Peer-to-Peer Lenders Versus Banks: Substitutes or Complements?

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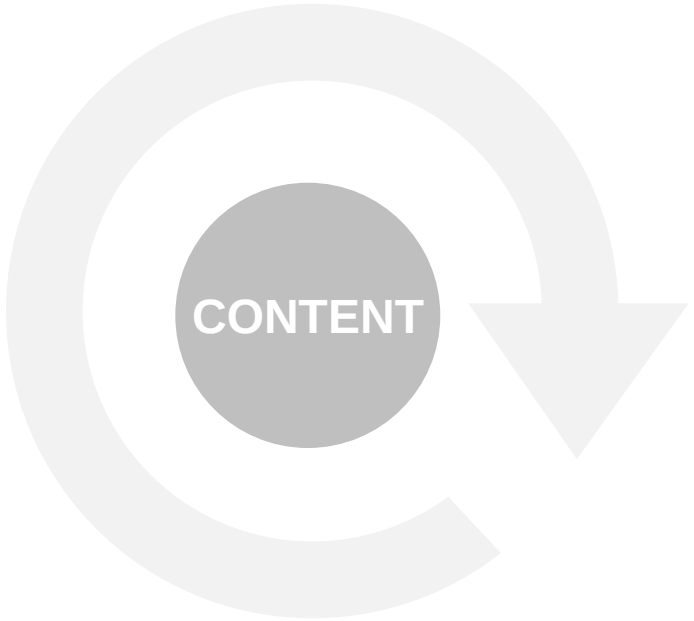


01 Conceptual Framework

Conceptual Framework

- Banks and P2P lenders compete with each other. For borrowers of a given quality, $\gamma \in R+$, each lender, either a bank or a P2P platform, offers a menu of price-quantity combinations specifying interest rates and the corresponding loan sizes.

- The relation between banks and P2P lenders is defined by the clientele they serve in equilibrium. Let $\alpha(\gamma) \in [0,1]$: the fraction of borrowers who are served by P2P lenders.

- $0<\alpha(\gamma)<1$: the two types of lenders are substitutes
  $\alpha(\gamma) = 0$ or 1: banks and P2P lenders are complements

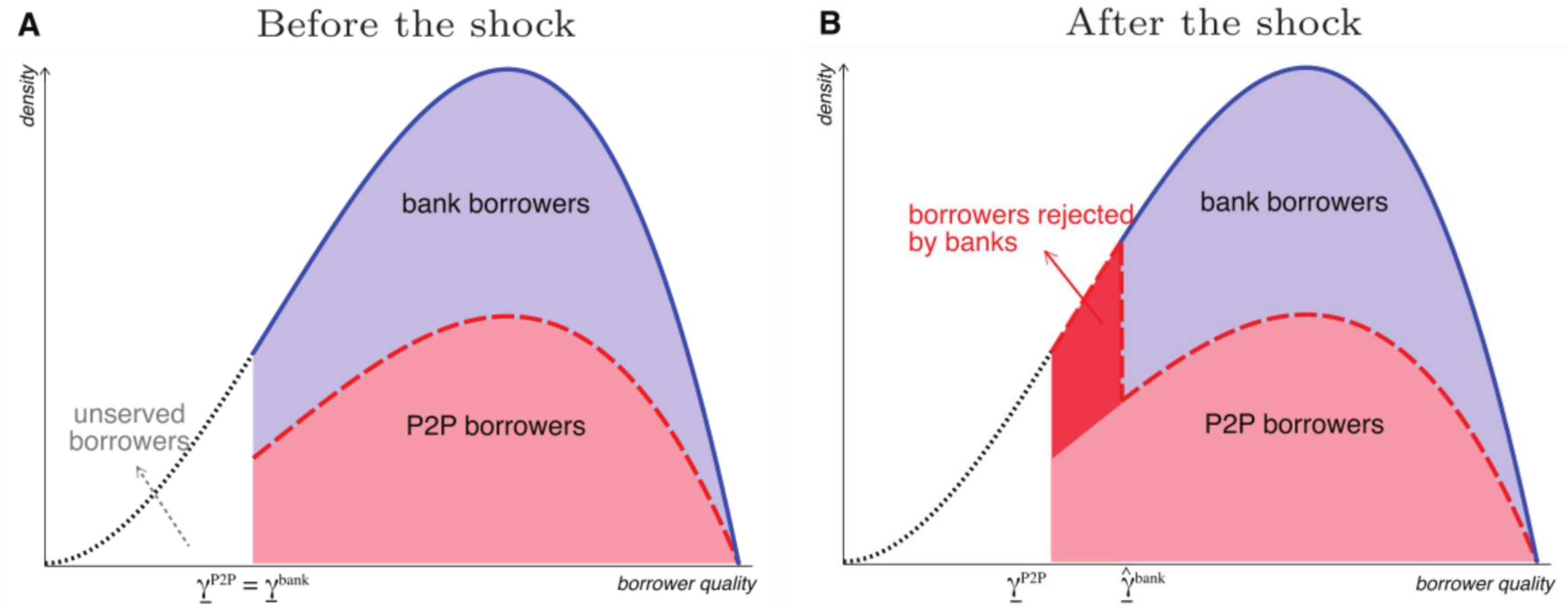
Conceptual Framework

- **Perfect substitutes**

$$\underline{\gamma}^{\text{bank}} = \underline{\gamma}^{\text{P2P}};\ 0 < \alpha(\gamma) < 1, \forall\ \gamma \geq \underline{\gamma}^{\text{bank}}.$$

- $\underline{\gamma}^{bank}$: optimal lender-specific threshold for banks
- $\underline{\gamma}^{P2P}$: optimal lender-specific threshold for P2P platforms

Conceptual Framework—Perfect Substitutes



Conceptual Framework—Perfect Substitutes

If P2P platforms and banks are perfect substitutes:

- a higher P2P lending volume;
- a lower average P2P borrower quality and lower quantiles of the P2P borrower quality distribution;
- an increased P2P lending volume only at the low end of the pre-shock borrower quality distribution.

