Open Banking: Credit Market Competition When Borrowers Own the Data

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Introduction

Open data economy

- "Open" customer data to external third parties, whenever customers who generate these data consent sharing their data
  - Instead of being isolated and kept within each individual institution

Open banking

- An initiative led by several governments (Australia, UK, Asian countries)
- Its core principle is not only customer data ownership (GDPR) but enabling customers to voluntarily share their financial data with other entities (PSD2)
- Represent perhaps the most transformative trend in the banking industry

Welfare implications?

- Lenders? Borrowers?
- "Voluntary" feature, opt-in/opt-out feature

Open Banking: An Illustration

A Survey done by Deloitte Insight, April 2019

> *"Imagine you want to use a financial product offered by an organization other than your bank. This product could be ... an app that gives you a full picture of your financial status (e.g., expenses, savings, and investments), or it could be a mortgage or line of credit. But for this product to be fully useful to you, it needs information from your bank, such as the amount of money you have coming in and going out of your accounts, how many accounts you have, how you spend your money, how much interest you have earned or paid, etc. You then instruct your bank to share this information with this other institution or app. Should you wish to stop using this product, you can instruct your bank to stop sharing your data at any given point in time, with no strings attached. This concept is called* **open banking**."

This Paper

Canonical credit market competition

- Analytical tractable framework with asymmetric screening technology
- Broecker (1990), but borrowers control data

What kind of data we are talking about?

- Credit quality; *production cost*
- "Privacy" and targeted loans by fintech*: consumer's preference*

Equilibrium credit quality inference

- Adverse selection as the backbone of credit market
- What does "sign-up"/"opt-in" itself say about my own credit quality? And someone who does not?

Key results from information externality

- Potentially perverse effect of open banking: all borrowers worse off despite voluntary sign-up
- Smaller equilibrium sign-up population for less privacy concerns

Related Literature

Credit market competition and information technology

- Broecker (1990), Hauswald and Marquez (2003, 2006)
- Thakor (1996), Rajan (1992), von Thadden (2004), Pagano and Jappelli (1993)

Fintech Disruption

- Buchak, Matvos, Piskorski and Seru (2018), Vives (2019), Fuster, Plosser, Schnabl and Vickery (2019), Tang (2019), Di Maggio and Yao (2020), Berg, Burg, Gombović and Puri (2020), Rajan, Parlour and Zhu (2020)

Privacy and Economics of Data

- Liu, Sockins and Xiong (2020), Aridor, Che and Salz (2020)

Common Value Auction

- Milgrom and Weber (1982), Banerjee (2005)

Road Map

Baseline model

- Credit market competition for borrowers with private types
- Lenders (bank and fintech) with asymmetric screening technologies

Open banking and data sharing

- Borrowers can voluntarily share their own data resided in bank
- But what kind of data? Welfare implications?
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Open banking: Credit information sharing

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Open banking: privacy and targeted loans

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Setting: Borrowers

Risk neutral borrowers need 1 dollar financing

- Project payout $\widetilde{R} = \overline{r}$ if h-type, $\widetilde{R} = 0$ if l-type
  - Offered interest rate $r \leq \overline{r}$, a natural upper bound
- Credit quality type is private information; $\Pr(h) = \theta$, likelihood ratio

$$\tau \equiv \frac{\theta}{1-\theta}$$

- Non-pecuniary benefit of receiving a loan δ
  - Type-independent, sufficiently small (so l-type shouldn't get the loan)
- Another interpretation: consumer loans, $\overline{r}$: usury laws prohibiting excessively high rates of interest

Non-tech-savvy borrowers

- A $\rho \in (0, 1)$ measure of borrowers with infinite sign-up cost; play a role in equilibrium belief updating
  - Technology non-savviness, averse to data sharing, etc.
  - Independent of credit quality type, unobservable

Setting: Lenders

Lenders

- Traditional bank b or fintech lender f
- Baseline: differs only by screening technology (weak vs strong)

