

Observing Unobservables: Identifying Information Asymmetries with a Consumer Credit Field Experiment

Dean S. Karlan

Yale University

MIT Poverty Action Lab

Jonathan Zinman

Dartmouth College

September 30th, 2005

Substantive Motivation

Primary question:

- Do adverse selection and moral hazard matter, in practice (in a credit market)

Substantive Motivation

- Extensive theoretical literature on information asymmetries
- Relatively little empirical evidence on existence, impacts of specific private information problems
 - In credit markets especially (Chiappori and Salanie)
 - Nobel Committee citation in 2001:
 - Zero empirical cites on credit market
 - Zero empirical cites on financial markets more generally
 - But 6 in labor, 4 in insurance
- Little evidence on any specific credit market failure, information asymmetry or otherwise
 - Despite NGO and government interventions

Methodological Motivation

Key question: How disentangle adverse selection from moral hazard, empirically?

- Do higher interest rate loans attract unobservably riskier clients (adverse selection)?
- Do higher interest rate loans induce unpredictably riskier borrower choices ex-post (moral hazard)?
- Methodological challenges (Ausubel 1999; Chiappori and Salanie 2000):
 - Can not answer both questions at once, with one interest rate;
Single contract may produce *both* adverse selection and moral hazard
 - Econometrician often lacks full information on how principal assesses *observable* risk

Methodological Motivation

- Field experiments can be used to test theories, identify structural parameters
 - “Not just for program evaluation any more!”

Our Approach

1. Design a “market field experiment” that:
 - Is motivated by specific models of private information.
 - Is designed to test these models by identifying underlying structural parameters of interest....
 - Identifies these parameters by randomizing interest rates along 3 dimensions.
2. Convince a Lender to implement experiment.
3. Guide Lender in implementing the experimental protocols.

Experimental Design Overview: 3 Dimensions of Price Variation

1. “offer rate”
 - Lender sends direct mail with randomly assigned interest rate to pool of prospective borrowers
2. “contract rate”
 - 40% of applicants randomly assigned a contract rate that is *lower* than their offer rate
3. “dynamic repayment incentive”
 - 50% of applicants randomly assigned favorable pricing on future loans
 - conditional on good repayment performance

Identifying Info Asymmetries: Basic Intuition Using 2 of 3 Dimensions

	High Contract Rate	Low Contract Rate
High Offer Rate	Moral Hazard / Repayment Burden 	
Low Offer Rate	N/A	

Design Intuition, Continued

- Impact of offer rate on repayment or profitability identifies any adverse selection
 - Nature of competition is important re: interpretation of results
 - No lemons problem here, but could be in U.S. credit cards
- Impact of contract rate identifies “repayment burden” effect, which combines:
 - Moral hazard === choices that lead to loan delinquency
 - Shocks === inability to repay.
- Dynamic repayment incentive helps identify pure moral hazard
 - Conditional on repayment burden, $D = 1$ provides borrower with additional *incentive* to repay

Empirical Strategy

$Y = f(\text{offer rate}, \text{contract rate}, \text{future rate}, \text{observed risk})$

- Y = default or profits
- All rates randomly assigned
- All randomizations conditioned on observable risk as assessed by the Lender
 - Critical because asymmetric information is all about agents exploiting *unobserved* risk
- Estimate this function using several methods:
 - Simple means comparison
 - OLS
 - Matching estimator
 - Instrumental Variables
 - Nonparametric plots

Experimental Design: Weakness

- External validity, generally
 - Problem with empirical work generally!
- External validity, specific to this implementation:
 - Sample is prior, successful borrowers
 - But “new” applicants are plausibly marginal ones of interest
 - Tried mailing list, no success
- Heterogeneous selection effects may pose an interpretation problem
- Large sample required to identify non-linear effects

So What's in it for the Lender?

- Experiment also identifies reduced-form effect on profits:
 - Karlan-Zinman 2005 on demand curves
 - BKMSZ 2005 on marketing and framing
- But Lender could get this by randomizing on one dimension of interest rates; we introduce additional operational complexity (three dimensions) to test contract theory
- Why did Lender agree to additional complexity?
 - Help evaluate investments in screening, enforcement
 - *Quid pro quo* as unpaid academics (v. consultants)
- Determinants of the adoption decision for experimental techniques interesting
 - IO/strategy problem

Review and Preview

Covered thus far:

1. Motivation
2. Design and Empirical Strategy

Now:

3. Market Setting
4. Implementation
5. Results

Market Setting: The Lender

- Very profitable consumer lender
- Established (20+ years)
- 100+ branches throughout South Africa
- All loan applications, underwriting done face-to-face

Market Setting: Loan Product

- Rates: 11.75% per month for first-time borrowers
- **98% of our offers below standard rates**
- Small (modal is \$150)
- Fixed repayment schedules
- No collateral
- Term loans
 - 1, 4, 6, 12 & 18 month loans available
 - 80%+ are four-month repayment schedules
- Monthly equal principal payments
- Interest charged over original balance
- No additional fees
- Example
 - R1000 loan for 4 months, 10.00% rate
 - R350 monthly payment

Market Setting: Borrowers

- Working poor and middle class
 - Must have verifiable employment
- Lots of rejected applicants (50% of first-timers)

Borrowers: Loan Usage

- Variety of uses (Table 1b):
 - School Fees
 - Retire Other Debt
 - Investment in household enterprise
 - Housing
 - Family and Events (holidays, funerals)
 - Vehicles
 - Consumption (necessities, durables)

Borrowers: Default and its Consequences

- Default rate is about 15%
- Consequences:
 - Bad mark on credit report (external score)
 - Penalized on internal (relationship) score
 - Legal action rare (never pursues under R1000)
 - Wage garnishing possible some cases

So What Might Moral Hazard Look Like This Market?

Mapping to theoretical models of moral hazard in:

- **Project choice:** Costly financing reduces returns in good state → opt into risky projects
 - Clearly is a range of “projects”
 - But little re-optimization of loan amount following revelation of contract rate
- **Effort (“debt overhang”):** Debt burden reduces incentives to safeguard ability to repay. Here:
 - Maintaining wage employment
 - Scraping together cash from other sources
- **Repayment decision (“voluntary default”):** Debt burden increases benefits of default relative to nonlinear penalty

Market Setting: Competition and Regulation

- Quasi-competitive “cash loan” market:
 - Many competitors for 1 month loans (high risk lenders) and 12+ month loans (banks).
 - Little if any competition in Lender’s niche (4 months)
- Negotiation on loan terms:
 - none on interest rates (important for identifying a/s)
 - little if any on maturity
 - loan size is negotiated.
- Regulated market:
 - Usury deregulation allowed institutions to supplant loan sharks as dominant players in this market
 - Debt burdens and lending practices regulated

Review and Preview

Covered thus far:

1. Motivation
2. Design and Empirical Strategy
3. Market Setting

Now:

4. Implementation (1 slide)
5. Results (2 slides)
6. Related work (1 slide)

Experiment Operations Steps

OFFER LETTERS MAILED:

57,533 letters sent with randomly different interest rates (“offer interest rate”) to former clients.