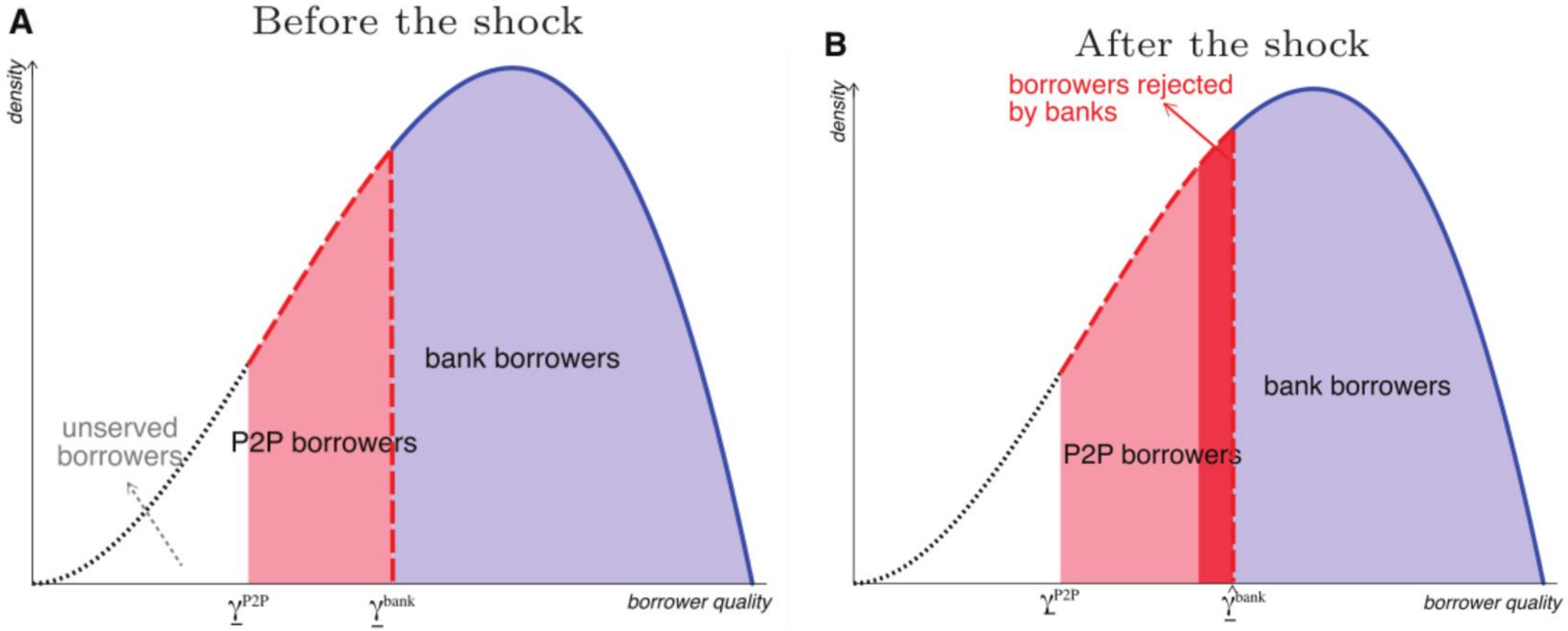
Conceptual Framework

- **Perfect complements**

$$\underline{\gamma}^{\text{P2P}} < \underline{\gamma}^{\text{bank}};\ \alpha(\gamma)=1,\ \forall \underline{\gamma}^{\text{P2P}} \le \gamma < \underline{\gamma}^{\text{bank}};\ \alpha(\gamma)=0,\ \forall \gamma \ge \underline{\gamma}^{\text{bank}}.$$

- P2P platforms have a lower lending threshold than banks.
- Those whose quality is between $\underline{\gamma}^{P2P}$ and $\underline{\gamma}^{bank}$ only obtain credit from P2P platforms;
- Others with quality above $\underline{\gamma}^{bank}$, while qualifying for P2P loans, borrow exclusively from banks.
- Borrowers whose quality is lower than $\underline{\gamma}^{P2P}$ are denied access to both types of credit.

Conceptual Framework—Perfect Complements



Conceptual Framework—Perfect Complements

If P2P platforms and banks are perfect complements:

- a higher P2P lending volume;
- a higher average P2P borrower quality and larger quantiles of the P2P borrower quality distribution;
- an increased P2P lending volume, concentrated around the right tail of the pre-shock borrower quality distribution.

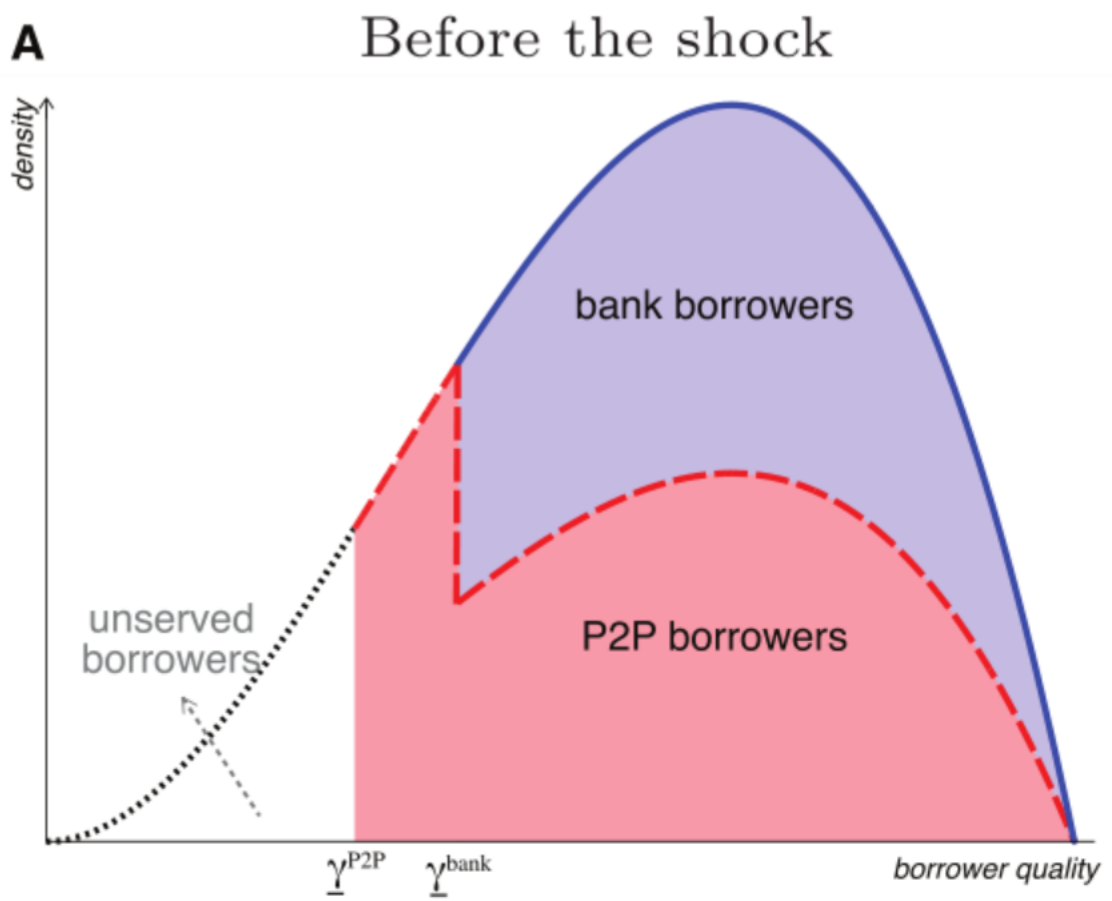
Conceptual Framework

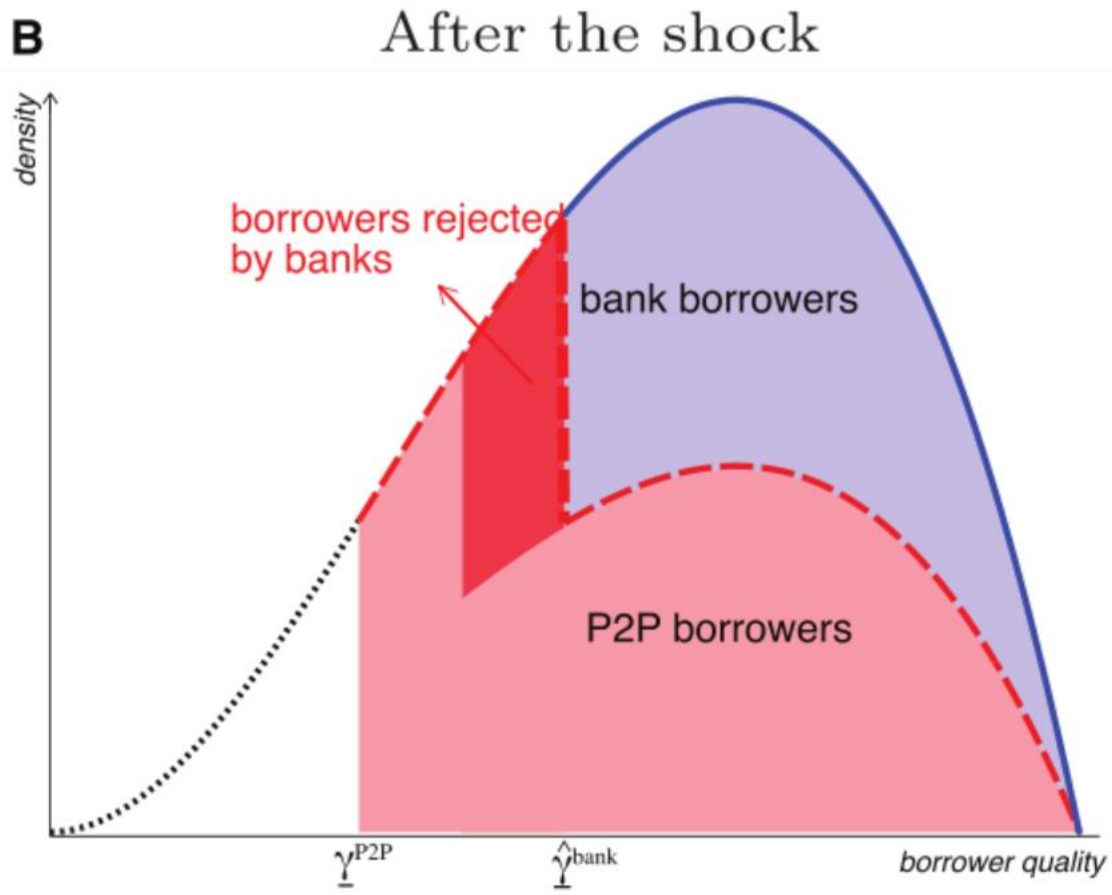
- **An intermediate case**

$$\underline{\gamma}^{P2P} < \underline{\gamma}^{bank};\ \alpha(\gamma)=1,\ \forall \underline{\gamma}^{P2P} \le \gamma < \underline{\gamma}^{bank};\ 0<\alpha(\gamma)<1,\ \forall \gamma \ge \underline{\gamma}^{bank}.$$

- P2P platforms may operate as substitutes for borrowers qualifying for bank credit while also catering to borrowers who are unserved by banks.

Conceptual Framework—An Intermediate Case





Conceptual Framework—An Intermediate Case

If P2P platforms are a substitute for banks in the high-quality borrower segment and yet complement banks in the low-quality-borrower segment:

- a higher P2P lending volume;
- no definitive predictions on the average P2P borrower quality and the quantiles of the P2P borrower quality distribution;
- an increased P2P lending volume, concentrated in the middle of the pre-shock borrower quality distribution.

02 Institutional Background

Institutional Background—Lending Club

- To apply for a loan, the applicant reports her name, address, purpose of the requested funds, and the amount to be borrowed.

- The platform uses the applicant's identity to acquire information on her credit report. It then deems ineligible any applicant whose debt-to-income (DTI) ratio is above 0.35 or whose FICO score is below 660.

- To applicants who pass this screening process, Lending Club proposes a menu of loans with different amounts, maturities (either 36 or 60 months), and interest rates.

Institutional Background—Pricing

Lending Club follows a two-step process when establishing the interest rate for each loan:

- Assigning a loan grade： Lending Club assesses borrower credit risk by assigning 35 credit grades— which range from A1 to G5—based on the borrower's credit score, DTI ratio, credit history, requested loan amount, and loan maturity. The applicable interest rate is then determined by the credit grade so assigned.

- Calculating the interest rate as the platform's base rate (for that grade) plus an upward adjustment reflecting the quoted factors: Lending Club determines an assumed default rate that attempts to project loan default rates for each grade. Third, we use the assumed default rate to calculate an upward adjustment to the base rates.

Institutional Background—Data

P2P data: 880,346 loan applications, of which 93,159 were funded

- detailed information on all loan applications and funded loans between 2009 and 2012.
- For the rejected loan applications, the available information includes FICO score, DTI ratio, employment length, and city of residence.
- For funded loans, there is additional information on the borrower's credit history and also on loan performance, provided the loan has reached maturity.

Bank data:

- Using Call Reports to identify banks that consolidate securitized assets under FAS 166/167;
- Using the Summary of Deposits to identify counties in which the branches of those banks are located and construct variables characterizing banking market structure at the county level: market concentration, share of small banks, share of national banks, and geographical diversity of local banks.

Institutional Background—Data

Table 1
Summary statistics: LendingClub loans

	Min.	Mean	Max.	S.D.	*N*
Panel A. All applications					
Amount	1,000	1,3104	35,000	10,111	880,346
FICO score	457	652	850	82.988	880,346
DTI	0.000	0.188	1.000	0.162	880,346
LengthEmploy	0	2.053	11	3.553	880,346
Panel B. Funded loans					
Interest rate	0.054	0.133	0.249	0.043	93,159
Amount	1,000	13,224	35,000	8,426	93,159
Maturity	0	0.135	1	0.342	93,159
DTI	0	0.147	0.332	0.079	93,159
FICO score	660	711	850	38	93,159
Predicted borrower quality	0	0.568	1	0.163	93,159
Mortgage	0	0.439	1	0.496	93,159
Home owner	0	0.106	1	0.308	93,159
Delinquency	0	0	1	0.016	93,159
Revolving balance	0	14,054	86,557	14,504	93,159
Total credit line	4	22.383	56	11.235	93,159
Open accounts	2	9.823	23	4.497	93,159
Revolver utilization	0	52.125	97.400	27.286	93,159
Inquiries last 6 months	0	0.953	5	1.151	93,159
Delinquency last 2 years	0	0.174	3	0.506	93,159
LengthEmploy	0	5.703	11	3.929	93,159
LengthCredit	4	14.358	38	7.081	93,159

Table1 presents summary statistics of borrower and loan characteristics. The average borrower receives $13,224, has a FICO score of 711, a DTI ratio of 0.147, and about six years' working experience. The average interest rate is 13.3%, ranging from 5.4% to 24.9%.

03 Empirical Strategy

Empirical Strategy—Model

- Identify the effects of this regulatory shock on P2P lending:

$$y_{c,t} = \beta Treated_c \times Post_t + Controls_{c,t} + \gamma_c + \sigma_t + \varepsilon_{c,t}, \qquad (1)$$

- c: counties
- t: quarters or years depending on the specification.
- $Treated_c$: a dummy variable set equal to 1 for counties with at least one branch of a treated bank, and set to 0 otherwise.
- $Post_t$: a dummy variable set to 1 for years 2011 onward and set to 0 for previous years.
- γ_c :a county fixed effect.
- σ_t : time fixed effect.
- $Controls_{c,t}$: other control variables, such as the banking market structure of county c at time t.
- The first set of dependent variables measures P2P lending volume.
- The second set of dependent variables concerns P2P borrower quality.

Empirical Strategy—Summary Statistics

Table 2
Summary statistics: County characteristics

	Min.	Mean	Max.	S.D.	*N*
Panel A. Lending volume					
$ applications (000s)	0	972	240,234	4,535	11,726
# applications	0	74	16,278	325	11,726
$ funded loans (000s)	0	99	33,176	573	11,726
# funded loans	0	8	2,526	44	11,726
Panel B. Normalized lending volume					
$ applications	0	7,619	291,908	10010.71	11,726
# applications	0	0.58	18.94	0.68	11,726
$ funded loans	0	599	50,457	1,342	11,726
# funded loans	0	0.05	1.92	0.09	11,726
Panel C. County explanatory and control variables					
Treated	0	0.66	1	0.47	11,726
HHI	467	3,107	10,000	2030	11,726
Share(SmallBanks)	0	0.40	1	0.40	11,726
Share(NationalBanks)	0	0.16	1	0.27	11,726
Geo.Diversification	1	3	40	4.60	11,726
Deposits	1,434	17,809	1,795,294	24,381	11,726
Population	670	104,331	10,045,175	325,093	11,726
Personal income	14,360	35,267	176,046	9,641	11,726
Unemployment	1.60	8.92	28.90	3.02	11,726

Table 2 reports summary statistics on county-level P2P lending volume. The average numbers of loan applications and funded loans are 74 and 8, respectively. In the largest local market, Los Angeles County, there were 16,278 applications and 2,526 originations in 2012.

Each of those dependent variables is normalized by county population.

Empirical Strategy—Model

$$y_{c,t} = \beta Treated_c \times Post_t + Controls_{c,t} + \gamma_c + \sigma_t + \varepsilon_{c,t}, \qquad (1)$$

- When either P2P application volume or P2P origination volume is used as the dependent variable in Equation (1), $\beta > 0$ irrespective of whether banks and P2P platforms are substitutes or complements.

- When the dependent variable is the average quality or a quantile of the borrower quality distribution, the predictions on quantiles imply that $\beta<0$ if banks and P2P platforms are substitutes.
- The opposite holds if they are complements.

- When the dependent variable is borrower frequency in the ten intervals, the predictions on frequency imply that $\beta>0$ only for intervals at the low (high) end of the quality distribution if P2P platforms and banks are substitutes (complements).

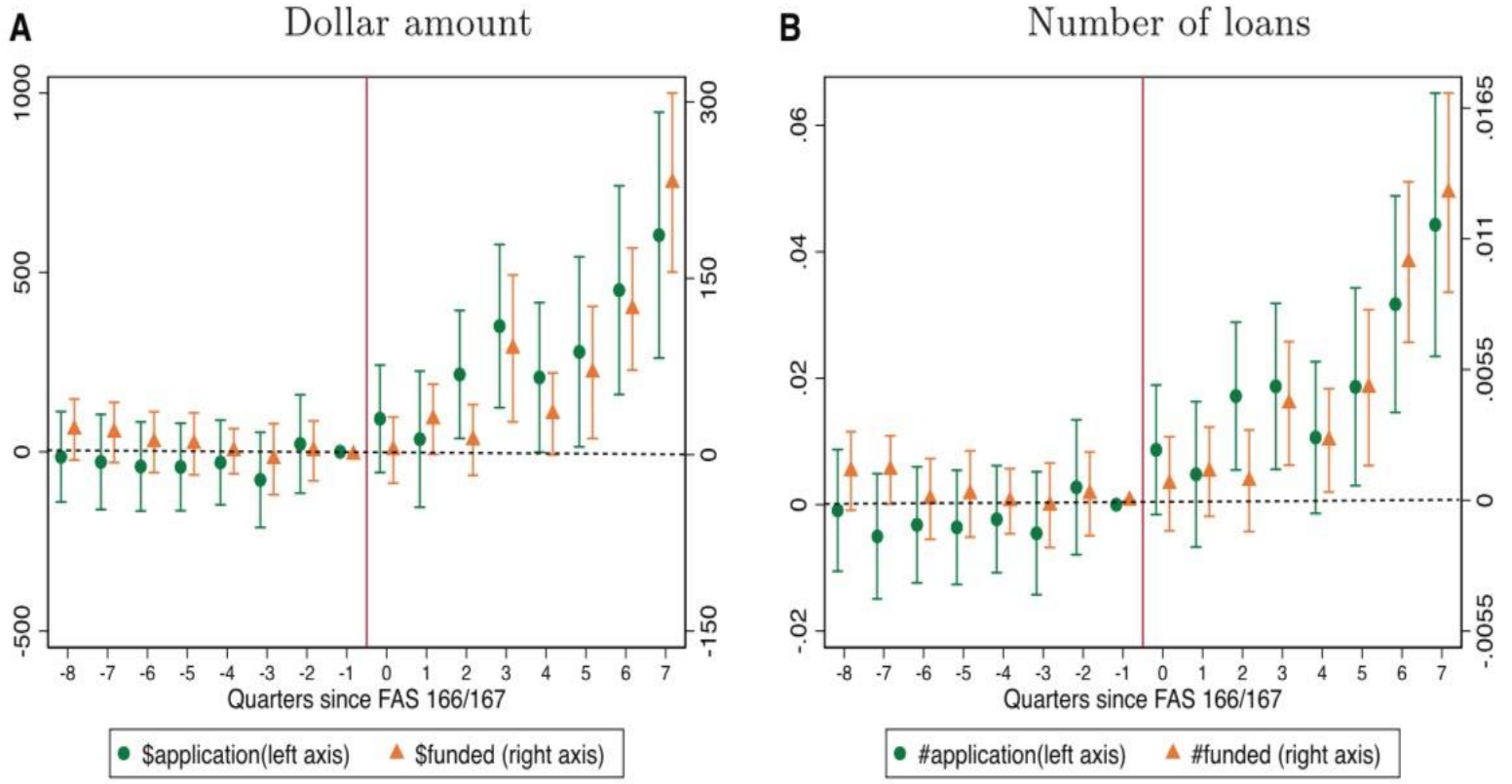
Empirical Strategy—Model

$$y_{c,t} = \beta Treated_c \times Post_t + Controls_{c,t} + \gamma_c + \sigma_t + \varepsilon_{c,t}, \qquad (1)$$

- When the dependent variable is the loan size, that is, the average and ten quantiles of P2P loan size:
- During the sample period, the loan size ranged from $1,700 to $35,000;
- Dividing the support of loan size into ten intervals with a fixed width of $3,400 and then calculate the number of loans within each loan size interval.

04 Main Results

Main Results—Testing predictions on volume



- This figure establishes that relative to control counties, P2P application and origination volumes increased significantly in treated counties after 2010Q4, in terms of both the total loan amount (panel A) and the number of loans (panel B).
- Observe also that there was no significant difference, between treated and control counties, in P2P lending volume before the shock.

Main Results—Testing predictions on volume

Table 3
Impact of FAS 166/167 on P2P application and loan volumes

	Applications		Funded loans	
	Amount($) [1]	Number(#) [2]	Amount($) [3]	Number(#) [4]
Treated × Post	1107.690***	0.070***	300.542***	0.016***
	(2.888)	(2.918)	(6.310)	(4.741)
1000 ≤ HHI < 1800	65.618	–0.019	–17.221	–0.000
	(0.130)	(–0.561)	(–0.191)	(–0.019)
HHI ≥ 1800	151.585	–0.014	–36.821	0.000
	(0.242)	(–0.343)	(–0.348)	(0.024)
Share(SmallBanks)	182.530	0.026	162.522	0.013
	(0.163)	(0.366)	(1.452)	(1.614)
Share(NationalBanks)	–1159.254	–0.014	383.648	0.029*
	(–1.291)	(–0.236)	(1.473)	(1.794)
Geo.Diversification	140.281**	0.013***	36.014	0.002*
	(2.167)	(3.055)	(1.481)	(1.696)
Population	–0.049***	–0.000***	–0.011***	–0.000***
	(–5.157)	(–5.225)	(–5.613)	(–5.651)
Deposits	0.004***	0.000***	0.001***	0.000***
	(3.098)	(2.953)	(2.617)	(4.038)
Personal income	0.013	0.000**	0.005	0.000
	(0.354)	(2.235)	(0.819)	(1.316)
Unemployment	747.445***	0.046***	79.788***	0.005***
	(6.339)	(6.521)	(3.792)	(4.885)
Year FE	Y	Y	Y	Y
County FE	Y	Y	Y	Y
Observations	11,726	11,726	11,726	11,726
R^2	0.710	0.756	0.532	0.557

- Consistent with Figure 4, relative to control counties, treated counties experienced an average increase in P2P loan applications of $1,108 (Column [1]), or of 0.070 additional loan applications (Column [2]), per 1,000 inhabitants.
- These values amount to 25.3% and 38.7% of the corresponding pre-shock levels. This increased demand was at least partially satisfied by the P2P platform.
- Its lending volume increased by $301 (Column [3]) or 0.016 additional originations (Column [4]), which are equivalent to 1.5 (1.1) times the pre-shock level of the dollar amount originated (number of originations).

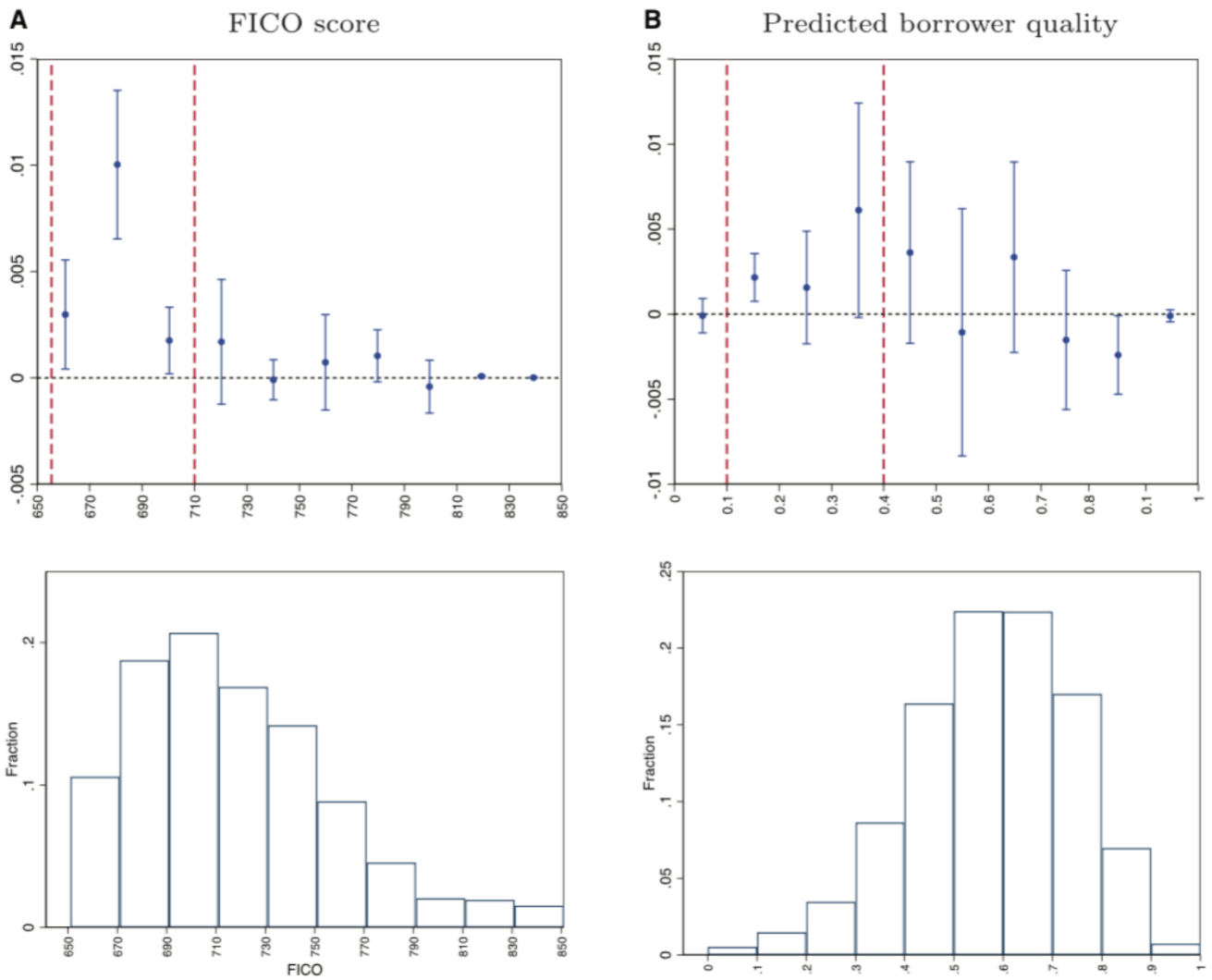
Main Results—Testing predictions on quality

Table 4
Impact of FAS 166/167 on P2P borrower quality distribution

	Percentile										Mean
	5th [1]	15th [2]	25th [3]	35th [4]	45th [5]	55th [6]	65th [7]	75th [8]	85th [9])	95th [10]	[11]
Panel A. FICO score											
Treated × Post	–2.357	–0.317	–0.046	–2.402	–2.148	–8.675***	–7.996**	–8.790**	–6.716*	–1.175	–3.707
	(–0.744)	(–0.100)	(–0.015)	(–0.752)	(–0.680)	(–2.610)	(–2.311)	(–2.384)	(–1.710)	(–0.286)	(–1.562)
Mean of Dep. Var.	700	702	707	712	715	726	729	737	744	751	722
R^2	0.554	0.515	0.471	0.445	0.431	0.460	0.441	0.417	0.428	0.522	0.447
Panel B. Predicted borrower quality											
Treated × Post	–0.052***	–0.020	–0.006	–0.013	–0.010	–0.024*	–0.019	–0.026*	–0.024	–0.010	–0.021
	(–3.060)	(–1.241)	(–0.393)	(–0.887)	(–0.630)	(–1.666)	(–1.275)	(–1.776)	(–1.604)	(–0.701)	(–1.479)
Mean of Dep. Var.	0.415	0.436	0.458	0.487	0.500	0.544	0.558	0.587	0.607	0.625	0.523
R^2	0.563	0.475	0.458	0.460	0.463	0.479	0.497	0.514	0.555	0.618	0.489
Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
County FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	5,059	5,059	5,059	5,059	5,059	5,059	5,059	5,059	5,059	5,059	5,059

Table 4 reports the results when borrower quality is measured by the FICO score (panel A) and when it is measured by the predicted borrower quality (panel B). For both proxies of borrower quality, the quantiles (Columns [1]–[10]) and also the mean (Column [11]) decreased simultaneously in treated counties relative to control counties, which is consistent with banks and P2P platforms being substitutes.

Main Results—Testing predictions on quality



In the interval containing FICO scores between 650 and 710, the number of originations increased by 0.013 per 1,000 inhabitants (significant at the 1% level), 1.9 times the pre-shock level.

In contrast, the number of originations did not increase significantly in other intervals when the FICO score exceeds 710. Thus, the increase in P2P lending induced by the shock to bank credit supply was located at the lower end of the P2P borrower quality distribution.

This finding accords with P2P platforms and banks being substitutes.

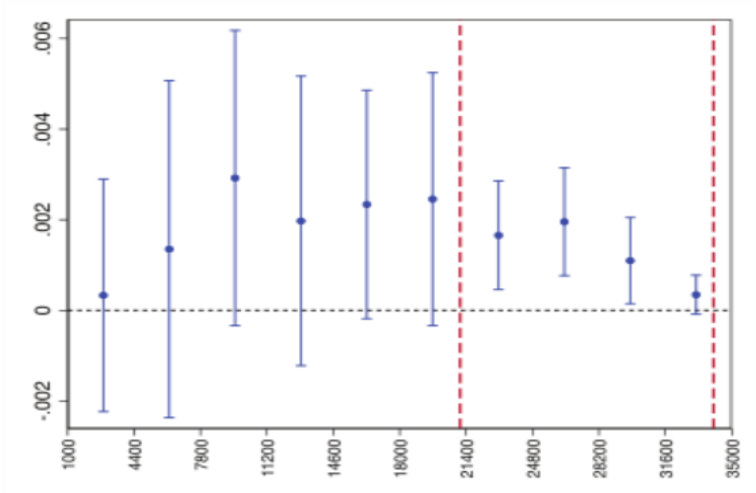
Main Results—Complementarity in the loan size dimension

Table 5
Impact of FAS 166/167 on P2P loan size distribution

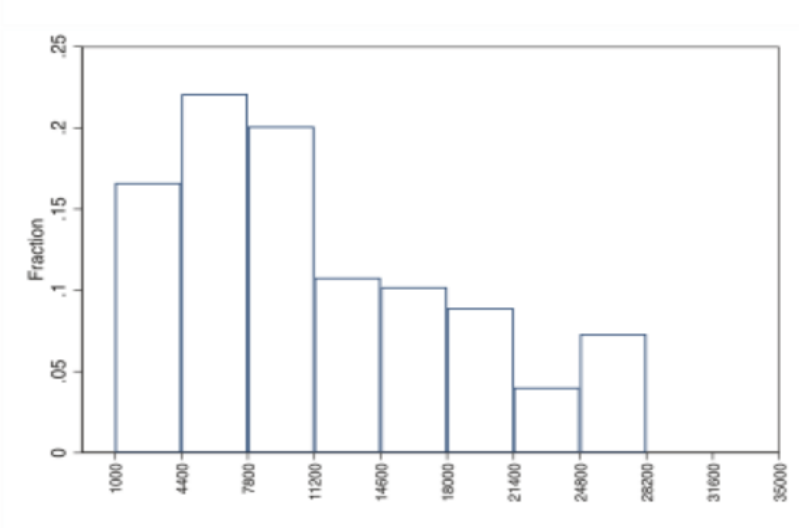
	Percentile										Mean
	5th [1]	15th [2]	25th [3]	35th [4]	45th [5]	55th [6]	65th [7]	75th [8]	85th [9]	95th [10]	[11]
Treated × Post	–431.227	133.105	539.770	315.903	782.406	122.866	860.915	955.827	1562.936**	3869.708***	1066.046**
	(–0.774)	(0.240)	(1.003)	(0.559)	(1.360)	(0.209)	(1.456)	(1.433)	(2.049)	(4.819)	(2.043)
Mean of Dep. Var.	6,244	6,630	7,161	8,021	8,524	10,270	10,883	12,280	13,501	14,546	9,833
Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
County FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	5,059	5,059	5,059	5,059	5,059	5,059	5,059	5,059	5,059	5,059	5,059
R^2	0.511	0.455	0.429	0.417	0.416	0.433	0.459	0.488	0.544	0.660	0.461

Table 5 shows the changes in the quantiles of the loan-size distribution.
The average loan size increased by a statistically significant amount of $1,066 (Column [11]).
Moreover, the P2P loan-size distribution shifted toward the right end, as all quantiles except the 5th increased (Columns[1]–[10]).
The top two quantiles, the 85th and 95th, increased significantly by $1,563 and $3,870, respectively.

Main Results—Complementarity in the loan size dimension



The upper part of Figure 6 shows that the increase in the number of originations occurred only in the top four intervals, where the loan size is between $21,400 and $35,000. This result is in line with those from quantile tests, because new loans were larger than the 95th percentile of the pre-shock loan size distribution, and the arrival of these loans induced an increase in almost all the quantiles, especially the highest quantiles.



When comparing the change in the loan size distribution (the upper part of Figure 6) with the pre-shock distribution (the lower part), we can see a sizable increase not only at the right tail of the distribution (i.e., between $21,400 and $28,200) but also beyond the right tail of the distribution (i.e., between $28,200 and $35,000).

05 Testing the Assumption

Testing the Assumption

- **Testing the Assumption of an Elastic P2P Credit Supply**
- **Testing the Validity of FAS 166/167 as a Negative Shock to Bank Credit Supply**

06 Concluding Remarks

Concluding Remarks

- **This paper addresses that question and provides insights derived by examining the relation between P2P platforms and banks.**

- **Exploiting a negative shock to bank credit supply, it show that P2P lending expands in the markets exposed to this shock.**

- **Also find evidence for substitution between banks and P2P platforms given that, when low-quality bank borrowers migrate to P2P platforms, the quality of the P2P borrower pool deteriorates. This result suggests that the credit expansion opportunities brought by P2P lenders only benefit infra-marginal bank borrowers.**

- **At the same time, however, P2P platforms complement banks by providing small loans.**

Thank you!