Screening technology

- Screening technology indexed by x_j, $j \in \{b, f\}$
- Binary signals $S_j \in \{H, L\}$ on borrower credit quality type

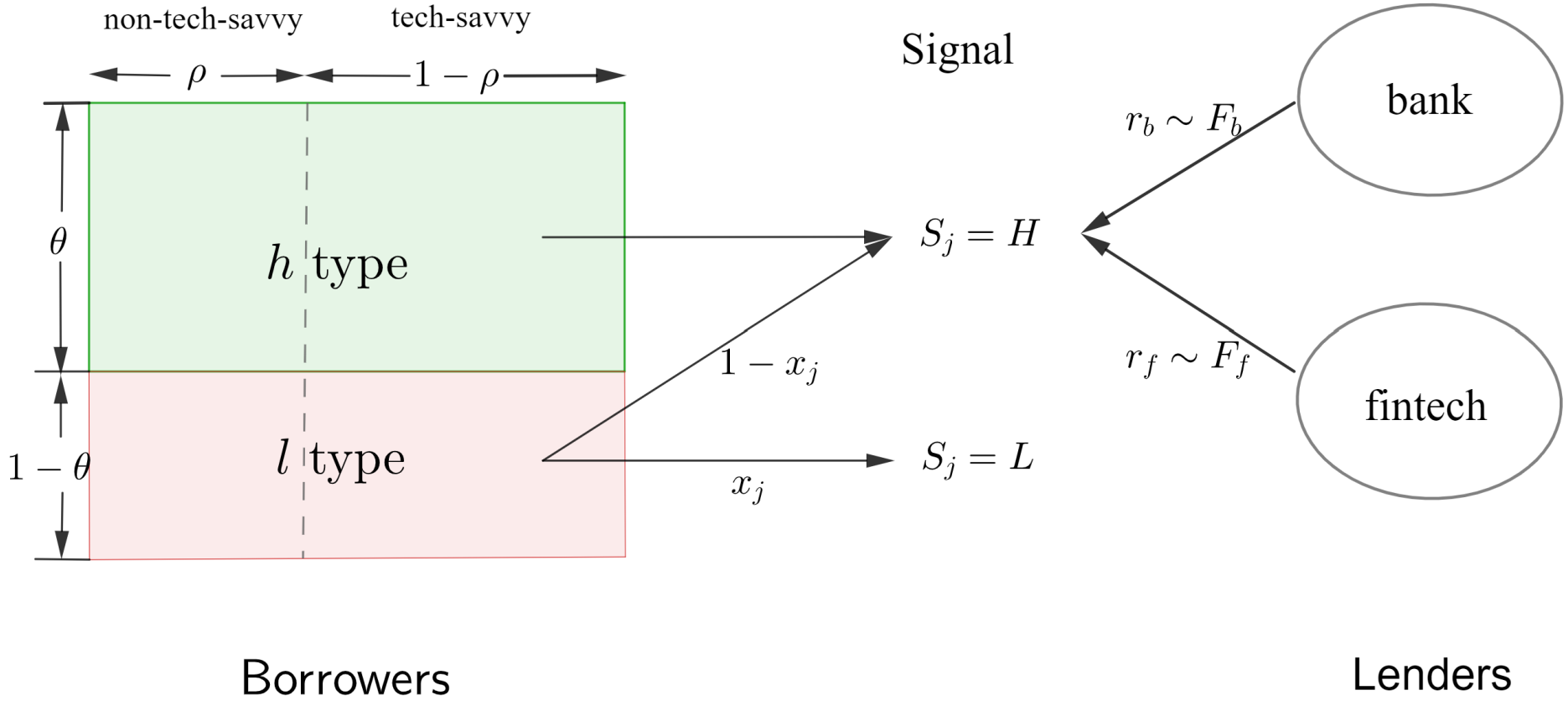
$$\mathbb{P}(S_j = H|h) = 1, \mathbb{P}(S_j = L|l) = x_j$$

  - "Bad-news" structure; baseline bank is stronger $x_b > x_f$

Loan offers

- Simultaneous offers with interest rate $r_j \leq \bar{r}$ conditional on good signal $S_j = H$

Setting: Model Scheme



Equilibrium: Strategies

Winner's curse $\Delta \equiv x_b - x_f$

- Non-existence of pure-strategy equilibria

The unique (mixed-strategy) equilibrium

- Stronger lender (bank) makes a profit $\pi_s = \frac{\Delta}{1+\tau} > 0$; weaker (fintech) earns zero
- After H signal, each offering $r_i \in [\underline{r}, \overline{r}]$ with the same $\underline{r} = \frac{1-x_f}{\tau}$;
  - $\phi(r) \equiv \frac{x_b}{\frac{\tau}{1-x_f} r - 1 + x_b}$
  - Bank always offers $F_b(r) = 1 - \phi(r)$ with mass $\phi(\overline{r})$ at $\overline{r}$; fintech passes with prob. $\phi(\overline{r})$
  - Conditional on offering, $F_b(r) = (1 - \phi(\overline{r}))\, F_f(r) < F_f(r)$, FOSD: bank offers higher rate
- Note, h-type care about interest rate; l-type care about loan probability

Equilibrium: Profits and Surplus

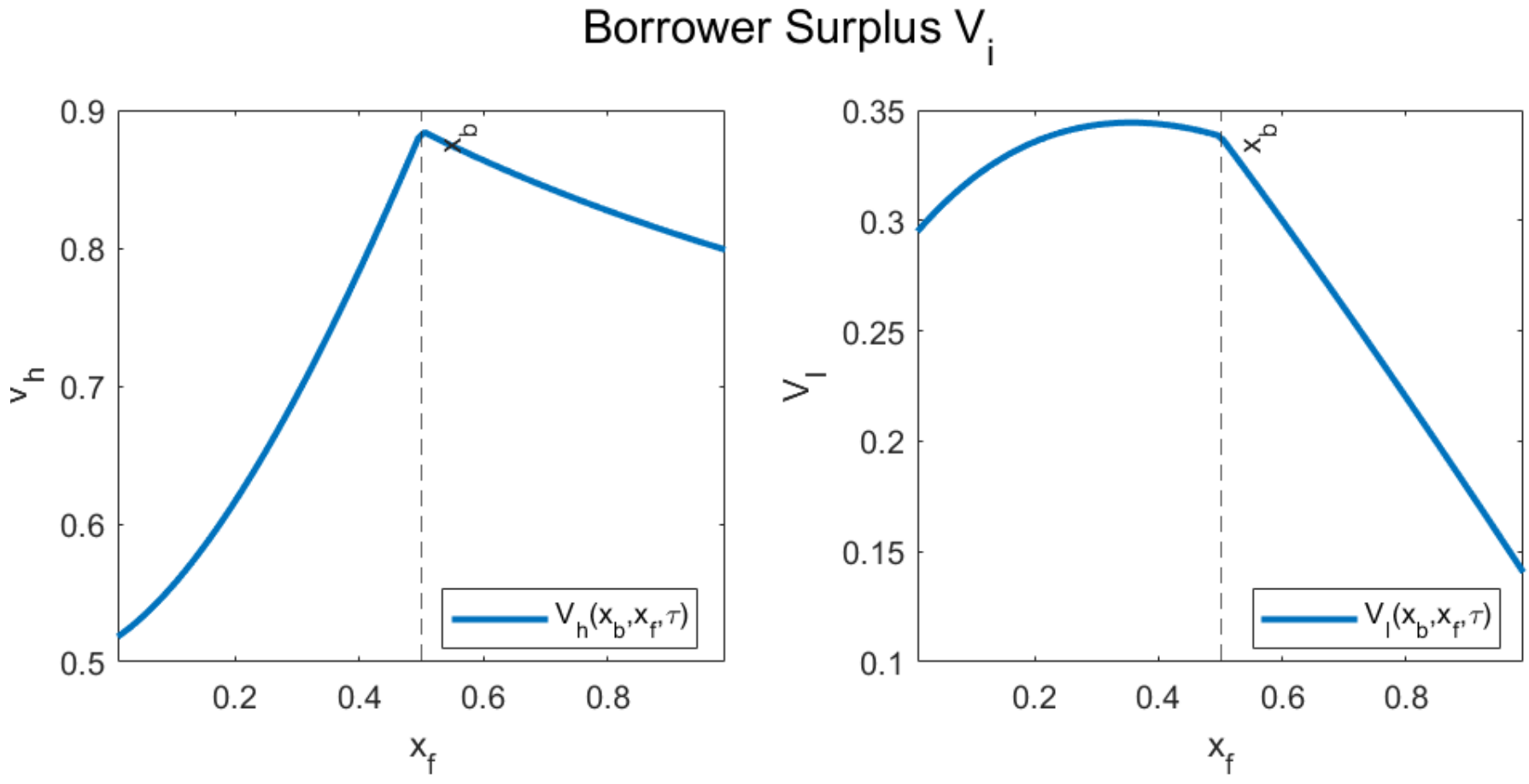
Lenders, when facing an aggravated winner's curse

- i.e. when $\Delta \uparrow$ and $\tau \downarrow$
- A higher (stronger) bank profit as well as the industry profit
- A higher interest rate and fintech more likely to pass

Borrowers, type-dependent V_i

- *Gap* $\Delta \equiv \max\{x_b, x_f\} - \min\{x_b, x_f\}$ & *Base* $x_w \equiv \min\{x_b, x_f\}$
- **Informational effect:** $x_w \uparrow \Rightarrow V_h \uparrow$ while $V_l \downarrow$
- **Strategic effect:** $\Delta \uparrow$, a worse winner's curse and less competition $\Rightarrow V_h \downarrow$ and $V_l \downarrow$
- Open banking may affect both gap and base (and others)

Equilibrium: Borrower Surplus



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Open Banking: Credit Quality Information

Data on credit quality

- Sharing borrower's bank transaction data $\Rightarrow$ boosts weaker fintech's screening to $x_f' > x_f$
- What is more, it might well be that

$$x_f' > x_b > x_f$$

  - Fintech is often equipped with advanced big-data technology, and some additional customer information (social media)
  - A too large x_f' hurts competition so might hurts all borrowers

Mandatory sign-up

- **Proposition:** There exists some sufficiently large $x_f' > x_b$ so that all borrowers are hurt

Equilibrium with Voluntary Sign-up (1)

Open banking has opt-in/opt-out feature

- Customers who own data shouldn't act against their own interest
- But....

Endogenous credit quality inference

- Adverse selection as the backbone of credit market competition
- What does "sign-up" itself say about my own credit quality and others who do not?
- $\sigma_i \in [0,1]$, $i \in \{h, l\}$: the fraction of i-type tech-savvy borrowers signing up for open banking
  - Updated posteriors for two market segments: τ_+ opt-in (sign-up), τ_- opt-out (not sign-up)

$$\begin{cases} \tau_+ \equiv \frac{\mathbb{P}[h|\text{sign up}]}{1-\mathbb{P}[h|\text{sign up}]} = \tau \cdot \frac{\sigma_h}{\sigma_l} \\ \tau_- \equiv \frac{\mathbb{P}[h|\text{not sign up}]}{1-\mathbb{P}[h|\text{not sign up}]} = \tau \cdot \frac{1-(1-\rho)\sigma_h}{1-(1-\rho)\sigma_l} \end{cases},$$

  - If all tech-savvy borrowers sign-up/opt-in, then $\tau_+ = \tau_- = \tau$

Equilibrium with Voluntary Sign-up (2)

Perverse effect of open banking

- There exists some non-zero measure set of parameters with two possible equilibria
  - Nobody signs up, then trivially open banking cannot help
  - $\sigma_h = 1$ and $\sigma_l \in (0, 1)$: we can show h-type has greater incentives to sign-up
- In the latter equilibrium
  - All borrowers become strictly worse off
  - The bank loses and the fintech gains, with a strictly greater industry total profit
  - Total welfare (sum of surplus and profits) improves

Welfare implications

- Open banking does foster competition as regulators have hoped but may hurt every customers

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Open Banking: Privacy Event and Targeted Loans

Consumer "preferences" for fintech loans

- Ex post, with prob. $\xi > 0$ i.i.d. can take fintech loans only
- Once bank data shared, ξ-event becomes observable to fintech (but not before)

Multi-dimensional data/information: interpretation of ξ-event

- Borrowers really like fintech loans
  - A consumer's preference for "immediacy" when shopping on e-commerce platform
  - Open banking: her bank records (revealing consumption habit) + browsing & location data $\Rightarrow$ identify demand immediacy.
- Borrowers have to take fintech loans
  - Say some emergency loan when traveling abroad
  - Open banking: fintech knowing borrower location now see if borrowers can get cheap bank loans in foreign currency

"Privacy" and Precision Marketing

- Deliver the right offer, at the right time, to the right customer

Equilibrium Before Open Banking

Equilibria before open banking

- Equilibrium structure depends on the size of ξ (captured borrowers, Varian, 1980)

When $\xi \leq \phi(\overline{r}; \tau)$

- Bank makes profit but fintech still zero profit
  - Fintech has some captured borrowers but not enough; may still pass given good signal
  - Bank competes more aggressively
- Cannot target on ξ-event $\Rightarrow$ *h*-type loses nothing

When $\xi > \phi(\overline{r}; \tau)$

- Both lenders charge higher rates and make positive profits
- Blunt aggressive policy toward these potentially "captured" borrowers $\Rightarrow$ *h*-type lose a lot

Open Banking and Sign-up Incentives

Equilibrium after signing-up open banking

- Fintech charges $\bar{r}$ in ξ-event; in non-ξ-event, just like baseline

Type-dependent sign-up incentives

- h-type care about interest rate, l-type care about loan probability

When ξ is small, all else equal

- h-types prefers not to sign up (opt-out)
  - After open banking, will be targeted in ξ-event!
- l-type prefers to sign up (opt-in)
  - After open banking, loans are for sure offered in ξ-event!

Equilibrium with Endogenous Sign-up

Endogenous credit quality inferences

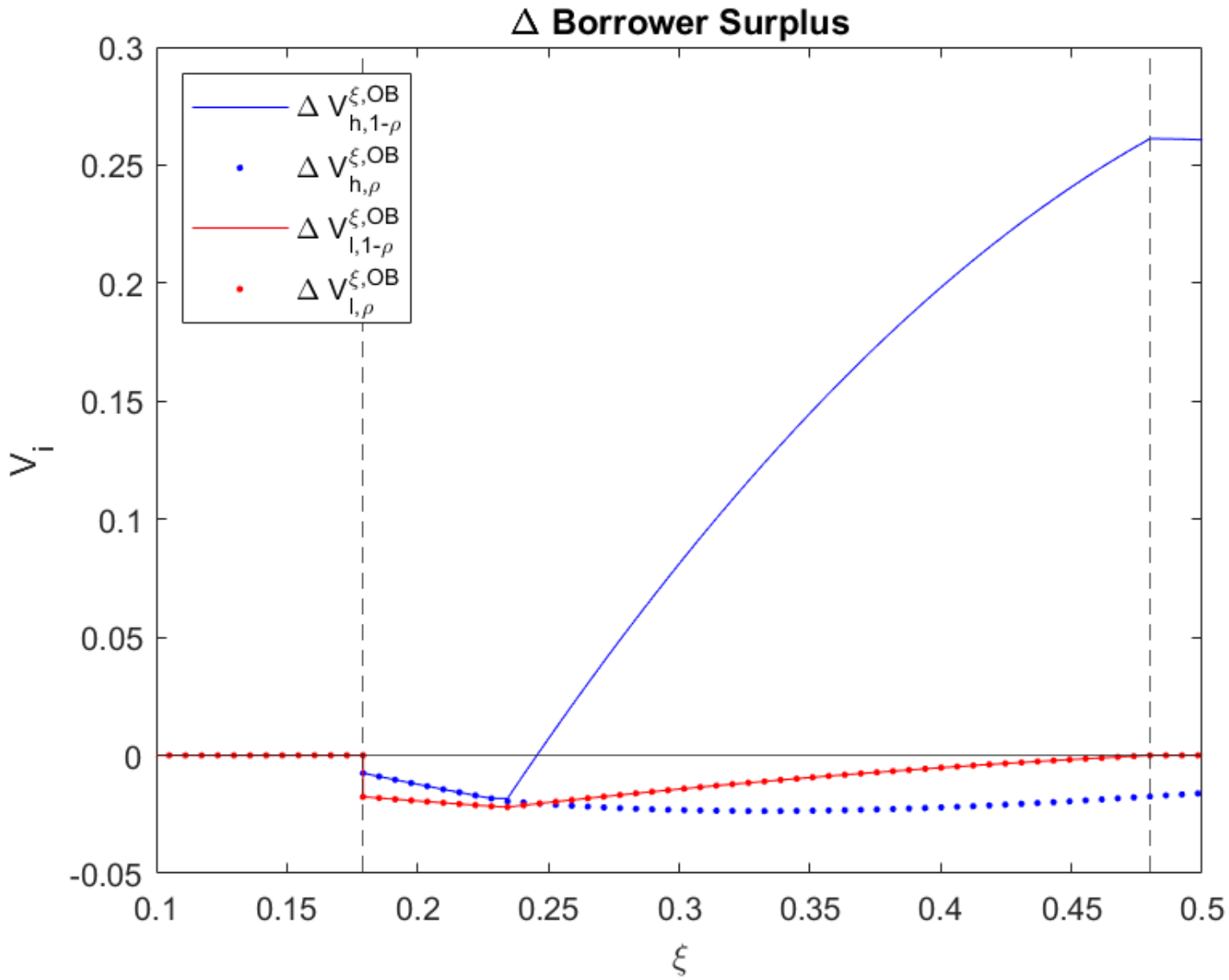
- Posteriors of two market segments τ_+, τ_-

Equilibrium characterization

- $\xi < \phi(\bar{r}; \tau)$: unique equilibrium: nobody signs up
  - Stigma effect: *l*-type has greater sign-up incentive than *h*-type
- $\xi > \phi(\bar{r}; \rho\tau)$: unique equilibrium: only tech-savvy *h*-type sign up
  - Surprising, as *h*-type being averse to targeted loans
  - Opt-out *l*-type get loans always, never sign up regardless of $\tau_+ \Rightarrow$ *h*-type always opt-in
- $\xi \in [\phi(\bar{r}; \tau), \phi(\bar{r}; \rho\tau)]$: some *h*-type and *l*-type sign up
  - Endogenous τ_- so that $\xi = \phi(\bar{r}; \tau_-)$. All borrowers might strictly worse off!

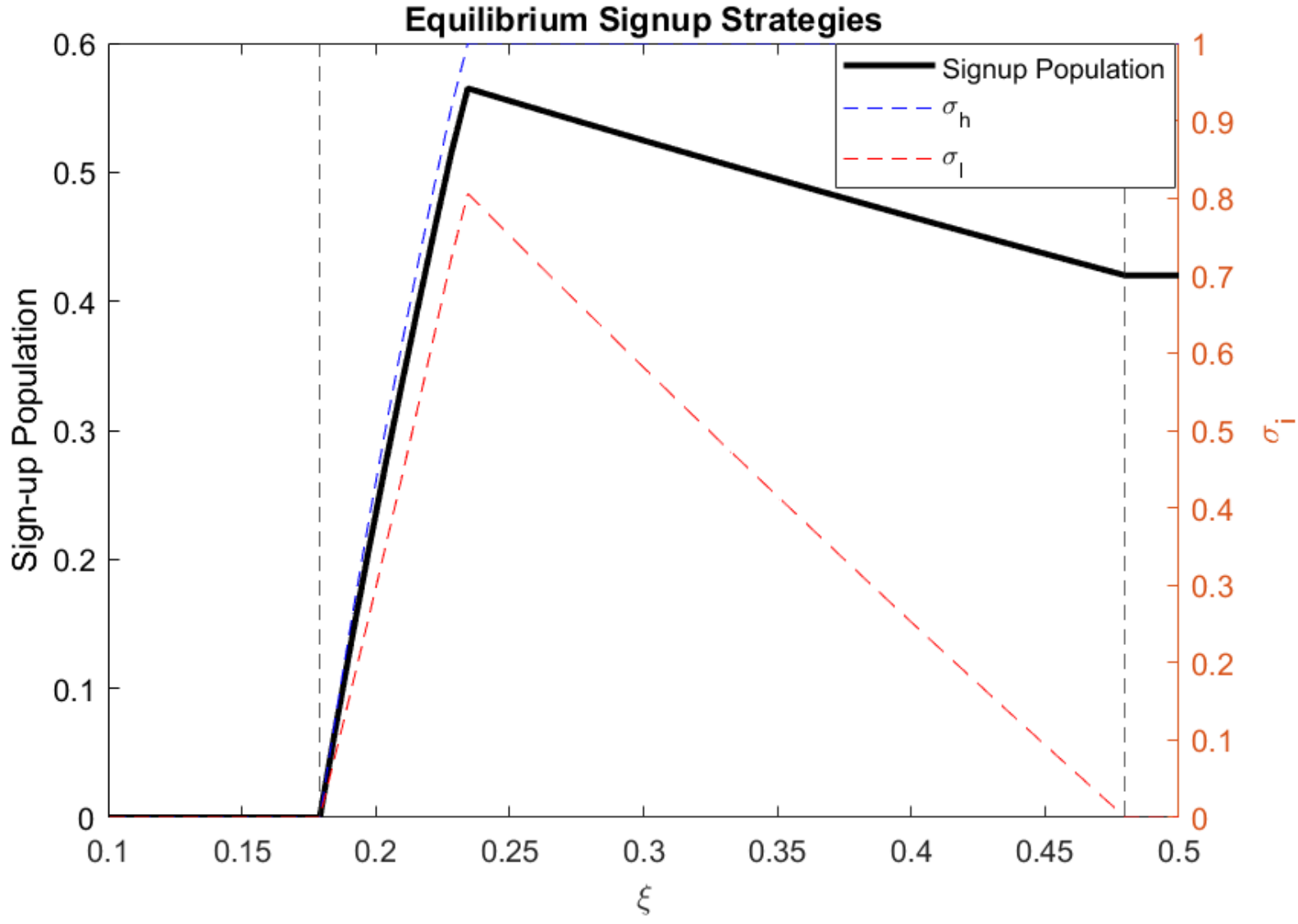
Borrowers' Welfare

All borrowers might be worse off; information externality (tech-savvy and non-tech-savvy)



Sign-up Population

Equilibrium sign-up population is nonmonotone in ξ



Conclusion and Future Work

- Voluntary data sharing of open banking is not a silver bullet for consumer protection
  - Borrowers can be all strictly worse off despite voluntary sign-up
  - Rich forms of information externality with frofound welfare implications
  - Fostered competition benefits Fintech typically

- Fintech in E-Commerce platform and traditional bank
  - "Open platform" to level the playing field?