INDIVIDUALS “SELECT” BY APPLYING IN BRANCH

5,028 individuals go to branch and apply for the loan

LOAN SUPPLY ORTHOGONAL TO INTEREST RATE

4,348 clients are approved.

Branch makes loan supply decisions based on “normal” interest rates.

CONTRACT INTEREST RATE ANNOUNCED

Client offered loan at r^c (contract rate). Client may revise size and term.

DYNAMIC REPAYMENT INCENTIVE ANNOUNCED

40% of clients told that contract rate is good for all loans for one year.

REPAYMENT OBSERVED

Client repays loan (or not). Average repayment ~85%.

Results: Gender Differences

- (We find that women select, and men behave, badly)
- Why think to look for differential behavior?
 - Behavioral finance literature (e.g., Barber and Odean)
 - Microfinance targets women in practice
 - Differential impacts of credit (Pitt and Khandker)
 - And of liquidity more generally (household bargaining)

Summary of Key Findings

- Adverse selection on interest rates?
 - Weak evidence in full sample
 - Large, significant for women
 - Non-existent for men
- Moral hazard on dynamic incentives
 - Robust in full sample
 - May be driven by men
- Information effects abate with “relationship”
- Economic significance? yes
 - Perhaps 20% of default due to info asymmetries.

Related Work

Testing contract theory in another market

- Applying similar design to test for adverse selection in private health insurance, in the Philippines

How consumers use private info is just part of their choice problem:

- Consumer choice & interest rates in this market
 - Demand curves for consumer credit (Karlan-Zinman 2005b)
 - Price: flat, except steep above normal rates
 - Maturity: very steep
 - Responses to non-economic frames and cues may be stronger than price elasticity (Bertrand-Karlan-Mullainathan-Shafir-Zinman 2005)
 - But difficult to predict which marketing treatments would work
- (How) do U.S. consumers understand rates? (with Victor Stango)
 - New evidence they systematically *underestimate* true cost of borrowing

EXTRA SLIDES

Experimental Design & Operation Details

- 57,533 letters mailed to former clients of a lender
 - Observably good clients in sense that they had repaid
 - So deck stacked against finding effects, to extent that private info is revealed via relationship, over time
- Each letter contains a randomly different interest rate: “offer” rate
- Rate randomizations conditional on Lender’s summary statistic for observable risk
 - 3 categories
 - Rate upper bounds constrained by Lender’s normal rates
- Range: 3.25% per month to 11.75% per month
 - Lender’s standard rates: 7.75% to 11.75%
- Clients apply in branch (86 branches throughout South Africa)
- Computer system identifies them as a “project” client
- Credit approval & maximum loan amount determined based on “normal” (i.e., non-project) interest rate

Experimental Design & Operation Details, *continued*

- Loan is approved & client chooses loan amount
- Computer system then produces randomly different interest rate: “contract” rate
 - 60% of clients receive same contract and offer rates
 - 40% of clients receive a contract rate < offer rate
- Clients then have opportunity to change their loan size amount
 - Only 10% did
 - Changes work *against* finding repayment burden effect
- Contract rate valid for *future* loans for random subset of clients (others get the rate for *current* loan only): “D”, the dynamic incentive.
- Related work:
 - Karlan & Zinman (2005): Uses randomized rates to estimate interest & term elasticity & identify liquidity constraints; similar to Gross and Souleles (QJE 2002); Attanasio, Goldberg & Kyriadzidou (2004).

Experimental Integrity Issues

1. Branch must not repeatedly randomize until good outcome announced:
 - Not physically possible. Rates hard-coded into the MIS system.
2. “Buzz” problem: what if people tell their friends about the “special” in-branch rates?
 - Virtually no reports of complaints like “my sister got X”.
 - Why? Borrowing a deeply private decision.
 - Works against finding adverse selection
 - Test: Contract rate does **not** predict take-up, but offer rate does. Table 2, column 4

OLS

	<i>Tookup=</i>
	<i>Dependent Variable</i>
Offer Rate	=1 (4)
	-0.003*** (0.001)
Contract Rate	0.001 (0.001)
Constant	0.068*** (0.004)
Observations	57533
R-squared	0.04

Experimental Integrity Issues

3. Rates orthogonal to observables? Yes, with one exception (Table 2, column 3):
 - Dynamic incentive: was predicted by 3 variables
 - Probably due to branch-level randomization in wave 2.
 - Including controls for the 3 variables in repayment behavior regressions does not change any result.
4. Lender (branch manager) does not let contract rate influence approval decision:
 - Test: Does contract rate predict rejection? No. (Table 2, column 5.)

Plan for Talk

- Lender background
- Experimental design
- **Theoretical overview**
- Empirics: Mapping design into tests of the theories.
 - Estimators and models
 - Key results & graphs
 - Heterogeneous effects
- Summary and next steps

Theoretical Overview: Start with a Definition....

- “Repayment Burden” === moral hazard component + bad shock component
 - “Moral hazard”: larger repayment amount produces default due to borrower’s *choice(s)*
 - “Shock” component is mechanical: in a world with uncertainty and liquidity constraints, the larger the repayment, the lower the probability a borrower can smooth a given shock

Theoretical Overview

Useful to categorize the asymmetric info problems that motivate our experiment:

- *Ex-ante* causes of default
 - “Selection” effects (adverse or advantageous)
- *Ex-post* causes of default
 - Moral hazard: behavioral change (“choice”)
 - Income effect: available cash, no “choice” on repayment

Theoretical Overview

- Selection Models
 - Adverse (Stiglitz and Weiss):
 - Lender's risk and borrower's return positively correlated
 - Low risk clients drop out of pool as rates increase
 - Advantageous (DeMeza and Webb)
 - Risk and return are negatively correlated
 - High-risk clients drop out of pool as rates increase
 - Examples:
 - Key unobserved variable is wealth, conditional on income wealthier are lower risk
 - Everyone gets same “return” to borrowing (plausible in a consumer credit context), and key unobserved variable is probability that maintains employment
 - Can persist in equilibrium if moral hazard puts brake on upward price pressure
 - Warning: We can not distinguish heterogeneous adverse selection effects from a pooling of adverse & advantageous selection effects.

