Unlocking Access to Credit via Lockout

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Motivation

Collateralized lending is the predominant source of credit for households in the US and much of the developed world

- More than 80% of US household debt is secured

Much less widespread in very poor countries. Why?

- Our conjecture: high repossession costs (relative to asset values)
  1. Contracts are difficult to enforce
  2. Property rights are difficult to establish

This paper: collateralized lending without repossession

- Instead loans are collateralized via lockout technology

Role of Collateral

Repossessing collateral serves (at least) two roles:

1. Recovery (κ): Provides something of value to the creditor in case the borrower defaults.
2. Incentives and Screening (λ): Takes something of value away from the borrower.

In models of collateralized lending:

- These two roles are inherently bundled.
- Repossession (or liquidation) is irreversible.

Lockout facilitate a richer space of contractual arrangements.

- Decoupling of the two roles
- Temporary/reversible activation of role 2

Examples of Lockout

1. PAYGO for Solar Home Systems (Fenix, M-Kopa)
   - Battery, solar panel, and small appliances
   - GSM chip installed in battery
   - Battery will not discharge electricity if borrower is delinquent
   - Fastest growing solar sector in Sub-Saharan Africa

2. Smart Phones (Payjoy)
   - Phone automatically locks if borrower is delinquent

3. Subprime Auto Loans (PassTime, Trax SI)
   - Interrupter installed on starter
   - Remotely activated when borrower is sufficiently delinquent
   - Received negative press (NPR story)
     (ignores that ex-post inefficiencies can be ex-ante optimal)
     - Not all borrowers were aware device was installed
     - Several states have banned/restricted these devices

What we do in this paper

Explore this new form of lending:

1. Simple model to illustrate
   - Lockout reduces strategic default
   - Lockout (+ downpayment) leads to *positive* selection
   - Stronger lockout ($\uparrow \lambda$) not necessarily welfare improving
     - Better selection and incentives, but more surplus destruction

2. A field experiment: loans collateralized via lockout on SHS
   - Quantify the effect of lockout on repayment and profitability
   - Decomposition: moral hazard vs selection
   - Effect of loan on household outcomes

Summary of Main Results

1. Lockout drastically increases repayment and profitability
   - Default rates decrease by 15pp
   - Loan profitability (IRR) increases by 50pp
2. Decomposition
   - $\approx 2/3$ due to moral hazard (ex-ante or ex-post)
   - $\approx 1/3$ due to selection
3. Household outcomes
   - Enrollment increases by 6pp
   - School expenditures increase by 40pp
   - No detrimental effects on household's balance sheet

Related Literature

Related Roles for Collateral

- Moral Hazard and Adverse Selection: Stiglitz and Weiss (1981), Bester (1985,1987), Besanko and Thakor (1987a,b)
- Pledgeability and Limited Enforcement: Bernanke and Gertler (1989), Kiyotaki and Moore (1997), Rampini and Vishwanathan (2010, 2013)

Collateral in Credit Markets

- Creditor rights matter: LaPorta et al. (1998), Qian and Strahan (2007), Vig (2013),...
- Strong evidence consistent with moral hazard: Berger and Udell (1990), ...
- More efficient repossession leads to more credit and lower borrowing costs: Benmelech and Bergeman (2009), Assuncao et al (2013)
- Cost of secured debt: Acharya et al (2007,2011), Donaldson et al 2019), ...

Microfinance, Education in Poor Countries, Rural Electrification ...

Model Ingredients

Two-periods, two types of agents

1. Firms
   - Technology to produce good at cost c
   - Offer a contract (d, p)
     - d: down payment to take possession at date 0
     - p: payment to avoid repossession at date 1
2. Households
   - Financially constrained, initial wealth $w < c$
   - Private value v for consuming the good at date 1
   - Privately observed (risky) income at date 1

Timing

Date 0:

- Firms post contracts
- Households choose which (if any) contract to accept
    - i.e., make downpayment to take possession

Date 1:

- Households privately realize $\tilde{v}_i$ and $\tilde{y}_i$ and decide whether to repay
- Firms repossess from households that default

Repossession Technology

Parameterize the repossession technology by a pair

- κ: fraction of firm's cost recovered
- λ: fraction of household's value destroyed

Exercise of interest

- Fix κ, explore the effect of higher λ

Model Results

- Stronger lockout ($\uparrow \lambda$) increases the profitability of lending through two channels
  - Less strategic default
  - Positive selection
- Thereby, making it easier for the firm to offer financing and still recoup costs
  - Market for SHS did not exist before lockout
- Contrast with the role of recovery
  - $\uparrow \kappa \implies$ more default and repossession
  - $\uparrow \lambda \implies$ less default and repossession
- However, $\uparrow \lambda$ also destroys more surplus in default
  - This makes the good less attractive to households
  - Particularly those with more income risk
  - An intermediate λ can be welfare maximizing
  - Consistent with modest penalty (locking) for missing payment

Field Experiment

- Partnership with Fenix International
  - Largest SHS supplier in Uganda
    - Expanding to Zambia, Mozambique, Cote D'Ivoire and Nigeria
  - Range of SHS products, 10-34W
  - Third largest user of mobile money in Uganda

Background Information

1. Access to electricity is low in Sub-Saharan Africa
   - 600 million people without access to the grid (42% of households).
2. Households have insufficient access to credit
   - Microfinance loans are expensive, unsecured, have low take-up, and modest welfare effects on the average borrower (Banerjee et. al., 2015).
3. Access to mobile phones is high in Sub-Saharan Africa ($\geq 80\%$)
   - Basic phones are cheap and (effectively) financed via lockout

New *ReadyPay* Rates.

Enjoy **DISCOUNTS** when you complete your loan early!

10W *ReadyPay* Home Eco 2	
Deposit:	19,000/-
Daily Rate:	600/-
Monthly Rate:	18,000/-
Duration:	35 months
Buy in Cash:	519,000/-
Buy on Loan:	649,000/-

Complete in 12 months for a 100,000/- DISCOUNT

10W *ReadyPay* Home Plus	
Deposit:	39,000/-
Daily Rate:	1,000/-
Monthly Rate:	30,000/-
Duration:	25 months
Buy in Cash:	631,000/-
Buy on Loan:	789,000/-

Complete in 12 months for a 100,000/- DISCOUNT

17W *ReadyPay* Home Comfort	
Deposit:	49,000/-
Daily Rate:	1,350/-
Monthly Rate:	40,500/-
Duration:	24 months
Buy in Cash:	799,000/-
Buy on Loan:	999,000/-

Complete in 12 months for a 110,000/- DISCOUNT

Home Eco customers who pay well can upgrade to a Home Comfort in 3 months

34W *ReadyPay* Home Deluxe	
Deposit:	99,000/-
Daily Rate:	1,800/-
Monthly Rate:	54,000/-
Duration:	24 months
Buy in Cash:	1,116,000/-
Buy on Loan:	1,395,000/-

Complete in 12 months for a 160,000/- DISCOUNT

34W *ReadyPay* TV Deluxe (Zuku)	
Deposit:	149,000/-
Daily Rate:	3,000/-
Monthly Rate:	90,000/-
Duration:	26 months
Buy in Cash:	1,999,000/-
	(Includes 1 Year Zuku subscription)
Buy on Loan:	2,539,000/-
	(Includes 2 Years Zuku subscription)

Complete in 12 months for a 270,000/- DISCOUNT

Pay well to be eligible for UPGRADES in 3 months!

Warranty:

- All systems come with a **3-year** limited warranty on the battery and panel.
- Accessories come with a **2-year** limited warranty.
- Any faults caused during manufacturing will be replaced for FREE at a *ReadyPay* service centre.

How Fenix Power works:

Method 1

Take your Fenix Power System home and enjoy 7 days of FREE power!

After your 7 free days, the system will lock.

Dial *165*62# to make a payment with MTN Mobile Money.

You will receive an SMS confirming your payment

Press network button for atleast 5 seconds after receiving SMS

Your system will unlock. Bigger payments give you MORE power!

Clear your balance and it will belong to you!

Research Questions

- How valuable is the lockout technology to the firm?
  - Quantify the effect on repayment and profitability
- Why is lockout valuable?
  - Moral hazard
  - Adverse selection
  - Commitment mechanism
- What are the impacts of the loans on households?

Loan Product – School Fee Loans

In 2017, Fenix began offering “school fee" loans to existing SHS customers that were in good standing on their account

- Ranging from 100k-500k ($25-$125) loan size, 3x per year
- 100 day maturity, 15-20% deposit,
- PAYGO structure, e.g., on 300k loan
  - Make 50k deposit
  - Receive 300k a few days later
  - 7 day grace period
  - 3k per day for 100 days after grace period
  - If miss a payment -> device locks
- NB: not really a debt contract (more like preferred equity financing)
- Implied interest rate depends on repayment
  - 168% with 100% on time repayment
  - 126% with 75% repayment (3 out of every 4 days)

Experimental Design

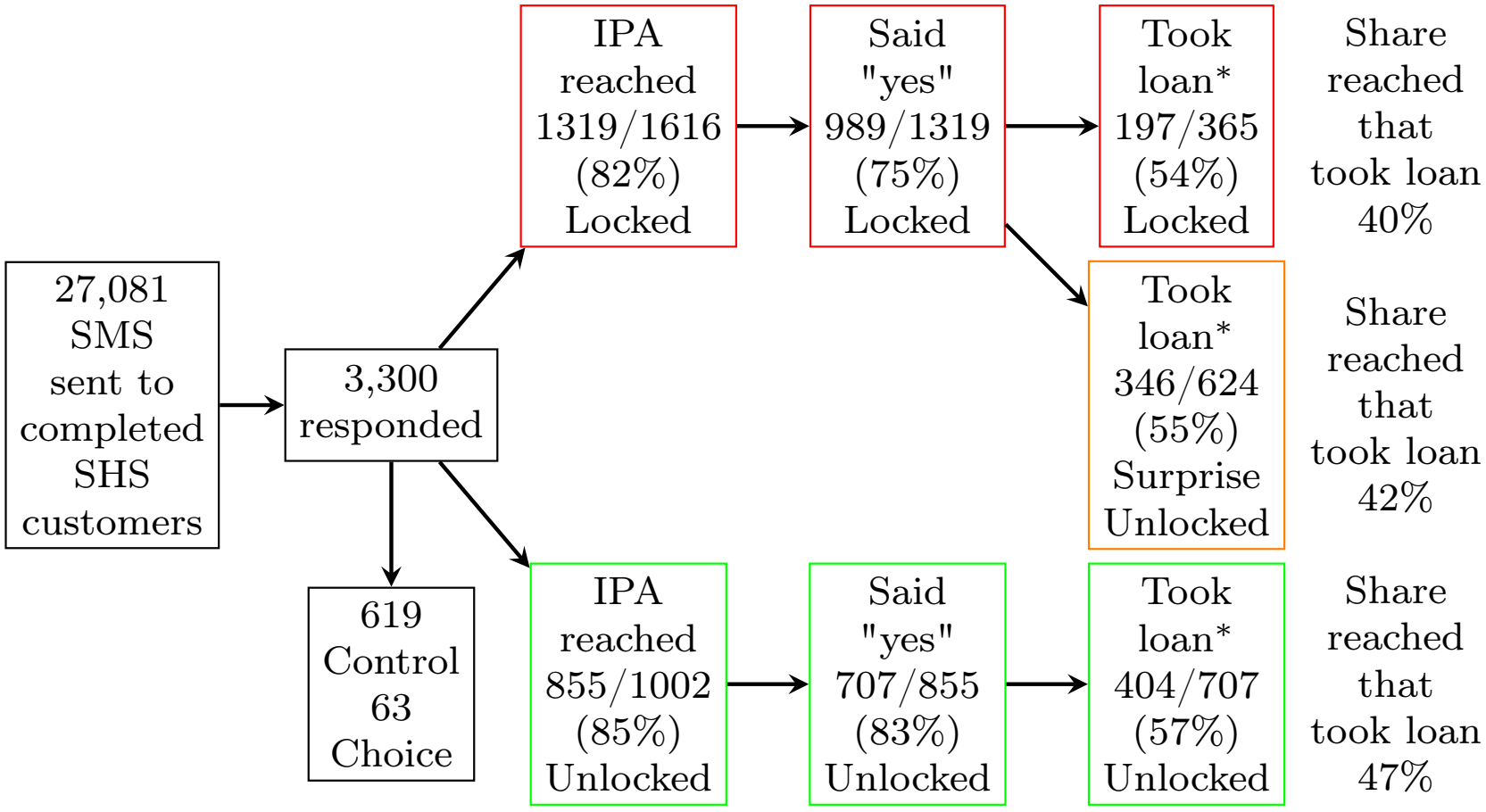
Sample

- Fenix customers who had completed payment on SHS and responded to SMS expressing interest in a loan

Design

- All loans were 300k ($80) with a 50k ($13) deposit
- Sample randomly divided into 4 groups
  1. Locked: Offered loan with lockout
  2. Unlocked: Offered loan with no lockout
  3. Surprise Unlocked: Offered loan with lockout, if they accepted, we "surprised" them (ala Karlan and Zinman, 2009)
  4. Control: No offer
- Difference in repayment between locked and unlocked captures both MH and AS
  - Locked - Surprise Unlocked: only MH
  - Surprise Unlocked - Unlocked: only AS

Sample Sizes and Take-up



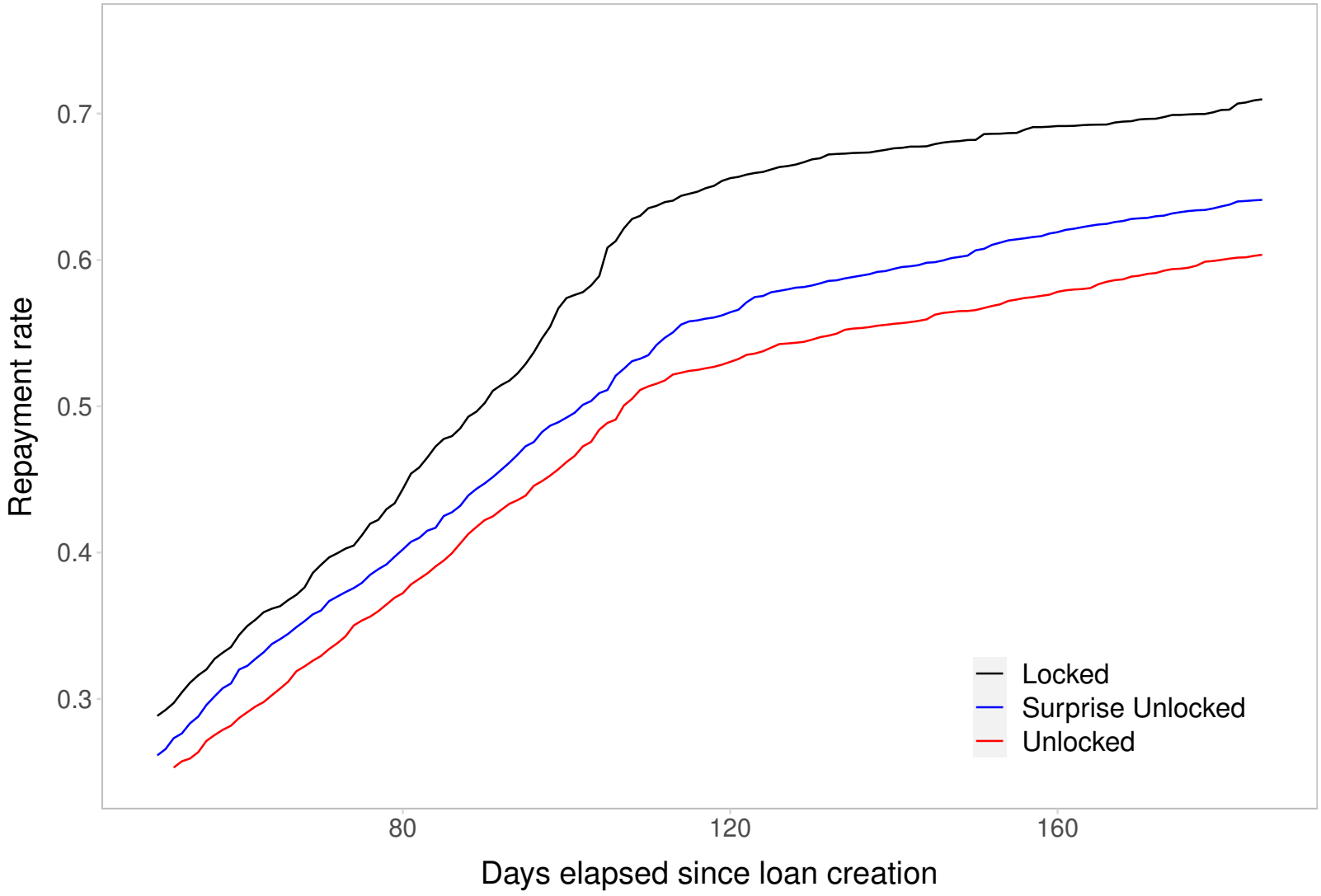
* Signed paperwork and paid deposit

Outcomes

- Firm-level outcomes
  1. Percent of (scheduled) principal repaid
     - Percent of time locked $\approx$ 1-Repayment Rate (at maturity)
  2. Loan completion
  3. Profitability (IRR)

- Household outcomes
  1. School enrollment
  2. Expenditures on education (fees, uniforms, books)
  3. Balance sheet effects

The Effect of Lockout on Repayment



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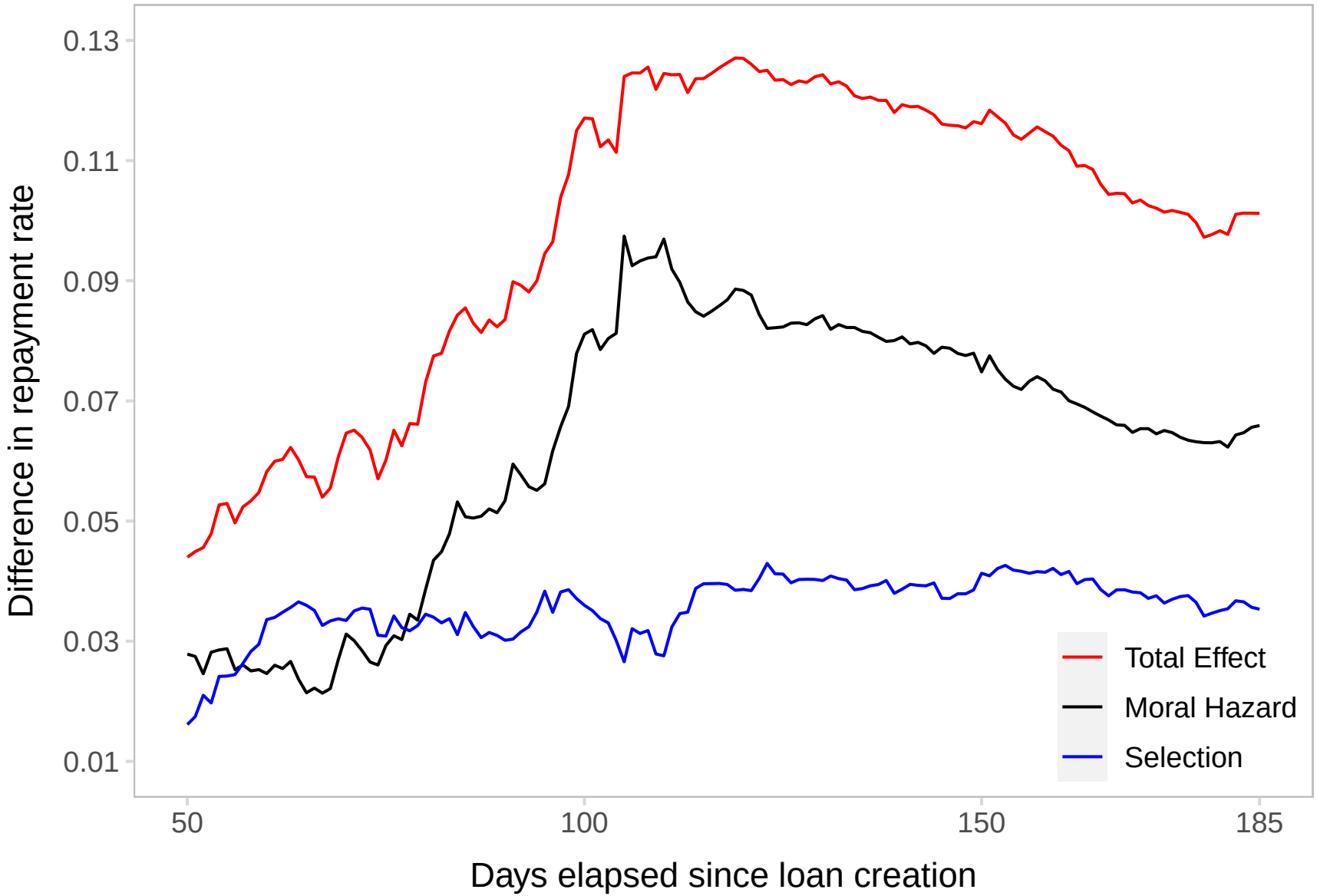

The Effect of Lockout on Repayment

LATE Estimates

Loan day	Mean Unlocked	Lockout	Adverse Selection	Moral Hazard
100	0.46	0.14***	0.04	0.09**
		(0.04)	(0.03)	(0.04)
150	0.57	0.13***	0.05	0.09**
		(0.04)	(0.03)	(0.04)
185	0.61	0.12***	0.04	0.08*
		(0.04)	(0.03)	(0.04)
n		655	814	593

The Effect of Lockout on Loan Completion

LATE Estimates

Loan day	Mean Unlocked	Lockout	Adverse Selection	Moral Hazard
110	0.31	0.10**	0.01	0.09*
		(0.05)	(0.04)	(0.05)
150	0.41	0.17***	0.05	0.12**
		(0.05)	(0.04)	(0.05)
185	0.45	0.15***	0.04	0.11**
		(0.05)	(0.04)	(0.05)
n		655	814	593

Profitability of School Fee Loans

Monthly IRRs of Loan Portfolios

Treatment Group	Account percent locked			All	n
	1st tercile	2nd tercile	3rd tercile		
Locked	1.7%	-4.5%	-9.8%	-4.3%	199
	(.04)	(.13)	(.35)	(.17)	
Surprise Unlocked	-0.3	-7.8	-13.2	-7.1	353
	(.04)	(.15)	(.41)	(.20)	
Unlocked	-3.9	-9.4	-13.9	-9.0	410
	(.04)	(.15)	(.39)	(.20)	
Prior SFL Experiment	9.2	7.8	2.4	6.2	1509
	(.02)	(.08)	(.20)	(.10)	

- Average fraction of days locked in parentheses

Educational Outcomes

Household-level LATE Estimates

	Enrollment	Days absent	Log school expenditures
Loan	0.0556*	0.0319	0.363**
	(0.0299)	(0.345)	(0.170)
Outcome control mean	0.88	1.28	317,997
n	1683	1625	1625

- Share of school-aged kids not enrolled almost cut in half.

Household Balance Sheet Effects

	Asset purchases (IHST)	Asset sales (IHST)	Money borrowed (IHST)	Net difference (IHST)
Loan	1.067	-0.446	0.199	-0.401
	(1.518)	(0.494)	(1.046)	(1.120)

- No significant impact on household finances.

Conclusion

Lockout facilitates a richer space of financial contracting

- Decouple the two roles of repossession, using digital technology
- Significantly increases repayment and profitability
  - Moral hazard accounts for $\approx 2/3$,
  - Selection accounts for $\approx 1/3$
- Increases enrollment and investment without detrimental effects to households' financial position
- Promise for access to affordable (secured) credit
  - Especially in poor/underdeveloped regions
- But not without cost: SHS locked 20-30% of its useful life

Questions for Future Work

- Can outcomes be further improved with better designed contracts?
  - When should the device lock?
  - Possible to get less locking without sacrificing incentives for repayment?

- Can the same technology be used to provide credit to firms?
  - If collateral generates output, locking may backfire