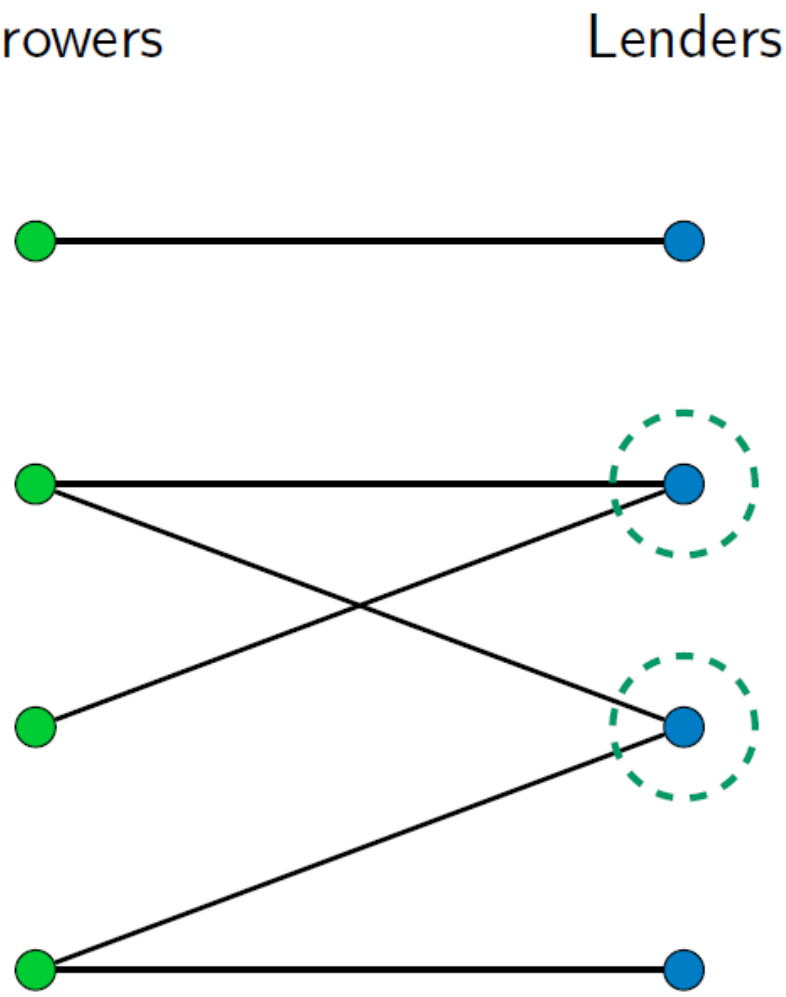
人人贷
renrendai.com

- Leading Platform with over 3 million accounts
- Founded in 2011
- In 2013, Cumulative Turnover since launch: $3.7bn
- Ranking in top percentile of Chinese marketplace lenders

We observe ALL lenders and borrowers transactions:

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

Identification



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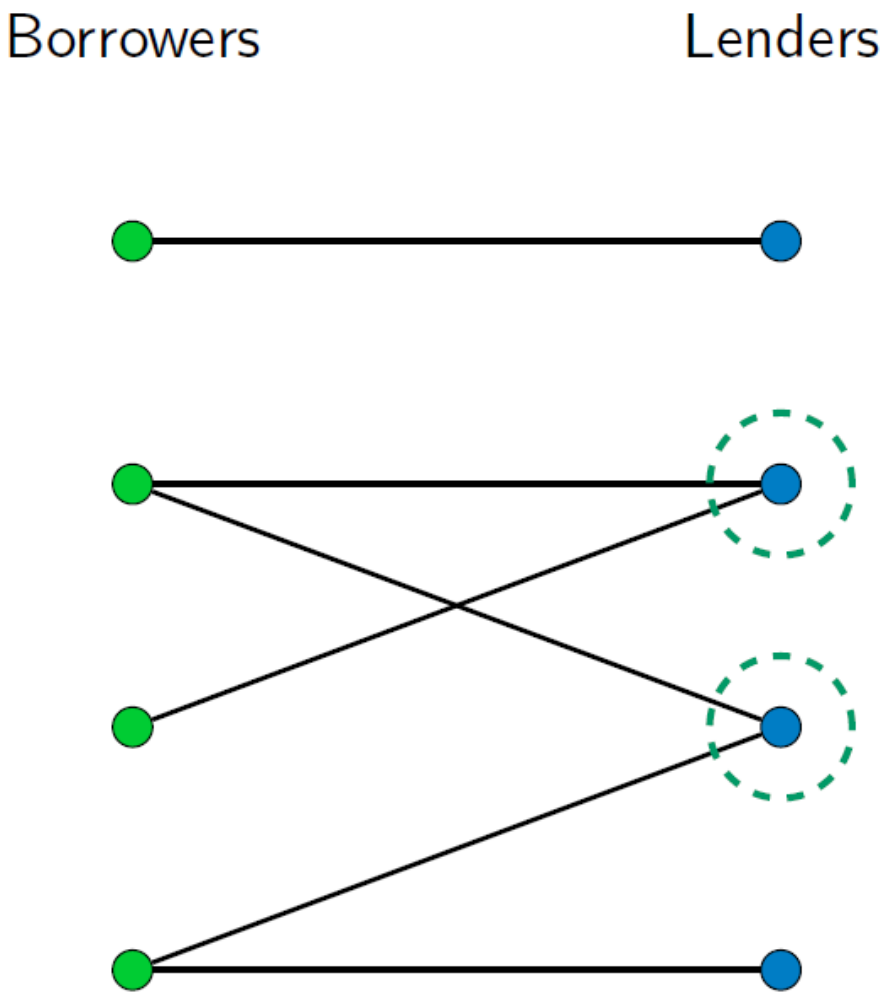

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- In 2013, cumulative turnover since launch: $3.7bn
- Ranking in top percentile of Chinese marketplace platforms
- We will focus on borrower-lender pairs
- Allows us to control for changes in credit supply via lender × date fixed effects

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)	57,991	62,864	3,000	49,100	3,000,000	68,477
Interest rate (%)	12.75	0.99	8.00	13.20	24.40	68,477
Interest rate spread (%)	8.02	1.10	3.00	8.20	19.60	68,477
Duration (months)	26.62	9.83	1.00	24.00	36.00	68,477
On-site verification (0/1)	0.77	0.42	0	1	1	68,438
Borrower credit score	172.61	28.33	0.00	180.00	182.00	68,314
Proportion of months delinquent (%)	1.76	10.75	0.00	0.00	100.00	68,477
Default (0/1)	0.013	0.11	0	0	1	68,468
Time to first bid (seconds)	33,971	141,281	0	623	2,771,210	68,413
Time to fully fund a loan (seconds)	35,459	141,620	0	1,193	2,771,332	68,413
B. Borrower characteristics						
Income (monthly RMB)	11,787	13,745	0	5,000	50,000	68,477
Age	38.23	8.47	23	37	57	68,477
College degree (0/1)	0.50	0.50	0	1	1	68,474
Male (0/1)	0.65	0.48	0	1	1	68,477
Home owner (0/1)	0.45	0.50	0	0	1	68,477
Number of applications since registration	1.47	4.59	1	1	148	68,477
Total amount borrowed since registration (RMB)	66,446	120,993	3,000	52,900	9,000,000	68,477
Number of lenders per loan	41.84	57.38	1	27	1,841	68,438

Loan to Annual Income: 41% - US: 20% (Balyuk, 2016)

Interest to Monthly Income: 6% - US: 7.5% (Morse, 2016)

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Loan to Annual Income: 41% - US: 20% (Balyuk, 2016)

Interest to Monthly Income: 6% - US: 7.5% (Morse, 2016)

Default Rate: 1.3% - US: 2.5% (Morse, 2016)

