The Digital Economy, Privacy, and CBDC

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Disclaimer: These are our views and not necessarily those of the ECB or the Eurosystem. The authors are not part of the digital euro project team and do not contribute to it.

Motivation

- A digital economy requires digital means of payments
  - ▶ as online sales grow, the use of cash is declining
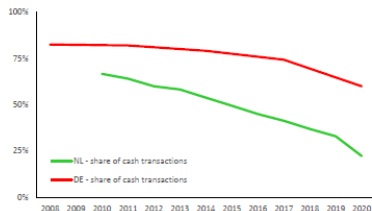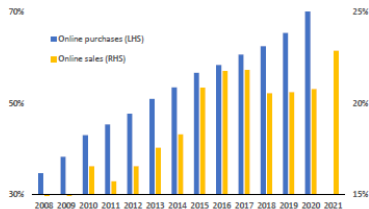
- New payment solutions are emerging
  - ▶ spearheaded by "BigTech" and "FinTech"

Motivation

- Digital payments generate lots of data (unlike cash)
  - ▶ business model of BigTech firms is to monetise (payments) data

- Privacy concerns have grown (e.g., Garratt and van Oordt, 2021)
  - ▶ "Orwellian": Cambridge Analytica - Facebook
  - ▶ "Economic": price discrimination, preference manipulation
  - ▶ Survey on digital euro: privacy is the #1 concern (43%)

- Privacy and payments:
  1. Economic trade-offs?
  2. Implications for CBDC debate?

Summary

- A model of financial intermediation and payment choice
  - ▶ two rounds of lending and production/sales

- Sellers distribute goods online or offline
  - ▶ online distribution is more efficient (better matching with buyers)
  - ▶ ...but requires a digital means of payment (e.g. bank deposits)
  - ▶ offline distribution can be settled in cash

- Payment method affects the information received by the lender
  - ▶ learning from payment flows in deposit accounts
  - ▶ with cash, bank must leave information rents to sellers
  - ▶ information used for rent extraction and future lending decisions

- Sellers may distribute goods offline settled with cash

Summary — CBDC

- **CBDC preserves anonymity**
  - ▶ bank does not observe payment flows when CBDC is used
  - ▶ best of both worlds: CBDC is anonymous but digital

- Bank always elicits information via separating contract
  - ▶ leaves rents to sellers
  - ▶ makes online distribution more attractive

- **Efficiency gains of CBDC**
  1. sellers choose a more efficient distribution channel
  2. continuation finance granted to more high types

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- Can the private sector provide a similar/better solution?

Summary — Digital Platforms

- A digital platform can make loans and issue payment tokens

- Tokens foster competition in loan market
    - platform learns from the token
    - bank uses separating contract to learn
    - competition between bank and platform implies better loan terms

- Tokens crowd out CBDC (CBDC adoption crisis)

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- Potential downside: "walled garden" (anti-competitive behaviour)
  - closed ecosystem to fend off future competition
  - entry by a more efficient platform
 - sellers do not switch to more efficient entrant platforms

Summary — CBDC with data sharing

- "Privacy is not the opposite of [data] sharing—rather it is control over sharing" (Acquisti et al. 2016)

- CBDC with data sharing is privately optimal
  - ▶ perfect competition in lending market
  - ▶ adoption: sellers prefer such a CBDC over tokens

- CBDC with data sharing is efficient (first best)
  - ▶ enables platform innovation and entry