Theoretical Overview

- Ex-post Models
 - Moral hazard
 - Project choice: Costly financing reduces returns in good state → opt into risky projects
 - Effort (“debt overhang”): Debt burden reduces incentives to maximize project returns
 - Repayment decision (“voluntary default”): Debt burden increases benefits of default relative to nonlinear penalty
 - Shocks (“income effect”)
 - Higher debt burden → Negative shocks more likely to bind and cause default. No behavioral change.

Existing Literature (Consumer Credit)

2 most kindred papers:

- Ausubel (1999 working paper)
 - Data from simple randomized credit card trial (designed by issuer)
 - Assumes no moral hazard
 - Finds evidence of adverse selection
- Edelberg (2005 working paper)
 - Structural approach to disentangle
 - Collateralized U.S. consumer credit markets
 - Finds evidence for both a/s and m/h

Plan for Talk

- Lender background
- Experimental design
- Theoretical overview
- **Empirics: Mapping design into tests of the theories.**
 - Estimators and models
 - Key results & graphs
 - Heterogeneous effects
- Summary and next steps

Models and Results: Overview

- Summary statistics
- 5 approaches:
 - Comparison of means: HiHi vs. HiLo (2x2)
 - OLS
 - Matching
 - IV
 - Graphs
- Selection on observables
- Heterogeneous effects
 - Lending relationships seem mitigate asymmetric info
 - Women select, and men behave, badly

Summary Statistics

- Applied rate = 8.7%
- Take-up rate = 7.6%
- As of July, 2004 (7-12 months since loan originations)
 - 77% current
 - 15% 2 + months in arrears
 - 2.2% chargeoffs so far
 - 12% in collection status or chargeoff status

Measures of Default

- Average Monthly Proportion Past Due
- Proportion of Months in Arrears (the Lender's measure)
- Account in Collection Status

Results Using “Model” #1: Simple Means Comparison

- Classify contract and offer rates into “high” or “low” categories, based on median of 3 observable risk categories
 - *a la* Figure 1
- Results (Table 3) foreshadow regressions:
 - Adverse selection: among females
 - Repayment burden effect: among males
 - A bit of evidence for both effects in full sample

Table 3: Comparison of Means: Selection Effects

	High Offer, Low Contract	Low Offer, Low Contract	t-stat: diff/0
Full Sample			
Average Monthly Proportion Past Due	0.102 (0.009)	0.082 (0.004)	1.90*
Proportion of Months in Arrears	0.211 (0.011)	0.202 (0.006)	0.72
Account in Collection Status	0.123 (0.013)	0.101 (0.007)	1.50
# of observations	625	2087	
Female			
Average Monthly Proportion Past Due	0.101 (0.013)	0.067 (0.005)	2.42**
Proportion of Months in Arrears	0.209 (0.02)	0.181 (0.008)	1.55
Account in Collection Status	0.121 (0.019)	0.082 (0.008)	1.88*
# of observations	307	1047	
Male			
Average Monthly Proportion Past Due	0.103 (0.013)	0.099 (0.007)	0.3
Proportion of Months in Arrears	0.2131 (0.016)	0.223 (0.009)	-0.51
Account in Collection Status	0.1257 (0.019)	0.120 (0.010)	0.26
# of observations	318	1040	

Table 3: Comparison of Means: Repayment Burden Effects

	High Offer, High Contract	High Offer, Low Contract	t-stat diff \neq 0
Full Sample			
Average Monthly Proportion Past Due	0.105 (0.006)	0.102 (0.009)	0.23
Proportion of Months in Arrears	0.244 (0.008)	0.211 (0.011)	2.38**
Account in Collection Status	0.139 (0.009)	0.123 (0.013)	0.99
# of observations	1636	625	
Female			
Average Monthly Proportion Past Due	0.089 (0.007)	0.101 (0.013)	-0.85
Proportion of Months in Arrears	0.221 (0.011)	0.209 (0.02)	0.64
Account in Collection Status	0.107 (0.121)	0.121 (0.019)	-0.65
# of observations	779	307	
Male			
Average Monthly Proportion Past Due	0.120 (0.008)	0.103 (0.013)	1.05
Proportion of Months in Arrears	0.264 (0.011)	0.213 (0.016)	2.60***
Account in Collection Status	0.168 (0.013)	0.126 (0.019)	1.87*
# of observations	857	318	

OLS Results

(Tables 4 and 5)

Core results:

- Adverse Selection
 - Full sample: insignificant (but sign and size)
 - Females: significant and large
- Repayment burden
 - Full sample: insignificant, with coefficients often $\sim=0$
 - Males: large, and sometimes significant
- Pure Moral Hazard
 - Full sample: large and significant
 - Significant only for males, but signed for females

Table 4: Disentangling Selection on Unobservables from Moral Hazard

Dependent Variable	Full Sample				
	OLS			Tobit	
	<i>Monthly</i>		<i>Monthly</i>		
	Average Proportion	Proportion of Months in Past Due	Account in Collection Status	Average Proportion Past Due	Proportion of Months in Arrears
	(1)	(2)	(3)	(4)	(5)
	Offer Rate (AS)	0.004 (0.003)	0.002 (0.004)	0.007 (0.005)	0.004 (0.005)
Contract Rate (MH)	-0.000 (0.003)	0.007* (0.003)	0.001 (0.005)	0.002 (0.004)	0.010 (0.007)
Rate Valid for One Year (vs one loan)	-0.011* (0.005)	-0.016** (0.008)	-0.019** (0.009)	-0.021** (0.009)	-0.032** (0.016)
Constant	0.079*** (0.014)	0.139*** (0.025)	0.069*** (0.024)	-0.065** (0.028)	-0.081 (0.052)
Observations	2215	2215	2215	2,215	2,215
R-squared	0.04	0.22	0.12		

Table 5: Disentangling Selection on Unobservables from Moral Hazard, by Gender

Dependent Variable	Male				
	OLS			Tobit	
	<i>Monthly</i>			<i>Monthly</i>	
	Average Proportion	Proportion of Months in Past Due	Account in Collection Status	Average Proportion	Proportion of Months in Arrears
	(1)	(2)	(3)	(4)	(5)
Offer Rate (AS)	-0.002 (0.004)	-0.004 (0.005)	0.001 (0.007)	-0.005 (0.006)	-0.008 (0.010)
Contract Rate (MH)	0.005 (0.003)	0.014*** (0.005)	0.010 (0.007)	0.010 (0.006)	0.021** (0.010)
Rate Valid for One Year (vs one loan)	-0.014 (0.009)	-0.025** (0.012)	-0.020 (0.015)	-0.033** (0.016)	-0.050** (0.023)
Constant	0.108*** (0.025)	0.178*** (0.040)	0.092** (0.043)	-0.008 (0.043)	0.002 (0.072)
Observations	2215	2215	2215	2,215	2,215
R-squared	0.06	0.12	0.04		

Table 5: Disentangling Selection on Unobservables from Moral Hazard, by Gender

Dependent Variable	Female				
	OLS			Tobit	
	<i>Monthly</i>			<i>Monthly</i>	
	Average Proportion Past Due	Proportion of Months in Arrears	Account in Collection Status	Average Proportion Past Due	Proportion of Months in Arrears
	(1)	(2)	(3)	(4)	(5)
Offer Rate (AS)	0.010*** (0.003)	0.008* (0.005)	0.013** (0.005)	0.013** (0.006)	0.013 (0.009)
Contract Rate (MH)	-0.005 (0.004)	-0.001 (0.005)	-0.009 (0.006)	-0.006 (0.006)	-0.003 (0.009)
Rate Valid for One Year (vs one loan)	-0.007 (0.008)	-0.006 (0.012)	-0.017 (0.012)	-0.008 (0.014)	-0.009 (0.025)
Constant	0.050*** (0.015)	0.097*** (0.026)	0.043 (0.027)	-0.121*** (0.029)	-0.176*** (0.057)
Observations	2133	2133	2133	2133	2133
R-squared	0.06	0.10	0.04		

**Dynamic Incentives:
Effect of Making Promotional Rate Valid for One Year versus One Loan**
 Dependent Variable: Monthly Average Proportion Past Due, OLS

	<i>Sample Restriction</i>	<i>Full Sample</i>	<i>Female</i>	<i>Male</i>
	(1)	(2)	(3)	
Offer Rate (AS)	0.004 (0.003)	0.012*** (0.004)	-0.004 (0.005)	
Contract Rate (MH)	0.002 (0.004)	-0.001 (0.005)	0.005 (0.005)	
Rate valid for one year, Indicator Variable	0.001 (0.015)	-0.024 (0.016)	0.031 (0.023)	
Rate valid for one year, # of points below normal rate	-0.005 (0.004)	0.003 (0.003)	-0.014** (0.006)	
Constant	0.278*** (0.071)	0.162* (0.083)	0.381*** (0.123)	
Observations	4348	2133	2215	
Adjusted R-squared	0.0532	0.0505	0.0559	
<i>Prob(both yearlong variables = 0)</i>	0.0419	0.3246	0.0410	

Magnitudes: How Much of Default is due to Private Information?

- Range of interest rates based on “observable” information is 400 basis points.
- Apply 400 basis points to the econometric results:
 - Table 5, Column 2: 5.6% point decrease in default for men from repayment burden
 - Table 5, Column 8: 3.2% point decrease in default for women from adverse selection
- Baseline default differentials based on observable risk are:
 - Male: 27% points default difference between observably “high” and “low” risk clients: $5.6\%/27\% = 21\%$ due to info problems
 - Female: 17% points default difference between observably “high” and “low” risk clients: $3.2\%/17\% = 19\%$ due to info problems

Model 3. Matching Estimator

- Concerns:
 - allow for interaction effects between random variables
 - relax the linear functional form assumptions
- Matches individuals on 2 of 3 random variables
(plus risk level, the stratification variable).
Control for month of offer (M)
- To test offer rate:

$$Y_{icdr} - \bar{Y}_{cdr} = \beta(r_{icdr}^o - \bar{r}_{cdr}^o) + \delta M_i + \varepsilon_{icdr} - \varepsilon_{cdr}$$

- To test contract rate:

$$Y_{iodr} - \bar{Y}_{odr} = \beta(r_{iodr}^c - \bar{r}_{odr}^c) + \delta M_i + \varepsilon_{iodr} - \varepsilon_{odr}$$

Matching Estimator Results

- Qualitatively similar to OLS (see Table 6):
 - Point estimates similar
 - Standard errors a bit bigger (due to losing hundreds of degrees of freedom)

Model 4. IV Approach

- Conceptualizes interest cost not as a rate, but as interest burden.
- Loan size endogenous
 - low rates → larger loans (Karlan-Zinman 2005)
 - so far we've conditioned on it, for robustness
- Now Instrument. First stage:
 - Endogenous variables: total interest cost
 - Instrumental variables: randomly assigned interest rates

IV Specification

$$Y_i = \alpha + \beta_0 \hat{I}_i^o + \beta_c \hat{I}_i^c + \delta X_i + \varepsilon_i$$

- I^o and I^c = nominal interest due (not the rates)
- X_i = risk & month of offer
- First stage:

$$(7) \quad I_i^o = \alpha^1 + \beta_1^1 r_i^o + \beta_1^1 r_i^c + \chi^1 X_i + \varepsilon_i^1$$

$$(8) \quad I_i^c = \alpha^2 + \beta_2^2 r_i^o + \beta_2^2 r_i^c + \chi^2 X_i + \varepsilon_i^2$$

IV Results (Table 7)

- Similar to before:
 - But now weakly significant adverse selection in full sample (columns 1-3)
 - But still driven by females

Model 5. Non-parametric plots

- Relaxes linear “treatment” effect assumption maintained in all of our regression specifications
 - Assumed linearity on selection and repayment burden
 - But *not* on pure moral hazard (the D effect)
- Nonparametric plots reproduce qualitative pattern of regression results (Figures 4-11)
- But not conclusive: big confidence bands admit possibility of important nonlinearities

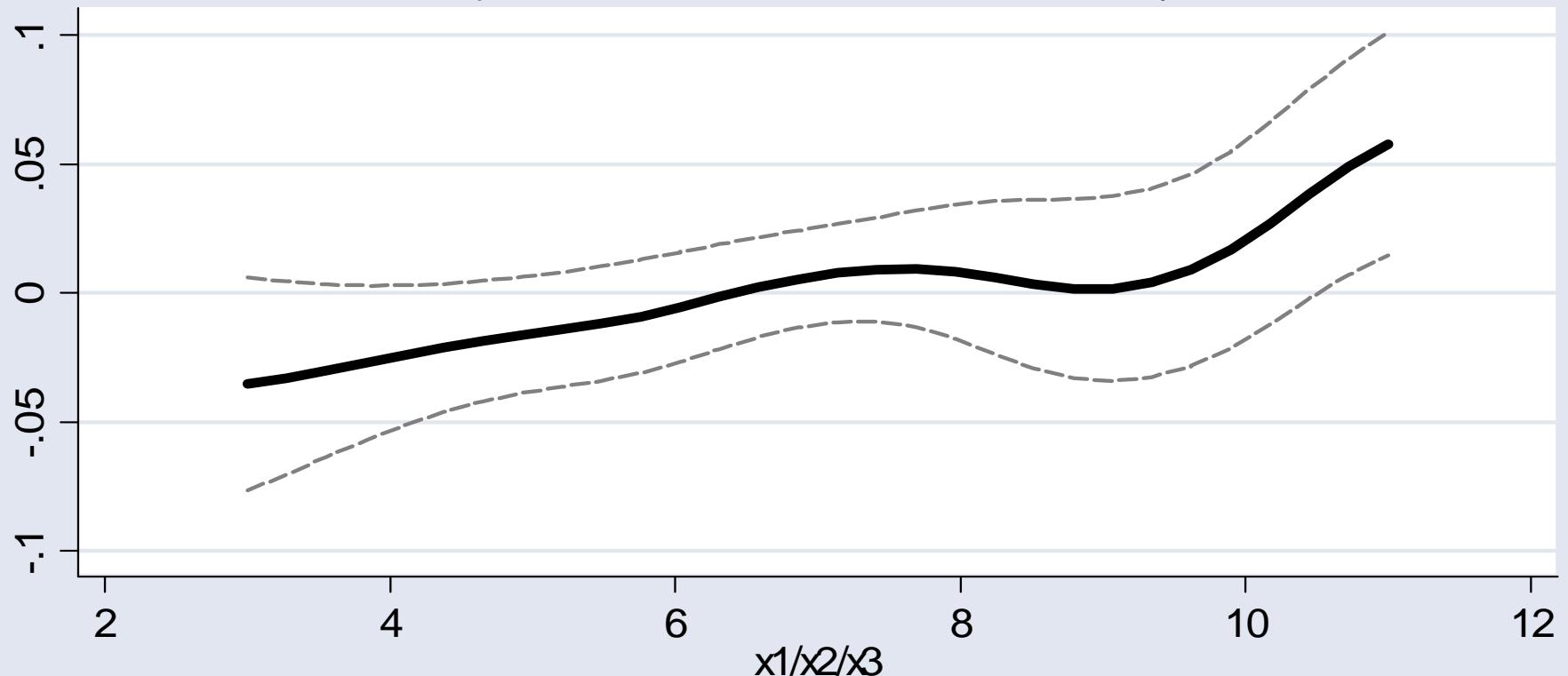
Coefficients for Offer Interest Rate Indicator Variables

Selection Effects, Female

Outcome: Monthly Average Proportion Past Due

OLS, Smoothed Plot of Coefficients on Offer Rate

Specification Includes Contract Rate Non-Parametrically

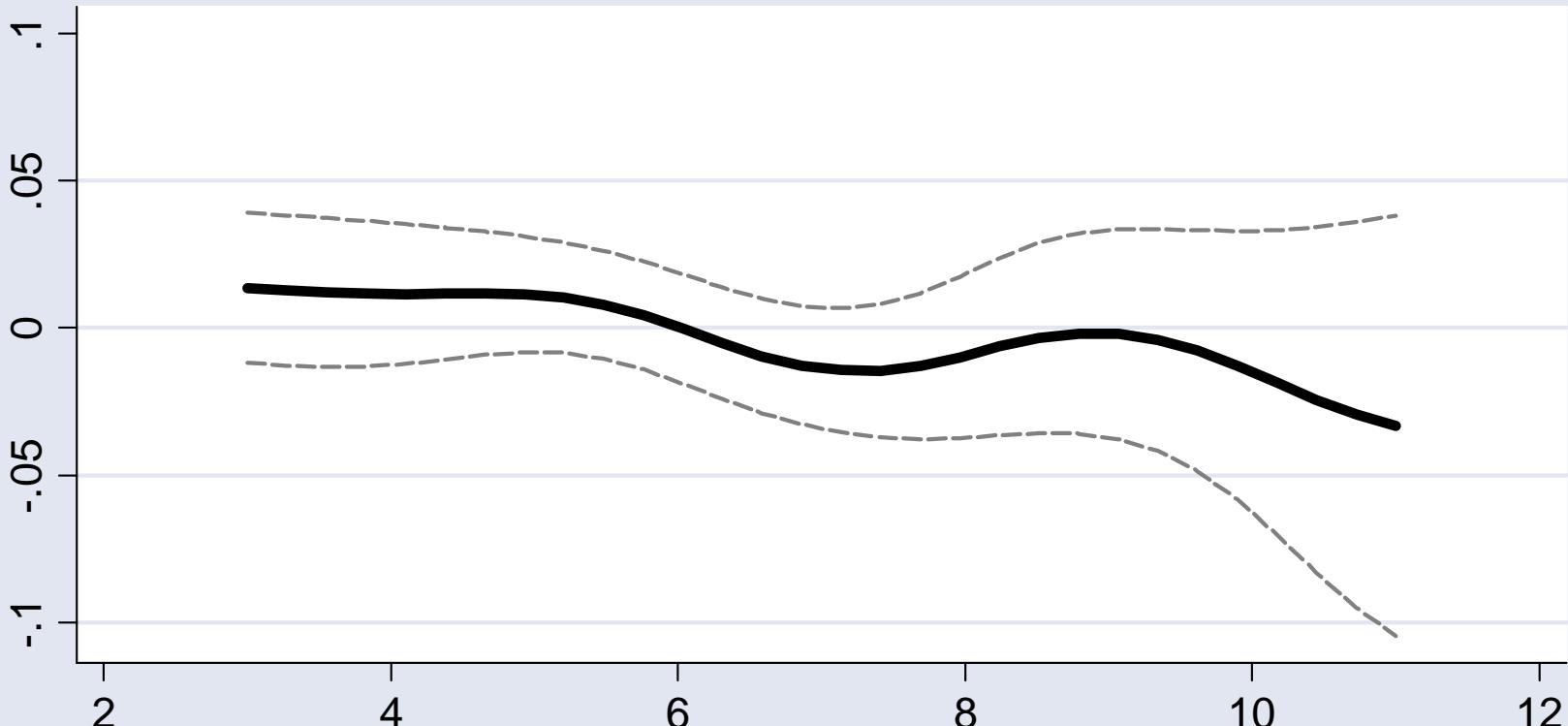


— Coefficients for Offer Interest Rate Indicator Variables
--- 95% Confidence Interval

Coefficients for Contract Interest Rate Indicator Variables

Repayment Burden Effects, Female

Outcome: Monthly Average Proportion Past Due
OLS, Smoothed Plot of Coefficients on Contract Rate
Specification Includes Offer Rate Non-Parametrically



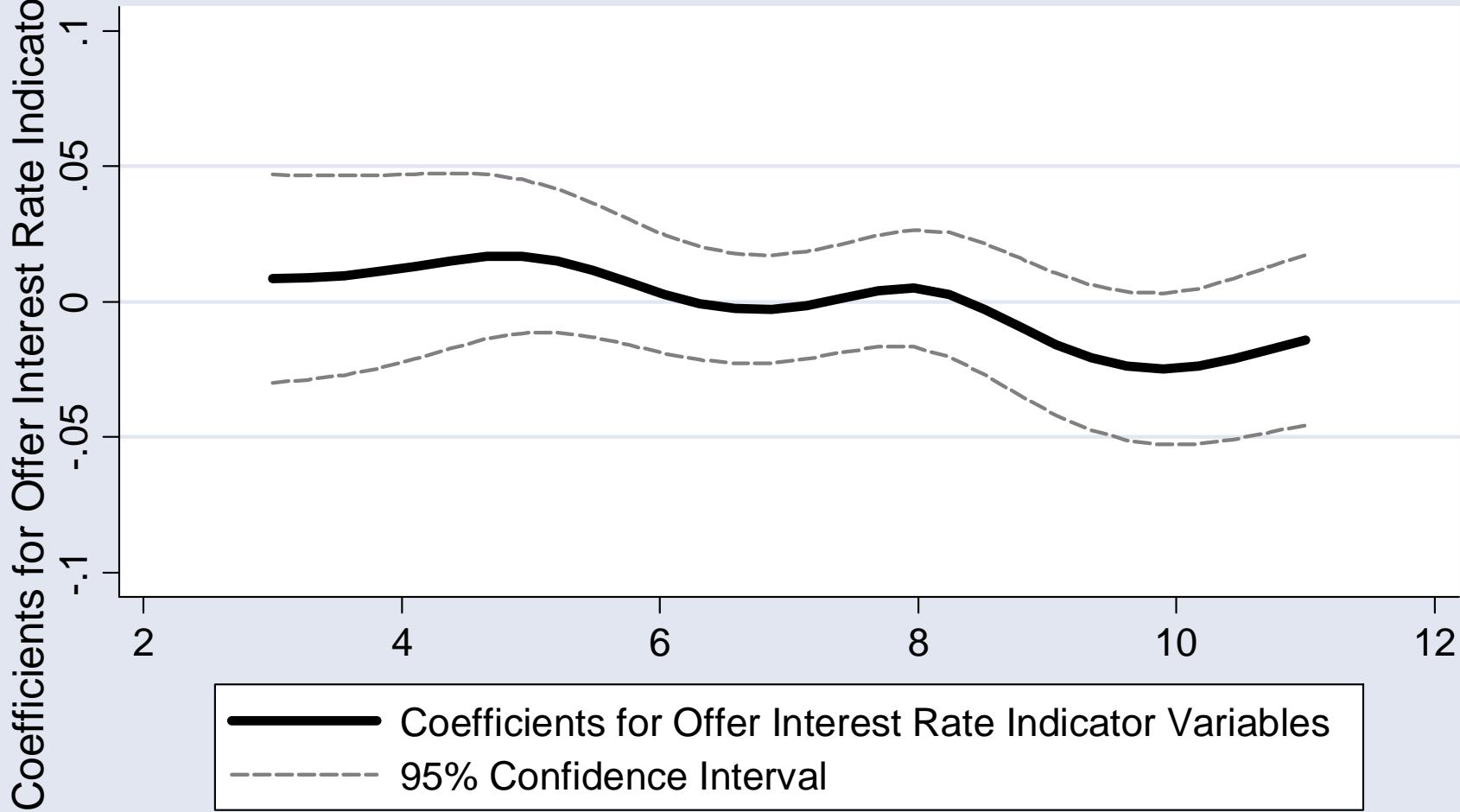
— Coefficients for Contract Interest Rate Indicator Variables
- - - 95% Confidence Interval

Selection Effects, Male

Outcome: Proportion of Months in Arrears

OLS, Smoothed Plot of Coefficients on Offer Rate

Specification Includes Contract Rate Non-Parametrically



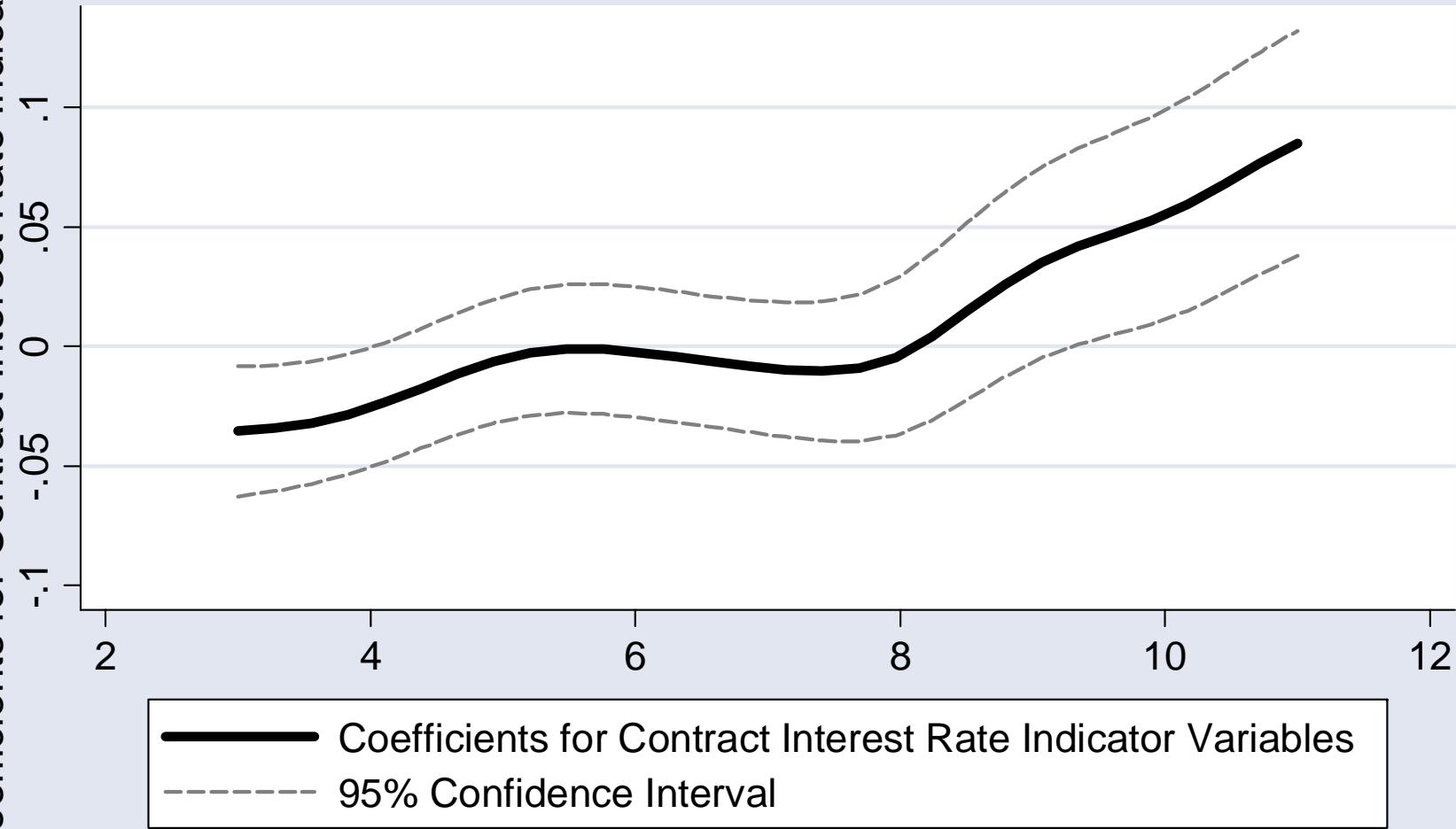
Coefficients for Contract Interest Rate Indicator Variables

Repayment Burden Effects, Male

Outcome: Proportion of Months in Arrears

OLS, Smoothed Plot of Coefficients on Contract Rate

Specification Includes Offer Rate Non-Parametrically



Selection on Observables

- Would be odd to find adverse selection, but no selection on observables.
- Create “observable risk” index by taking predicted default from regression of default on observables.
- Do probit of whether *applies* on index, offer rate, and their interaction
 - Interaction term identifies observable selection; i.e., are observably riskier applicants less price elastic?
- We find selection on observables *for women* but not for men.

Table 9: Selection on Observable Information

Probit, Dependent Variable: "Applied for Loan"

	<i>Sample:</i>	All	Female	Male
		(2)	(3)	(4)
Offer Rate (AS)		-0.004*** (0.001)	-0.006*** (0.002)	-0.002 (0.002)
Predicted Past Due Percentage		-158.064** (76.012)	-268.010** (122.971)	-17.186 (112.913)
Offer Rate* Predicted Past Due Percentage		10.071 (8.852)	23.443* (13.105)	-4.948 (13.786)
Observations		52985	25221	27764

* significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors in parentheses, and corrected for clustering at the branch level.

Heterogeneity in Effects

- Gender interpretation
- Length of lending relationship

Gender pattern: What drives it?

- Several deep stories, most hard to test in our data:
 - Exposure to risk (loan use, employment stability, health status)
 - Response to bad shock/costs of default
 - Outside options (credit, mobility)
 - Access to resources (household control, illiquid asset holdings)
 - Preferences/decision-making
- What we can do: rule out the relatively uninteresting story that women and men are simply observably different in our sample (by demographics) in ways that aren't captured by the risk summary statistic
 - Table 8: adding demographics (and their interactions with rates) does not change core results
 - Table 9: observable selection for women, not men

	<i>Demographic Control Variable:</i>	<i>Married</i>	<i>Dependants in Hhold</i>	<i>Educated</i>			
		(1)	(2)	(3)	(4)	(5)	
<i>Experimental Variables</i>							
Offer Rate (AS)		0.023 (0.435)	-0.252 (0.537)	0.089 (0.432)	0.176 (0.530)	0.079 (0.402)	-0.213 (0.410)
Contract Rate (MH)		0.415 (0.393)	0.716 (0.508)	0.482 (0.446)	0.660 (0.527)	0.260 (0.414)	0.557 (0.440)
Rate Valid for One Year (vs one loan)		-1.158 (1.160)	-0.706 (1.510)	-1.098 (1.237)	-1.920 (1.434)	-0.878 (1.028)	-1.081 (1.252)
Female		-2.985 (1.939)	-3.095 (2.585)	-2.558 (1.980)	-1.021 (3.110)	-2.215 (1.886)	-2.652 (2.631)
Demographic Variable (see column heading)		-1.838 (1.952)	-2.040 (2.854)	-0.036 (0.536)	0.427 (0.741)	-1.761 (2.432)	-2.487 (3.909)
<i>Female * Experimental Variables</i>							
Female * Offer Rate (AS)		0.887* (0.456)	1.369** (0.632)	0.834* (0.460)	0.637 (0.661)	0.902* (0.480)	1.534** (0.604)
Female * Contract Rate (MH)		-1.042** (0.476)	-1.575** (0.718)	-1.029** (0.497)	-1.440** (0.678)	-1.138** (0.482)	-1.783*** (0.640)
Female * Rate Valid for One Year (vs one loan)		0.813 (1.350)	-0.037 (2.143)	0.896 (1.343)	2.732 (2.052)	1.077 (1.351)	1.554 (1.903)
<i>Demographic Control Variable * Experimental Variables</i>							
Female * Demographic Control Variable		yes		yes		yes	
Female * Demographic Control Variable * Experimental Variables		yes		yes		yes	
Constant		10.161*** (2.476)	10.236*** (2.791)	8.917*** (2.542)	8.252*** (2.986)	9.608*** (2.240)	9.821*** (2.546)
Observations		4317	4317	4317	4317	4348	4348
R-squared		0.05	0.05	0.05	0.05	0.05	0.05

Information Revelation?

- Explore revelation by augmenting model with:
 - # of prior loans
 - Interaction of this with the interest rate variables
 - Interactions with offer and contract rates indeed negative and significant
 - Not on moral hazard (intuitive?)
 - Correlations are large; e.g., offsets 43% of adverse selection at mean # of prior loans
- Information problems diminish with length of lending “relationship”
 - Not necessarily causal.
 - Could be composition effect (i.e., more frequent borrowers are unobservably better “types”).

Table 11: Do Information Asymmetries Diminish for Clients with More Frequent Borrowing History? (Female)

OLS, Dependent Varibale: Monthly Average Proportion Past Due

	Sample:	Female		
		(4)	(5)	(6)
Offer Rate (AS)		0.014*** (0.004)	0.010*** (0.003)	0.010*** (0.003)
Contract Rate (MH)		-0.005 (0.004)	-0.001 (0.004)	-0.005 (0.004)
Rate Valid for One Year (vs one loan)		-0.007 (0.008)	-0.007 (0.008)	-0.006 (0.011)
# of prior loans with the lender		0.003 (0.002)	0.001 (0.002)	
Offer Rate*# of prior loans		-0.001*** (0.000)		
Contract Rate*# of prior loans			-0.001*** (0.000)	
Rate Valid for One Year*# of prior loans				-0.000 (0.001)
Constant		0.040** (0.017)	0.046*** (0.016)	0.070*** (0.015)
Observations		2119	2119	2119
R-squared		0.06	0.06	0.05

* significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors in 67 parentheses, and corrected for clustering at the branch level.

Table 11: Do Information Asymmetries Diminish for Clients with More Frequent Borrowing History? (Male)

OLS, Dependent Variable: Monthly Average Proportion Past Due

	Sample:	Male		
		(7)	(8)	(9)
Offer Rate (AS)		0.001 (0.005)	-0.002 (0.004)	-0.002 (0.004)
Contract Rate (MH)		0.005 (0.003)	0.008* (0.004)	0.005 (0.003)
Rate Valid for One Year (vs one loan)		-0.015 (0.010)	-0.015 (0.010)	-0.023 (0.017)
# of prior loans with the lender		-0.001 (0.003)	-0.001 (0.003)	
Offer Rate*# of prior loans		-0.001 (0.000)		
Contract Rate*# of prior loans			-0.001 (0.000)	
Rate Valid for One Year*# of prior loans				0.002 (0.002)
Constant		0.119*** (0.034)	0.121*** (0.032)	0.142*** (0.025)
Observations		2198	2198	2198
R-squared		0.06	0.06	0.06

* significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors in 68 parentheses, and corrected for clustering at the branch level.

Take-Aways

- Experimental methodologies, with proper care, can be used to tease out important theoretical parameters of interest.
- Adverse selection and moral hazard both empirically relevant in this market:
 - Unique evidence of *specific* credit market frictions
 - Adverse selection for women (not men)
 - Moral hazard for men (not women)
- Prior borrowing (the lending relationship) may mitigate information problems here

Take-Aways: Key Limitations of the Paper

- Nonlinear effects? Not enough power to test, convincingly
 - Even with 58,000 offers and 4,300 loans
- External validity
 - General problem with empirical work on *samples*
 - Best guess: we've identified lower bound on empirically relevant info problems posed by marginal applicants *in South Africa*
 - Sample of prior borrowers, and relationship seems to matter
 - Cleanly identify only moral hazard that is alleviated by D
 - In other markets?
 - All can say is that many similar consumer credit markets in both developing and developed worlds

Next Steps

TRY ADDRESS KEY EXTERNAL VALIDITY ISSUE

- 3-dimensional interest rate design, but with first-time borrowers.

UNDERWAY:

- Randomize credit approval and loan size to first-time applicants
 - First-order variation in repayment burden (moral hazard)
 - Impacts of relaxing credit constraints important for developing prescriptions for policymakers and NGO practitioners
- Games and survey to get at gender effect drivers

FIELD EXPERIMENTS AND THE BANK

- Put methodology to work for business areas

What's the Firm's Optimal Interest Rate?

- Eventually: calculate profit(loss) per loan
 - Initial loan
 - Longer-horizon (if lower initial rates affect retention)
 - Simply looking at accounting profits will understate benefits of rate cut, since lower rates decrease collection costs under asymmetric info
 - So may make adjustments to accounting profits based on whether ever went into collection.
- Regress profit on rate(s)
 - Cleanest: sample where offer rate = contract rate

Account Number 105349191

Bisley

3201

June 24 2003

A special rate for you.

Dear Mr [REDACTED]

Congratulations! As a valued client, you are eligible for a special interest rate loan. This is a limited time offer so please come in by 31 October 2003 to apply.

Enjoy low monthly repayments with this offer!
For example:

LOAN AMOUNT	LOAN TERM	MONTHLY REPAYMENT
R2000	6 MONTHS	R200.56

LOANS AVAILABLE IN OTHER AMOUNTS SUBJECT TO TERMS & CONDITIONS

There are no hidden costs. What you see is what you pay.

How to apply:

Bring your ID book and latest payslip to your usual branch at 27 Church Street Pietermaritzburg, by **31 October 2003**.

J. Ncube
Mrs J. Ncube
Branch Manager

27 Church Street
Pietermaritzburg
3201
Tel: 033 845 4630

BUSINESS HOURS
MON - FRI 09:00 - 16:00
SAT 08:00 - 12:00

WE SPEAK ZULU

PS: Unfortunately, if you have already taken a loan since the date this letter was issued, you do not qualify for this offer.

Bisley
3201

Account Number | 105349191

BUSINESS HOURS
MON - FRI 08:00 - 16:00
SAT 08:00 - 12:00

SIYASIKHULUMA
ISIZULU

A special rate for you.

Dear [REDACTED]

Congratulations! As a valued client, you are eligible for a special interest rate on your next cash loan from [REDACTED]. This is a limited time offer so please come in by 31 October 2003 to take advantage of this offer.

You can use this cash to pay off a more expensive debt, repair your home, buy an appliance, pay for school or for anything else you want.

- Enjoy low monthly repayments with this offer! For example:

	4 Months	6 Months	12 Months
Interest %	22%	20%	18%
R500	R122.20	R110.56	R80.54
R1000	R196.65	R180.45	R110.25
R2000	R222.70	R200.56	R180.35
R4000	R382.27	R300.99	R250.54

LOAN AVAILABILITY SUBJECT TO TERMS & CONDITIONS

Loans available in other amounts. There are no hidden costs. What you see is what you pay.

If you borrow elsewhere you will pay 10% more in interest payments on a R2000, 4 month loan!

How to apply:

Bring your ID book and latest payslip to your usual branch, by **31 October 2003** and ask for

To extend your deadline, call 0860 333 0004 or SMS 0860 222 334.

Mrs J. Ncube
Branch Manager

PS: Unfortunately, if you have already taken a loan since the date this letter was issued, you do not qualify for this offer

**WIN
10 CELLPHONES
UP FOR GRABS
EACH MONTH!**