2013 Experiment – Questions:

- Do marketplace borrowers demand extra credit?
- Do lenders adjust loan prices and/or duration?
- Do lenders increase screening?
- Are new marketplace 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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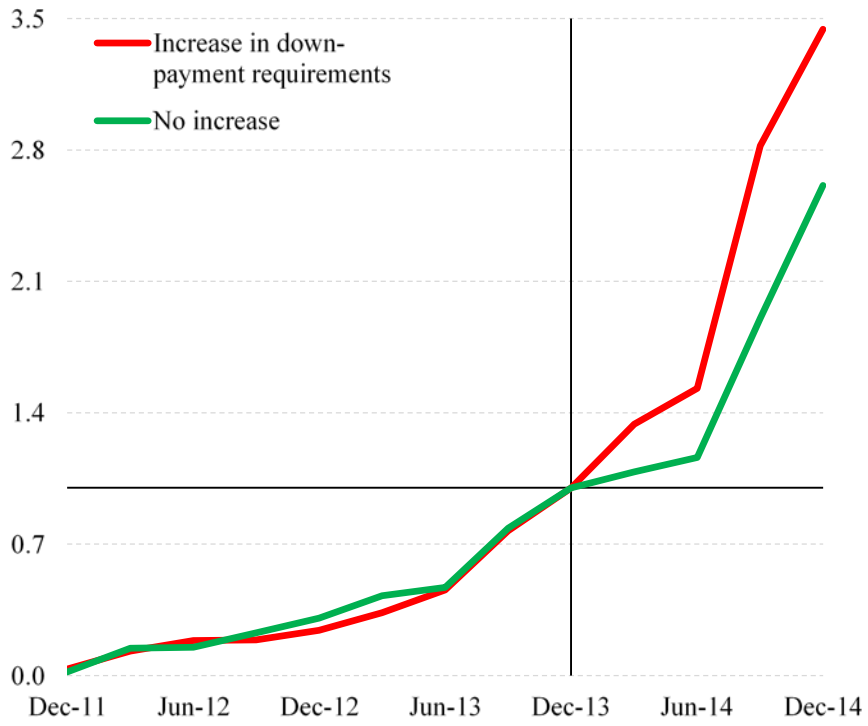
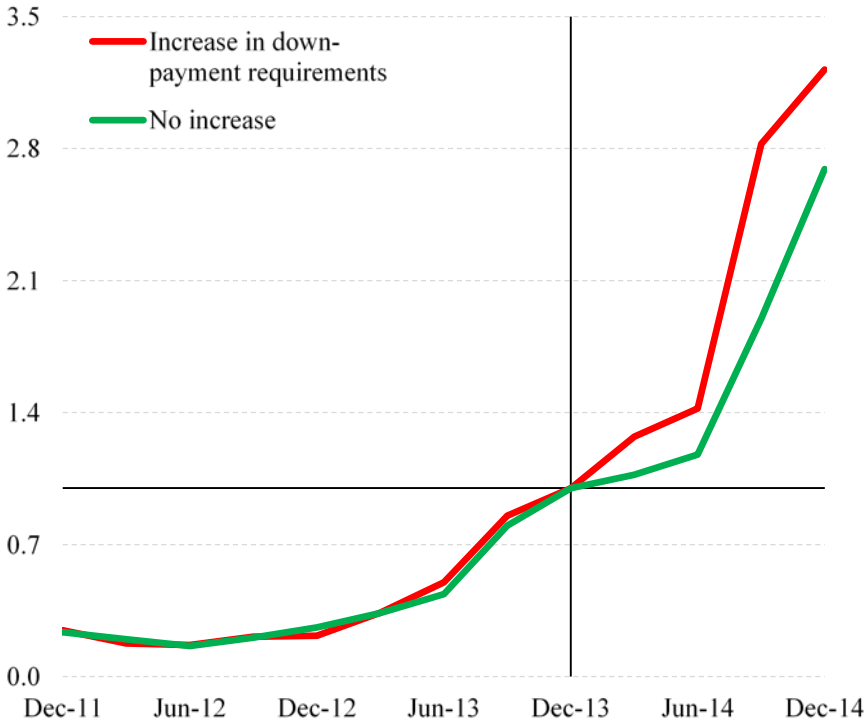
To take into account serial correlation of the standard errors, we collapse and take first differences before and after the shock

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

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				Intensive margin	Extensive margin
	(1)	(2)	(3)	(4)	(5)	(6)
Treated	0.137**	0.070*	0.093***	0.064**	0.014	0.067**
	(0.053)	(0.035)	(0.031)	(0.026)	(0.015)	(0.027)
Controls:						
Price and Province controls	Y	Y	Y	Y	Y	Y
City controls	N	N	Y	Y	Y	Y
Household finance controls	N	N	Y	Y	Y	Y
Platform penetration controls	N	N	N	Y	Y	Y
Region FE	Y	Y	Y	Y	Y	Y
Lender FE	N	Y	Y	Y	Y	Y
R^2	0.07	0.40	0.41	0.41	0.58	0.40
N	2,811,813	2,802,047	2,802,047	2,802,022	66,377	2,724,416

Economic Effects

- Marketplace borrowing increases of 100% in treated cities over the 13 months following the policy change…

- …which covers about 66% of the increase in down-payment requirement for a city like Nanjing
  - Nanjing is the median among the treatment group cities in terms of house price level

- 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:		Borrower is a homeowner:	
	Tier 2	Registered	Lent		
	(1)	(2)	(3)	(4)	(5)
Treated	0.049*	0.081**	0.086**	0.047	-
	(0.028)	(0.032)	(0.034)	(0.034)	-
Treated × Home owner				0.064**	0.052*
				(0.031)	(0.028)
Controls:					
Price and Province controls	Y	Y	Y	Y	Y
City controls	Y	Y	Y	Y	Y
Household finance controls	Y	Y	Y	Y	Y
Platform penetration controls	Y	Y	Y	Y	Y
Region FE	Y	Y	Y	Y	Y
Lender FE	Y	Y	Y	Y	Y
City FE	N	N	N	N	Y
R^2	0.38	0.28	0.24	0.48	0.49
N	2,387,330	2,054,695	1,933,372	2,792,273	2,792,273

Results – Loan volume

- Borrower-lender level

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

	Lending channel		Experience		Portfolio Size	
	Direct	Uplan	Low	High	Small	Big
	(1)	(2)	(3)	(4)	(5)	(6)
Treated	0.019	0.110***	0.030***	0.074***	0.044**	0.083***
	(0.020)	(0.028)	(0.011)	(0.026)	(0.017)	(0.027)
Controls:						
Price and Province controls	Y	Y	Y	Y	Y	Y
City controls	Y	Y	Y	Y	Y	Y
Household finance controls	Y	Y	Y	Y	Y	Y
Platform penetration controls	Y	Y	Y	Y	Y	Y
Region FE	Y	Y	Y	Y	Y	Y
Lender FE	Y	Y	Y	Y	Y	Y
R^2	0.62	0.37	0.70	0.37	0.60	0.37
N	699,455	2,098,721	1,403,582	1,396,908	1,386,137	1,413,897
F test	6.45		7.29		6.76	

Empirical strategy

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The empirical strategy assumes that any increase in credit supply is distributed equally among borrowers

Lending Speed

- Loan level

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

	Time to fund a loan		Time to first bid	
	(1)	(2)	(3)	(4)
$Treated \times Post$	0.120	-0.062	0.131	-0.048
	(0.167)	(0.129)	(0.179)	(0.156)
Controls	Y	Y	Y	Y
City FE	Y	Y	Y	Y
Month FE	Y	Y	Y	Y
Region × Month FE	Y	Y	Y	Y
Loan conditions	N	Y	N	Y
R^2	0.51	0.58	0.57	0.63
N	64,888	64,725	64,861	64,698

Questions:

- Do marketplace borrowers demand extra credit? **Yes**
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Results – Ex-post performance

- Borrower level

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

			Loss given default	
	Delinquency	**Default**	**Loan size**	**Outstanding loan amount**
	(1)	(2)	(3)	(4)
$Treated \times Post$	0.010***	0.006**	2.559***	0.308***
	(0.003)	(0.003)	(0.610)	(0.087)
Controls	Y	Y	Y	Y
City FE	Y	Y	Y	Y
Month FE	Y	Y	Y	Y
Region × Month FE	Y	Y	Y	Y
R2	0.23	0.13	0.25	0.19
N	64,927	64,918	786	786

Results – Ex-post performance

- Delinquencies
  - **Delayed Repayments increase of about 56%**

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

Questions:

- Do marketplace borrowers demand extra credit? **Yes**
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- Are new marketplace borrowers riskier? **Yes**

Other Experiments

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33% drop (from 60 to 40%)
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First Houses: 20% drop (from 25 to 20%)

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in mortgage down-payment
requirements for first homes

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

We find:

- A reduction of amount lent via marketplace: 30% and 60% respectively on an annual basis

LTVs and House Prices

$$\Delta L_c = \alpha + \beta Treated_c + \gamma' \Delta x_c + \varepsilon_c$$

	2005		2013		2016	
	(1)	(2)	(3)	(4)	(5)	(6)
Treated	-0.040**	-0.073***	0.003	0.000	0.005	0.007
	(0.018)	(0.026)	(0.003)	(0.003)	(0.004)	(0.005)
Controls	N	Y	N	Y	N	Y
Region FE	Y	Y	Y	Y	Y	Y
R^2	0.24	0.53	0.11	0.74	0.08	0.32
N	34	34	51	51	48	48

Policy Implications

- Our findings: LTV caps prone to be bypassed via marketplace

Solution may not be trivial:

- Curb marketplace lending:
  - Erode the flexibility that makes marketplace viable

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

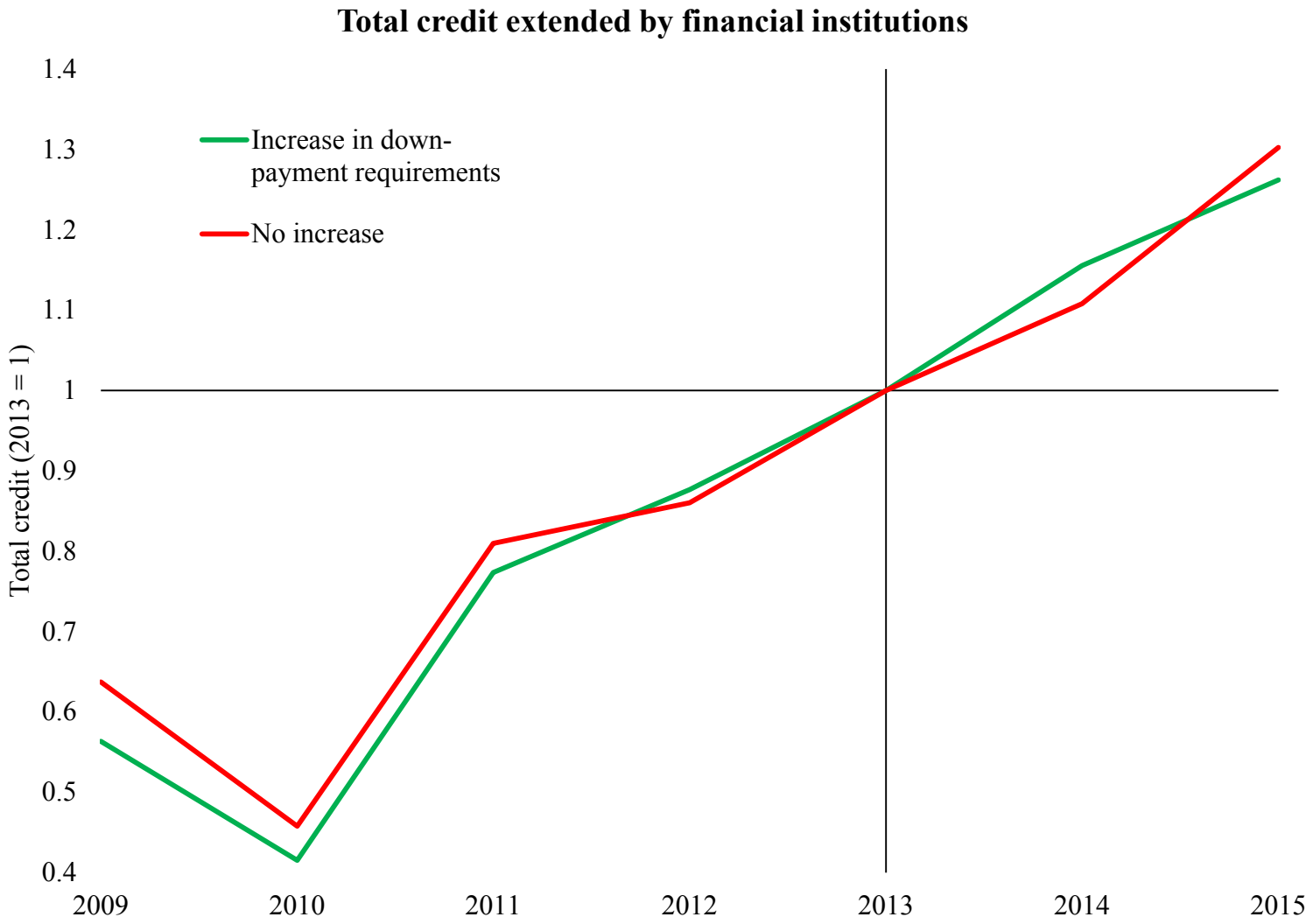
Wrap up

- Marketplace credit: a channel to elude LTV caps?
- We rely on two demand shocks (in 2013 and 2015)
- Marketplace 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)	11,413	11,634	-221	-0.243
Age	39.08	38.83	0.25	0.626
College degree (0/1)	0.49	0.46	0.03	1.035
Male (0/1)	0.58	0.58	0	-0.010
Home owner (0/1)	0.18	0.28	-0.10	-2.217**
Number of applications since registration	2.36	1.56	0.81	0.851
Total amount borrowed since registration (RMB)	73,173	61,802	11,371	1.333
Number of lenders per loan	33.05	34.25	-1.20	-0.724
Number of loans per capita growth (%)	75.16	88.37	-13.21	-1.403
B. Lender characteristics				
Portfolio size (RMB)	655,649	638,804	16,845	0.309
Portfolio size (nr. loans)	271.40	263.20	8.20	0.658
Uplan lending (% of RMB)	71.30	69.70	1.60	0.385
Uplan lending (% of loans made)	75.30	73.50	1.80	0.416
Experience (nr. loans made by lender since registration)	5,100	5,841	-741	-1.387
C. Macroeconomic characteristics				
Province GDP per capita (RMB)	60,805	45,831	14,974	1.272
Province annual GDP per capita growth (%)	8.35	11.26	-2.91	-1.363
Province annual population growth (%)	0.01	0.01	0.00	0.565
House price index	0.20	0.15	0.05	0.792
% change in house prices (past 6 months)	17.69	17.59	0.10	0.233
Household net debt-to-income	-0.72	-0.42	-0.30	-1.260
Annual real wage growth (%)	0.41	0.70	-0.29	-0.920
Unemployment rate (%)	13.70	14.10	0.40	-0.190
RenrenDai penetration (applications per 10,000 inhabitants)	2.31	1.93	0.38	0.900
Growth of RenrenDai penetration (Jan 2012-Oct 2013) (%)	75.2	88.3	-13.1	1.403

Total Borrowing



City Level Regressions

	Credit volumes			
	Applications		Loans	
	(1)	(2)	(3)	(4)
Treated	0.061***	0.041***	0.017*	0.022***
	(0.023)	(0.016)	(0.009)	(0.010)
Controls	N	Y	N	Y
R^2	0.29	0.61	0.18	0.59
N	52	52	52	52

2015 Experiment

A. Credit volumes – March 2015

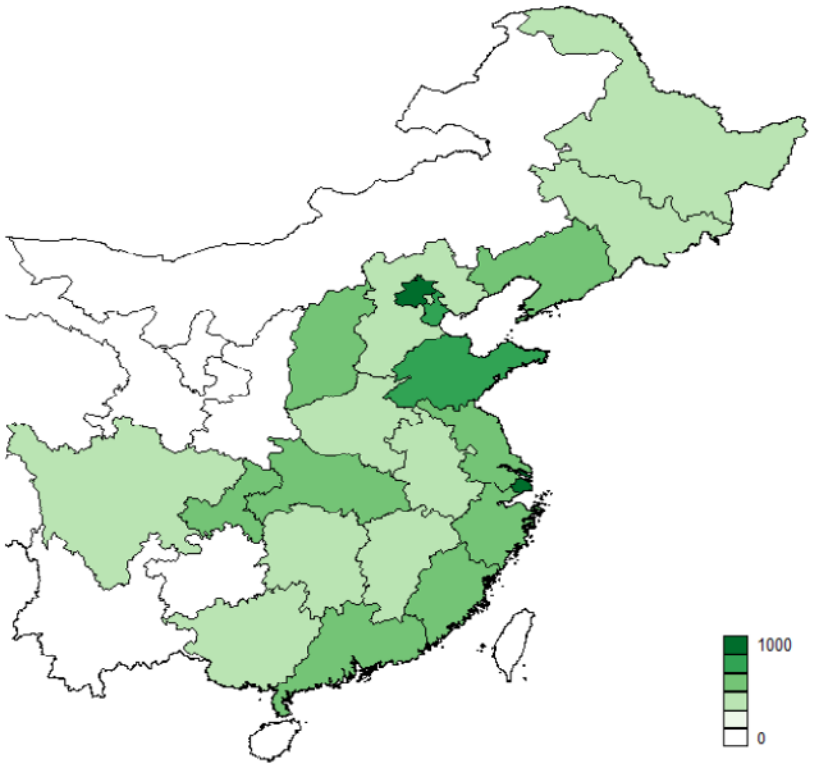
	(1)	(2)	(3)
Home owner	-0.045***	-0.023***	-0.024***
	(0.007)	(0.003)	(0.004)
Controls	Y	Y	Y
Region FE	Y	Y	Y
Lender FE	N	Y	Y
City FE	N	N	Y
R^2	0.016	0.309	0.315
N	18,420,341	18,393,983	18,393,983

2016 Experiment

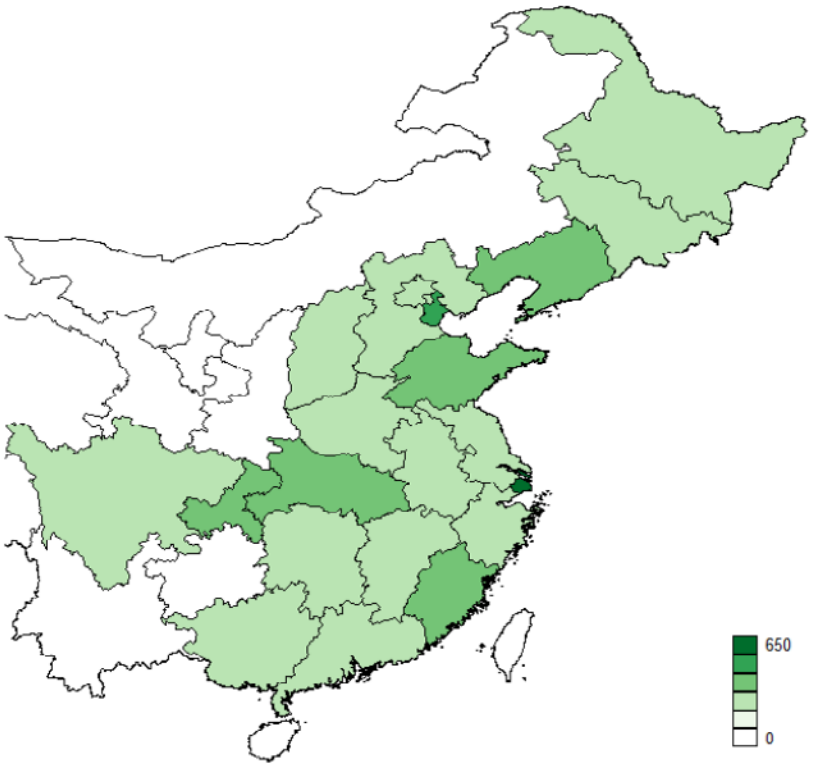
B. Credit volumes – February 2016

	Full Sample		Intensive margin	Extensive margin
	(1)	(2)	(3)	(4)
Treated	-0.083**	-0.052**	-0.044***	-0.051**
	(0.036)	(0.024)	(0.014)	(0.024)
Controls:	Y	Y	Y	Y
Region FE	Y	Y	Y	Y
Lender FE	N	Y	Y	Y
R^2	0.01	0.25	0.42	0.24
N	14,890,092	14,867,378	280,654	14,531,514

Renrendai Penetration



Applications per 100 inhabitants (Rmb)



Loans per 100 inhabitants (Rmb)

Purpose of the Loans