Regulatory Interventions in Markets for Consumer Financial Products: The Case of Credit Cards

Manolis Galenianos Alessandro Gavazza

April 2020

Motivation:

- After the Financial Crisis, more active **regulation** of consumer financial products
  - U.S.: Dodd-Frank 2010, Bureau of Consumer Financial Protection.
  - U.K.: Financial Conduct Authority (FCA) in 2012.

- Key features of recent regulations:
  1. Focus on Consumer Surplus rather than on Aggregate Welfare;
  2. Consumers are Confused/Irrational/Imperfectly Informed;
  3. Behavioral Economics and Paternalistic Approach

  $\longrightarrow$ Direct Regulation of Prices and/or Fees (Caps);

  $\longrightarrow$ Standardized Products + Price Comparison Websites.

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Examples of Price Regulations:

- United States:
  - Abolition of overdraft fees on credit cards in 2009 (Agarwal, Chomsisengphet, Mahoney, and Stroebel, 2015).
  - Abolition of prepayment penalties on mortgages in 2010 (Mayer, Piskorski, and Tchistyi, 2013).

- United Kingdom:
  - November 2014: Cap on interest rates on payday loans = max 0.8 percent per day.
  - November 2016: Cap on pension exit fees = max 1 percent.
  - Among those currently under study:
    - Cap/ban on mutual fund fees (*The Financial Times*, May 26, 2016)
    - Mortgage origination fees (*The Financial Times*, December 12, 2016).
    - Brokers' mortgage procuration fees (*The Financial Times*, December 12, 2016).

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This paper (1)

QUESTIONS:

- How policy interventions affect imperfect markets?
- How do consumers adjust to policy interventions?
- How do sellers adjust to policy interventions?

CREDIT CARD MARKETS:

- Interesting ground for empirical/quantitative work:
  - Target of recent regulations;
  - Some pre-crisis data on offers and on accepted rates $\longrightarrow$ large dispersion of interest rates for observationally-identical borrowers.

This paper (2):

- Setup a (static) search model with two key features:
  - Endogenous search effort;
  - Product differentiation.

- Calibrate it using pre-crisis data on credit cards;

- Quantify the role of endogenous search effort versus product differentiation on lender pricing and equilibrium allocations.

- Two policy experiments:
  1. Cap on Interest Rates. Key trade-off:
     - PROS: Eliminates high-interest-rate offers;
     - CONS: Fewer offers ("access") + Lower search effort.
  2. Higher fixed costs for lenders (i.e., compliance, etc.).

Literature:

- Credit cards
  Ausubel (1991), Calem and Mester (1995),
  Grodzicki (2015), Stango and Zinman (2016).

- Search in consumer financial products
  Mortgages: Woodward and Hall (2012),
  Allen, Clark, and Houde (2019);
  Mutual funds: Sirri and Tufano (1998),
  Hortaçsu and Syverson (2004).

One of the first papers that quantitatively studies regulatory interventions in markets for consumer financial products using a search framework.

Data

- Survey data (Stango and Zinman, 2016):
  1. Interest rates on the credit cards that individuals hold, January 2006-December 2008 ("accepted offers").
     We focus on:
     - Four groups: sub-prime; near-prime; prime; and super-prime.
     - Individuals who carry a balance.
  2. Interest rates on the credit card offers that individuals receive in January 2007 ("received offers").
- Aggregate data:
  3. Fraction of credit card borrowers ("revolvers") by borrower group.
  4. Risk-free rate: interest rate of the one-month Treasury bill on January 16th, 2007.
  5. Aggregate charge-off rate in Q1 2007 from Fed Board.
  6. Average funding cost: Standard & Poor's Credit Card Quality Index Base Rate.

Dispersion of Interest Rates

For borrowers in group j (sub-, near-, prime, and super-):

$$R^j_{ikt} = \gamma^j_X X_{it} + \gamma^j_Z Z_{ikt} + \epsilon^j_{ikt}, \tag{1}$$

R_{ijt}: individual i's APR on credit card k in month t.

Near-Prime Borrowers	(1)	(2)	(3)	(4)	(5)	(6)
FICO Score				-0.046	-0.043	-0.052
				(0.011)	(0.011)	(0.013)
Reward Card					0.494	0.562
					(0.453)	(0.565)
Credit Limit					-0.211	-0.255
					(0.046)	(0.078)
Credit Balance					0.242	0.225
					(0.064)	(0.100)
R^2				0.019	0.044	0.043
Observations	27,059	944	900	900	885	661
10th Percentile	10.49	11.24	12.99	13.16	13.09	13.20
25th Percentile	14.90	14.99	15.94	16.01	16.06	16.55
50th Percentile	18.24	18.99	19.24	19.09	19.31	20.20
75th Percentile	23.15	23.24	23.30	24.07	23.87	25.72
90th Percentile	28.99	29.24	29.24	29.03	28.75	29.16

Empirical Targets

Table: Summary Statistics

Panel A: Accepted Offers	Sub-	Near-	Prime	Super-
10th Percentile Accepted Offer	14.39	13.20	11.56	10.79
25th Percentile Accepted Offer	17.58	16.55	14.81	13.82
50th Percentile Accepted Offer	21.93	20.20	17.93	16.84
75th Percentile Accepted Offer	27.80	25.72	21.90	19.54
90th Percentile Accepted Offer	30.16	29.16	28.68	23.98
Fraction with Credit Card Debt	54.56	55.33	54.00	36.02

Panel B: Received Offers	
Fraction Receiving 2+ Offers (%)	75.00
Median Number of Offers Received, Conditional on 2+ Offers	3.00
Average Number of Offers Received, Conditional on 2+ Offers	4.00
10th Percentile of Differences in Offered Rates	0.00
30th Percentile of Differences in Offered Rates	2.25
50th Percentile of Differences in Offered Rates	4.34
70th Percentile of Differences in Offered Rates	7.25
90th Percentile of Differences in Offered Rates	9.25
Charge-Off Rate	4.01
Average Funding Cost	7.02

Model: Borrowers

- Static Search Model
- J groups (observable), with shares ω_j;
- Within each group j:
  - Heterogeneous with respect to willingness to pay $\tilde{z} \sim M(\cdot)$;
  - Default rate ρ, cost of default δ;
  - Receive offers at aggregate arrival rate L;
  - Choose effort $e \in [0,1]$ that determines the probability that they examine an offer
    $\longrightarrow$ Arrival rate: $\alpha(e, L)$;
    Cost of effort $q(e, L)$, increasing and convex;
  - Choose offer with lowest $c = R + a$, where a is a heterogenous product attribute, possibly correlated with R, $a \sim F_a(\cdot|R)$;
    Rest of the talk: a and R uncorrelated;
  - Payoff: $(1-\rho)(\tilde{z} - R - a) + \rho(\tilde{z} - \delta) = (1-\rho)(z - R - a) \geq 0$.

Model: Lenders

- Lenders:
  - Measure Λ.
  - Heterogeneous with respect to funding cost $\tilde{k} \sim G(\cdot)$.
  - Choose $R(k)$ to maximize profits:

$$\pi_k(R) \quad = \quad \Big(R(1-\rho) - k\Big)P(R) - \chi,$$

    - $k = \tilde{k} + \rho$ is the cost of the loan, which includes charge-off rate ρ;
    - $P(R)$ is the probability that offer with rate R is accepted;
    - χ is the fixed cost.

Solution: Borrowers (1)

- A borrower's effective number of offers follows a Poisson distribution with parameter $\alpha(e, L)$.
- The expected value of loan offers for a type-z borrower who exerts examination effort e is:

$$V_z(e) = \sum_{n=1}^{\infty} \frac{e^{-\alpha(e,L)}\alpha(e,L)^n}{n!} v_z(n)$$

where $v_z(n)$ is the value to a z-borrower of sampling $n \geq 0$ offers:

$$v_z(n) = \int_{-\infty}^{z} (1-\rho)(z-c)\, d\bar{F}_c(c|n)$$

and $\bar{F}_c(c|n) = 1 - \big(1 - F_c(c)\big)^n$ is the distribution and of the minimum c out of n draws from $F_c(\cdot)$, the convolution of the endogenous distribution of R and exogenous a :

$$F_c(c) = \int_{-\infty}^{\infty} F_R(c-a) F_a'(a|R) da.$$

Solution: Borrowers (2)

- Borrowers' optimal effort $e \in [0,1]$ solves:

$$V_z'(e) \quad = \quad q'(e,L),$$

where

$$V_z'(e) \quad = \quad \sum_{n=0}^{\infty} \frac{e^{-\alpha(e,L)}\alpha(e,L)^n}{n!}\big(v_z(n+1) - v_z(n)\big)\alpha'(e,L)\,.$$

- