

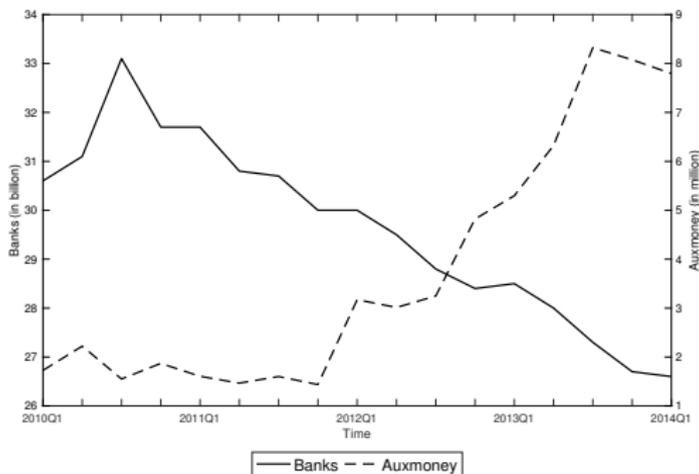
## **P2P Lenders versus Banks: Cream Skimming or Bottom Fishing?**

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## Motivation: P2P lending is going up and bank lending is going down in Germany



**Figure: New Credit Provision P2P Lending vs Banks.** Banks credit refers to non-construction consumer credit lines and is defined in billion €. P2P lending refers to the credit intermediated by Auxmoney and is defined in million €.

Source: Research Data and Service Center (RDSC) of the Deutsche Bundesbank and Auxmoney, sample period Jan 2010-Aug 2014.

## Motivation: P2P lenders versus banks

Why do we observe bank loans trending down and P2P loans trending upward? The commonly-given explanations:

- ▶ Fintech credit has to do with advances in technology (computing power, ability to process big data to screen borrowers – Buchack, Matvos, Piskorski, and Seru (2017)), lower fixed costs
- ▶ Heavier post-crisis regulatory burden for banks/regulatory arbitrage – Phillipon (2015)
- ▶ Unclear whether observed trends are just a coincidence, what kind of loans banks are losing, and possible pricing differences between banks and P2P lenders (are P2P loans cheaper, and if so, why?) – all have possible risks and regulatory implications

## Research Questions

The emergence of the P2P credit market raises some fundamental questions:

1. Does P2P lending negatively impact bank lending? Under what circumstances do banks lose loans to P2P platforms?
2. What are the risk characteristics of the loans that migrate from banks to P2P platforms?
3. Are P2P platforms lending at higher or lower risk-adjusted interest rates than banks?

# Objectives

We address these questions by:

- ▶ Developing a theory model of the competition between banks and P2P platforms
- ▶ Testing the predictions of the model through an empirical analysis, based on region/bank-level data on new consumer lending by German regional banks and the German P2P platform Auxmoney

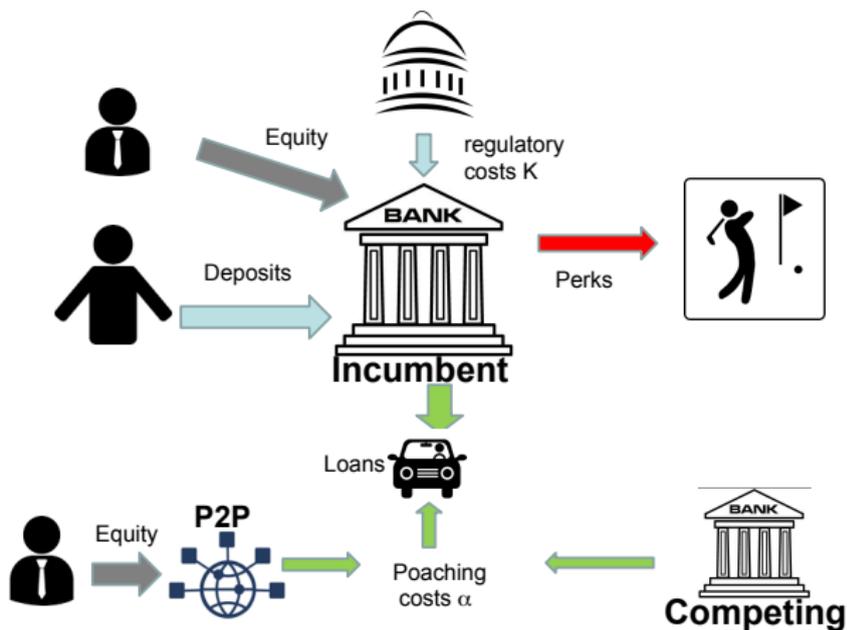
## Key Results

### Theoretical predictions supported by empirical results

- 1a. P2P lending and bank lending are negatively correlated
- 1b. This effect is more pronounced in states in which banks are more capital-constrained and borrowers are more “aware” of Auxmoney existence, i.e. these two forms of lending are at least partial substitutes
2. P2P lending is bottom fishing and taking away the riskiest and least profitable customers from banks
3. P2P borrowers are riskier but risk-adjusted interest rates charged by P2P lenders are lower than those charged by banks

## The Model: Ingredients

| Banks vs. P2P                    |                        |
|----------------------------------|------------------------|
| Levered lenders<br>-moral hazard | All Equity<br>-no M.H. |
| Deposit rents                    | No                     |
| Regulatory Costs                 | No                     |



# The Model: Ingredients

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## Sequence of Events

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t=0

t=1

- ▶ Bank's cost of acquiring a borrower,  $\hat{\alpha}$ , is realized. P2P platforms have same cost.
  - ▶ Borrower takes a loan of  $L$ , with repayment obligation of  $L_R^i$ ,  $i \in \{g, G\}$ .
  - ▶ Good loan can be  $g$  or  $G$ . Bank's loan opportunity publicly observable.
  - ▶ Bank can also invest in  $B$  loan that generates private benefit  $\Pi$  (socially inefficient).
  - ▶  $L$  is financed with a mix of uninsured deposit,  $D^i$ , and equity,  $E^i$ .
  - ▶ A competing bank may or may not arrive.
  - ▶ Bank has regulatory cost  $K$ .
  - ▶ Social cost of bank failure  $\Omega(D) > 0$
  - ▶ Depositors enjoy value of liquidity services ( $\gamma D$ ) and set  $D_R^i$ ,  $i \in \{g, G\}$  after observing loan terms. Market structure similar to Holmstrom and Tirole (1997)
    - loan repayment =max. pledgeable borrower CF– if no competitor arrives.
- ▶  $g$  pays off  $L_R^g$  with probability(w.p.)  $q$  and 0 w.p.  $1 - q$ .
  - ▶  $G$  pays off  $L_R^G$  with probability(w.p.)  $p$  and 0 w.p.  $1 - p$ .
  - ▶  $p > q$ .
  - ▶ All contracts are settled, and depositors are repaid  $D_R^i$ ,  $i \in \{g, G\}$  if the bank experiences loan repayment. Depositors also receive  $\gamma D$  if the bank does not default.

## The Model: Results

**Proposition 1:** In the second best, with asset-substitution moral hazard, bank endogenously chooses interior debt-equity mix:

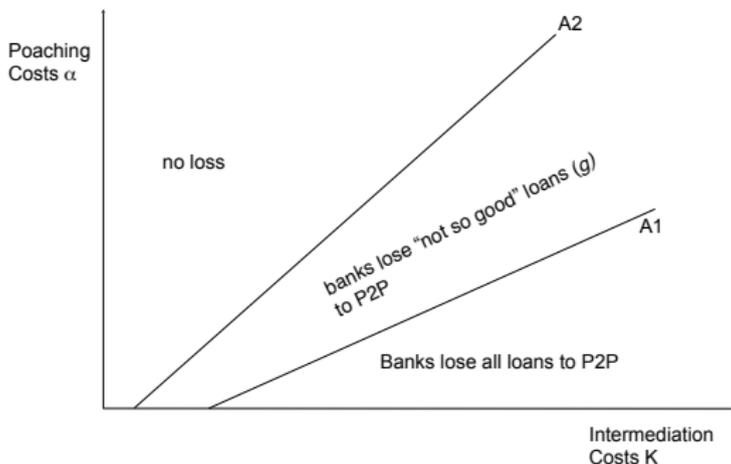
- ▶ if no competitor arrives, the incumbent bank will choose equity capital  $> 0$
- ▶ If a competitor arrives, the incumbent bank holds more equity

**Corollary 1.** No competing bank will ever successfully take a borrower away from an incumbent bank (because they are all identical).

- ▶ The loan interest rate will be lower when a competing bank arrives than when it does not.
- ▶ Only if the competing bank faces a lower intermediation cost,  $K$ , will it take the borrower away.

## The Model: Results

**Proposition 2:** If poaching cost is in the range  $[A_1, A_2)$ ;



- ▶ P2P lenders arrive and steal the least profitable borrowers away.
- ▶ P2P Loan risk-adjusted interest rate will be lower than what banks charge.

## The Model: Results

**Corollary 3:** If some banks experience an increase in  $K$  that makes some risky loans less profitable for them,

- ▶ these loans may be picked up by unaffected banks if they are not capital constrained. Overall bank lending is unaffected.
- ▶ If the unaffected banks are capital constrained and cannot expand their lending, these loans will go to P2P lenders, and overall bank lending will decline.

## The Model: Testable Hypotheses

**Hypothesis 1:** There is a negative relationship between the volumes of bank lending and P2P lending.

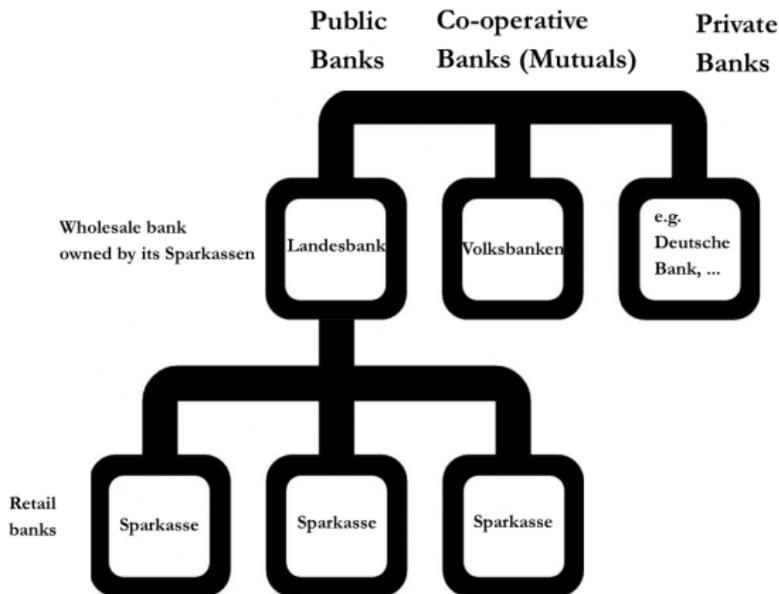
**Hypothesis 2:** P2P loans are riskier than banks loans.

**Hypothesis 3:** The risk-adjusted interest rate on bank loans is higher than the risk-adjusted interest rate on P2P loans.

## Data

- ▶ 105 regional banks (Sparkassen and Volksbanken): consumer credit bank level new lending data from Bundesbank (Not available for US banks)
- ▶ Auxmoney (largest and oldest P2P platform in Germany): state level
- ▶ monthly data on: volume (new loans), interest rate and risk

# Digression on the German Banking Structure



About 40% of banking assets in Germany are in public banks B/S, 10% in co-operative banks and 50% in private banks. Our sample contains 71 Sparkassen (21 in treated states), 34 Volksbanken (9 in treated states).

# Hypothesis 1: There is a negative relationship between bank lending and P2P loans.

$$\log(L_{t,b(s)}^{bank}) = \gamma_1 \log(L_{t,s}^{P2P}) + \gamma_2 \log(L_{-t,b(s)}^{bank}) + \Delta_s + \Delta_t + \epsilon_{t,b(s)}$$

|                         | (I)                | (II)               | (III)              |
|-------------------------|--------------------|--------------------|--------------------|
|                         | $\log(L_{t,b(s)})$ | $\log(L_{t,b(s)})$ | $\log(L_{t,b(s)})$ |
| $\log(L_{t,s}^{P2P})$   | 0.01<br>(0.03)     | -0.15***<br>(0.03) | -0.02**<br>(0.01)  |
| $\log(L_{t,-b(s)})$     | -0.09<br>(0.14)    | -1.30***<br>(0.24) | -1.41***<br>(0.34) |
| State FE ( $\Delta_s$ ) |                    | Yes                | Yes                |
| Time FE ( $\Delta_t$ )  |                    |                    | Yes                |
| Cluster                 | Bank               | Bank               | Bank               |
| adj. R <sup>2</sup>     | 0.01               | 0.32               | 0.35               |
| # Obs                   | 6,026              | 6,026              | 6,026              |

$L_{t,b(s)}^{bank}$ : new loans volume by bank  $b$ , located in state  $s$  in month  $t$ ,

$L_{t,s}^{P2P}$ : new loans volume by P2P lender in state  $s$  in month  $t$ ,

$L_{t,-b(s)}^{bank}$  sum of new loans volume by all other banks in state  $s$  in month  $t$ . 15

## More on Hypothesis 1: Does P2P Lending Have a Causal Effect on Bank Lending? The EBA Capital Exercise 2011

- ▶ In October 2011, after the EBA stress test of June 2011 and subsequent failure of Dexia
- ▶ The capital exercise required large banks to reach and maintain a 9 percent core tier 1 capital ratio by the end of June 2012
- ▶ HELABA and NordLB (Landesbanken) had to significantly increase their capital (by 2.67% and 2.99% of Total assets)
- ▶ Sparkassen linked to those Landesbanken needed to raise capital and this could decrease their lending

## The EBA Capital Exercise

**Question 1:** How do the higher capital requirements of their Landesbank affect the savings banks (Sparkassen)?

- ▶ When a Landesbank is required to have more capital, the Sparkassen in these states are also faced with higher regulatory costs due to their links with their Landesbank since much of the additional capital is provided by their local Sparkassen.

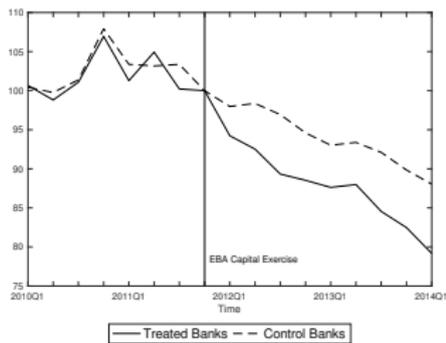
This has two effects on the Sparkassen that work in the same direction to reduce lending by these banks.

- ▶ **Direct:** these banks are using loanable funds to purchase equity in their Landesbank rather than lending the money.
- ▶ **indirect:** the equity investment increases the risk of the Sparkassen and requires a higher capital ratio, which de facto increases their regulatory costs.

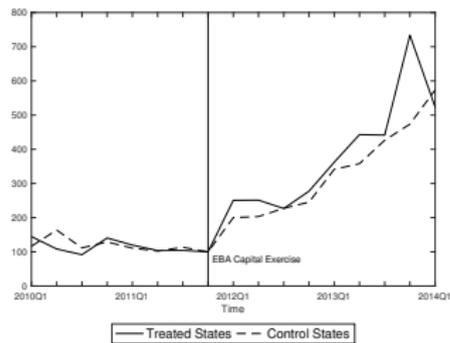
**Question 2:** What are the effects of higher regulatory costs on credit supply?

- ▶ Banks reduce their lending

# Hypothesis 1: Parallel Trends using EBA Capital Exercise



(a) Credit provision by banks



(b) Credit provision by Auxmoney

- ▶ **Treatment Group:** banks in states where NordLB and HELABA are present
- ▶ **Control Group:** banks in other states

# Hypothesis 1: Diff-in-Diff (state level): Total Bank Lending (aggregated at state level) Declined in Treated States Relative to Control States

$$\log(L_{t,s}) = \alpha_1 \text{treated}_s * EBA_t + \alpha_2 EBA_t + \alpha_3 \text{treated}_s + \Pi W_{t,s} + u_{t,s}$$

|                                | Bank new loans – State Level |                    |                    | P2P Lending        |                   |                   |
|--------------------------------|------------------------------|--------------------|--------------------|--------------------|-------------------|-------------------|
|                                | $\log(L_{t,s})$              | $\log(L_{t,s})$    | $\log(L_{t,s})$    | $\log(L_{t,s})$    | $\log(L_{t,s})$   | $\log(L_{t,s})$   |
| $EBA_t * \text{treated}_{t,s}$ | -0.01<br>(0.10)              | -0.06***<br>(0.02) | -0.05***<br>(0.01) | 0.60***<br>(0.10)  | 0.20***<br>(0.08) | 0.22***<br>(0.06) |
| $EBA_t$                        | -0.28**<br>(0.11)            | -0.12***<br>(0.01) |                    | -0.20<br>(0.17)    | 0.60***<br>(0.05) |                   |
| $\text{Treated}_{t,s}$         | 1.16***<br>(0.08)            |                    |                    | -0.29***<br>(0.09) |                   |                   |
| Controls                       | Yes                          | Yes                | Yes                | Yes                | Yes               | Yes               |
| State FE                       |                              | Yes                | Yes                |                    | Yes               | Yes               |
| Time FE                        |                              |                    | Yes                |                    |                   | Yes               |
| adj. R <sup>2</sup>            | 0.150                        | 0.994              | 0.997              | 0.09               | 0.63              | 0.79              |
| # Obs                          | 741                          | 741                | 741                | 590                | 590               | 590               |

**Treatment Group:** banks in states where NordLB and HELABA are present;  
**Control Group:** banks in other states;  $L_{t,s}$ : new loans volume in state  $s$  in month  $t$ ;  $\text{Treated}_{t,s} = 1$  if treated states (NordLB and HELABA), 0 otherwise;  
 $EBA_t = 1$  after October 2011, 0 otherwise.

# Hypothesis 1: Diff-in-Diff (bank level): Banks in Treated States (when disaggregated t bank level) Reduced Lending Relative to Banks in Control

$$\log(L_{t,b}) = \alpha_1 \text{treated}_b * EBA_t + \alpha_2 EBA_t + \alpha_3 \text{treated}_b + \Pi W_{t,b} + u_{t,b}$$

|                            | Affected Banks (Sparkassen) |                    |                    | Unaffected Banks (Volksbanken) |                    |                 |
|----------------------------|-----------------------------|--------------------|--------------------|--------------------------------|--------------------|-----------------|
|                            | $\log(L_{t,b})$             | $\log(L_{t,b})$    | $\log(L_{t,b})$    | $\log(L_{t,b})$                | $\log(L_{t,b})$    | $\log(L_{t,b})$ |
| $EBA_t * \text{Treated}_b$ | -0.09***<br>(0.03)          | -0.07***<br>(0.02) | -0.07***<br>(0.03) | 0.16<br>(0.10)                 | 0.15<br>(0.09)     | 0.17*<br>(0.10) |
| $EBA_t$                    | -0.01<br>(0.13)             | -0.11***<br>(0.02) |                    | -0.16***<br>(0.03)             | -0.14***<br>(0.02) |                 |
| $\text{Treated}_b$         | -0.13***<br>(0.04)          |                    |                    | -0.25<br>(0.26)                |                    |                 |
| Controls                   | Yes                         | Yes                | Yes                | Yes                            | Yes                | Yes             |
| Bank FE                    |                             | Yes                | Yes                |                                | Yes                | Yes             |
| Time FE                    |                             |                    | Yes                |                                |                    | Yes             |
| adj. R <sup>2</sup>        | 0.039                       | 0.962              | 0.971              | 0.041                          | 0.962              | 0.974           |
| # Obs                      | 5,754                       | 5,754              | 5,754              | 5,754                          | 5,754              | 5,754           |

**Treatment Group:** (i) Sparkassen linked to treated Landesbanken (NordLB or HELABA) called affected banks, and (ii) Volksbanken in treated states called unaffected banks; **Control Group:** banks in non-treated states.  $L_{t,s}$ : new loans volume by bank  $b$  in month  $t$ ;  $\text{Treated}_s = 1$  if treated states (NordLB and HELABA), 0 otherwise;  $EBA_t = 1$  after October 2011, 0 otherwise.

## Effect of Bank Capital: Test of Lending Responses to the Shock by Unaffected Banks in Treated States.

Banks with more capital were more able to increase their lending in response to the reduced lending of treated banks.

$$Expansion_{t,b} = \alpha_0 + \alpha_1 capital_{t,b} + \Delta_t + u_{t,b}$$

|                | (I)               | (II)               |
|----------------|-------------------|--------------------|
|                | Expansion         | Expansion          |
| Capital        | 15.22**<br>(6.11) | 15.37***<br>(3.07) |
| Time FE        |                   | Yes                |
| Cluster        | Bank              | Bank               |
| R <sup>2</sup> | 0.132             | 0.145              |
| #Obs           | 108               | 108                |

**Expansion**<sub>*t,b*</sub> = 1 if one year increase in lending volume in 2012 puts banks in top quartile of lending increase, 0 otherwise;  $\Delta_t$  time FE; **capital**<sub>*t,b*</sub> capital ratio of bank *b* at time *t*.

## Effect of Poaching Cost (awareness of P2P lending means lower poaching cost): Diff-in-diff estimation and Google Search for Auxmoney.

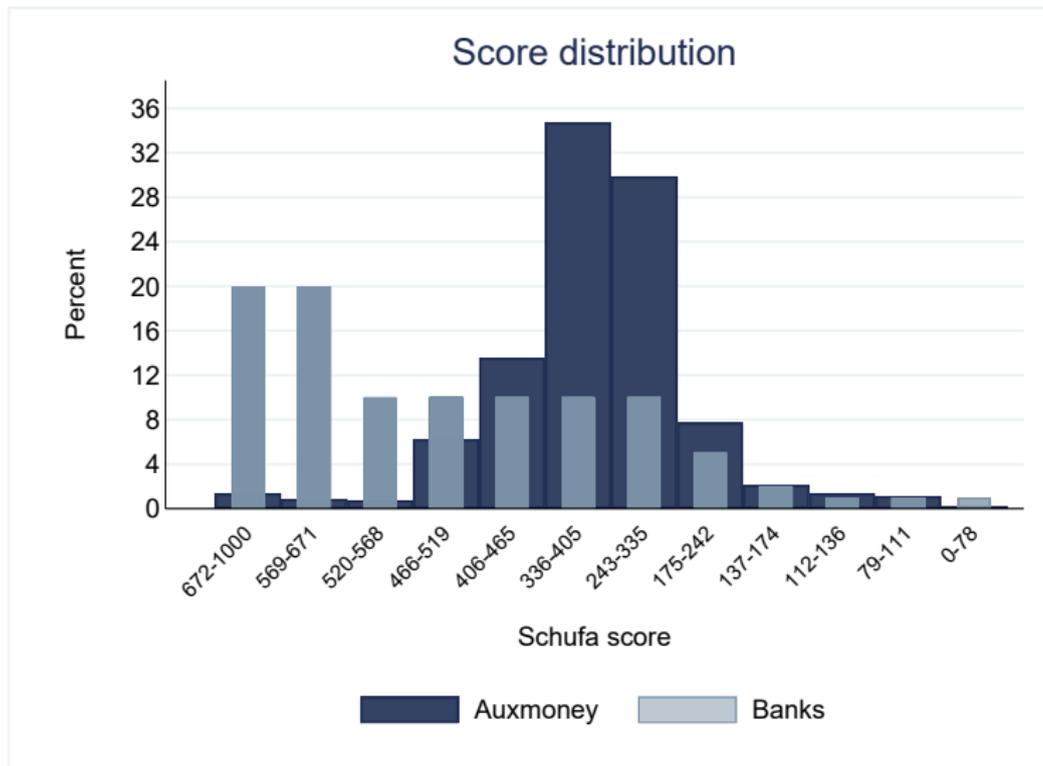
P2P lenders gain more share in treated states with greater pre-shock awareness of P2P lending.

$$\log(L_{t,s}) = \alpha_1 \text{treated}_s * \text{EBA}_t + \alpha_2 \text{EBA}_t + \alpha_3 \text{treated}_s + \alpha_4 \text{google}_{t,s} + \text{IIW}_{t,s} + u_{t,s}$$

|                     | Bank new loans – State Level<br>(I)<br>$\log(L_{st})$ | P2P Lending<br>(II)<br>$\log(L_{st})$ |
|---------------------|---|---------------------------------------|
| Google Search       | -0.0004***<br>(0.0001)                                | 0.002**<br>(0.001)                    |
| diff-in-diff vars.  | Yes   | Yes                                   |
| Controls            | Yes   | Yes                                   |
| State FE            | Yes   | Yes                                   |
| Cluster             | State   | State                                 |
| adj. R <sup>2</sup> | 0.155   | 0.431                                 |
| # Obs               | 741   | 590                                   |

$L_{t,s}$ : new loans volume in state  $s$  in month  $t$ ; **Treated** $_{t,s} = 1$  if treated states (NordLB and HELABA), 0 otherwise; **EBA** $_t = 1$  after October 2011, 0 otherwise; **Google Search** gives the amount of search for the word *Auxmoney* in state  $s$  and month  $t$ .

## Hypothesis 2: P2P loans are riskier than banks loans.



## Hypothesis 2: P2P loans are riskier than banks loans.

$$\sigma_{t,b} = \beta_1 \text{auxmoney}_{t,b} + \Delta_s + \Delta_t + u_{t,b}$$

|                     | (I)               | (II)              | (III)             |
|---------------------|-------------------|-------------------|-------------------|
|                     | $\sigma_{t,b}$    | $\sigma_{t,b}$    | $\sigma_{t,b}$    |
| Auxmoney Dummy      | 7.33***<br>(0.01) | 7.44***<br>(0.04) | 7.36***<br>(0.04) |
| State FE            |                   | Yes               | Yes               |
| Time FE             |                   |                   | Yes               |
| Cluster             | Bank              | Bank              | Bank              |
| adj. R <sup>2</sup> | 0.81              | 0.82              | 0.83              |
| # Obs               | 5,903             | 5,903             | 5,903             |

$\sigma_{t,b}$ : probability of default for loans provided either by banks or P2P lenders at month  $t$ ; **Auxmoney Dummy=1** if loans are provided by P2P lender and 0 otherwise.

### Hypothesis 3: The risk-adjusted interest rate on bank loans is higher than the risk-adjusted interest rate on P2P loans.

$$r_{t,b} = (1 - \sigma_{t,b}) \times (1 + i_{t,b}) + \sigma_{t,b} \times RR_{t,b} - 1$$

$$r_{t,b} = \beta_2 \text{auxmoney}_{t,b} + \Delta_s + \Delta_t + e_{t,b}$$

|                     | (I)                | (II)               | (III)              |
|---------------------|--------------------|--------------------|--------------------|
|                     | <i>r</i>           | <i>r</i>           | <i>r</i>           |
| Auxmoney Dummy      | -1.87***<br>(0.07) | -2.00***<br>(0.09) | -1.91***<br>(0.09) |
| State FE            |                    | Yes                | Yes                |
| Time FE             |                    |                    | Yes                |
| Cluster             | Bank               | Bank               | Bank               |
| adj. R <sup>2</sup> | 0.02               | 0.03               | 0.05               |
| # Obs               | 5,885              | 5,885              | 5,885              |

Risk adjusted rate is computed using probability of repayment times nominal rate + probability of default times recovery

## Conclusion

- ▶ We develop a simple model of interaction between bank lending and P2P lending
- ▶ Model predicts:
  1. P2P lending increases when the cost of lending goes up for some banks due to a regulatory shock
  2. Effect of P2P lending on bank lending is bigger when unaffected banks in treated states have less capital (more financially constrained)
  3. Effect of P2P lending on bank lending is bigger when there is greater awareness of P2P lending
  4. P2P lenders are prying away the riskiest loans from banks and charging lower risk-adjusted rates
- ▶ We find empirical support for these predictions

**Thank you!**