- Policy implications for CBDC design
  - ▶ A restriction to anonymity can lead to low adoption
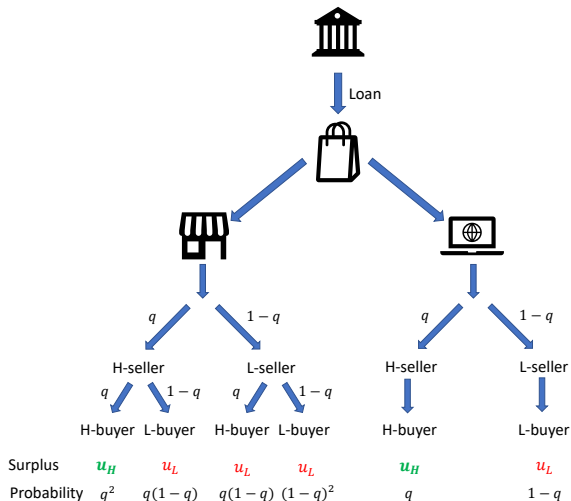 - ▶ Privacy features such as data sharing can raise welfare
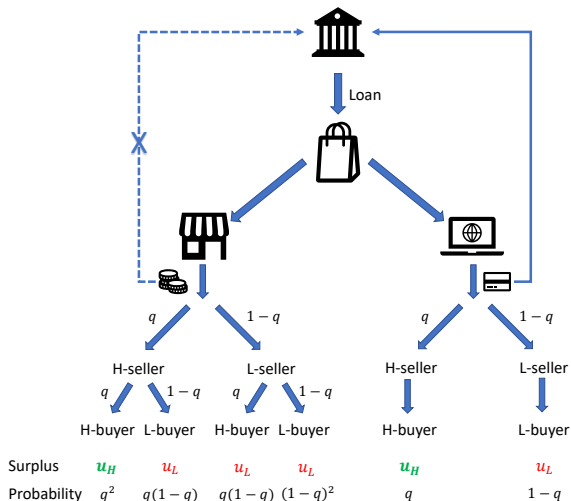
Model

Model

Model

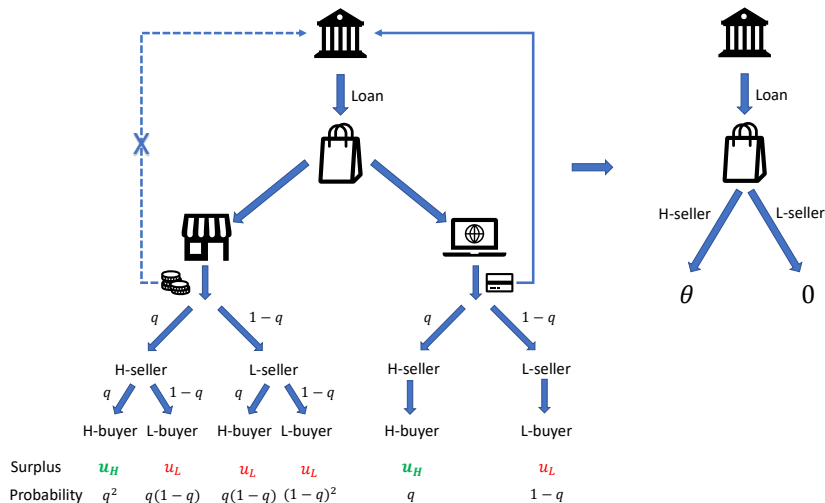| Surplus	u_H	u_L	u_L	u_L	u_H	u_L
Probability	q^2	$q(1-q)$	$q(1-q)$	$(1-q)^2$	q	$1-q$
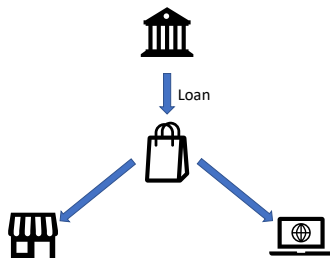
- Efficiency gain from online sales: $q > q^2$

Model

Model

Surplus: u_H u_L u_L u_L u_H u_L

Probability: q^2 $q(1-q)$ $q(1-q)$ $(1-q)^2$ q $1-q$
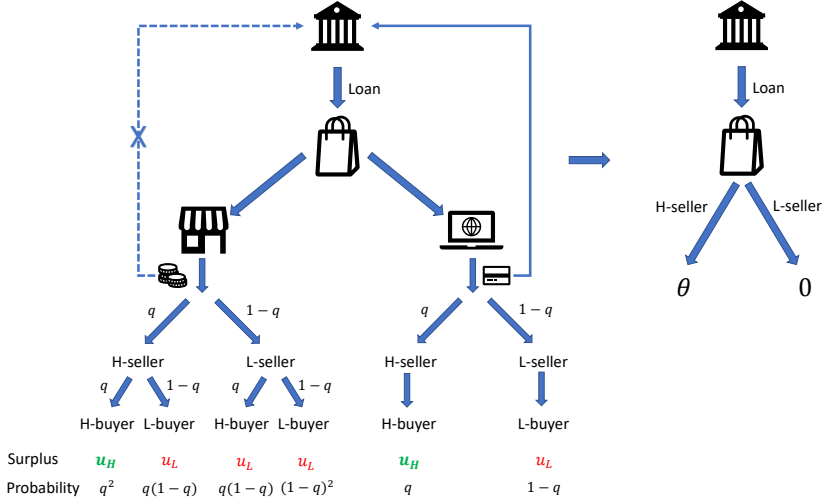
Seller can abscond with a fraction λ of loan or sales

Adverse selection: bank extends second loan only if informed

Model

Surplus	u_H	u_L	u_L	u_L	u_H	u_L
Probability	q^2	$q(1-q)$	$q(1-q)$	$(1-q)^2$	q	$1-q$

- First-best: Online distribution and re-finance H-sellers

Timeline
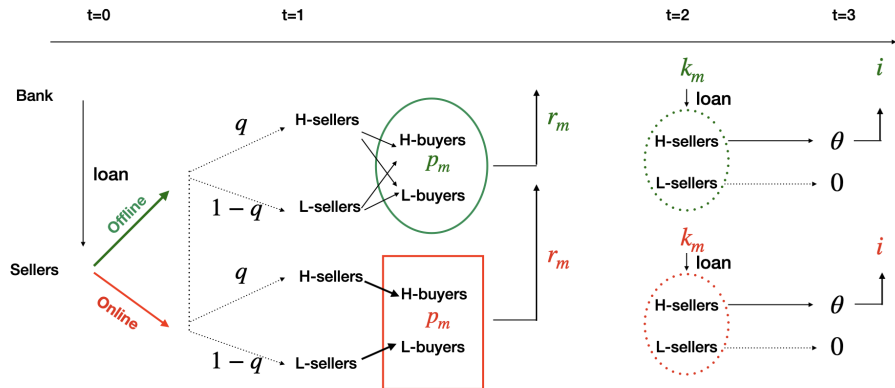
Equilibrium

Bank lending

- When sellers stay offline, banks must learn through screening:
  - ▶ full pooling (never optimal)
  - ▶ partial pooling: HH-sellers are separated, pool of HL- and L-sellers
  - ▶ full separation: both HH-sellers and HL-sellers are separated

- Banks trade off
  - ▶ higher surplus from refinancing
  - ▶ cost of separation: ceding some surplus to sellers

Lemma

Under the OFF-C scheme, banks offer a separating contract for

$$(1 - q)(\theta - 1) > \lambda(\theta - u_L)$$

and a partial pooling contract otherwise.

Seller's choice of venue and means of payment

- Sellers trade off efficiency of distribution vs. informational rents
  1. Offline distribution is inefficient, but the anonymity of cash generates informational rents
  2. Online distribution is efficient, but payment flows provide information to the bank

Proposition

1. When the bank offers a partial pooling contract under OFF-C, sellers distribute online iff $q(\lambda - q)(u_H - u_L) \geq (e - q\lambda\theta)$.

2. When the bank offers a separating contract under OFF-C, sellers distribute online iff $q(\lambda - q)(u_H - u_L) \geq (e - q\lambda\theta) + q\lambda(\theta - u_L)$.

CBDC

Add CBDC as means of payment

- We add a CBDC = "digital cash"
  - ▶ Anonymous but digital → can be used for online sales

> **Lemma**
>
> If sellers choose ON-CBDC, the bank **always** uses a separating contract.

  - ▶ Intuition: lower cost of separation as HL-sellers are absent

- CBDC enables sellers to capture the best of both worlds
  - ▶ distribute digitally, but capture informational rents

- Sellers always prefer CBDC over deposits

- In some instances, sellers prefer cash over CBDC (and stay offline)

Introducing CBDC improves efficiency

- Two efficiency gains of CBDC
  1. more online distribution: better matching ($u_H > u_L$)
  2. bank is informed more often (more separation): more continuation lending to H-sellers (with surplus $\theta - 1$)

Extensions (in the paper)

- Digital platform
  - ▶ issues tokens as means of payment
  - ▶ can make continuation loans

- Non-competitive behaviour of platforms ("walled garden")

- CBDC with data sharing

Conclusion

- Model of financial intermediation and payment in the digital economy

- Online distribution is efficient, but raises privacy concerns

- Sellers may prefer to stay offline and settle in cash
  - privately optimal but socially inefficient

- A CBDC enables digital distribution without privacy concerns
  - best of both worlds
  - higher efficiency

- Further results on digital platforms + tokens, anti-competitive behaviour, data-sharing (and their implications for CBDC design)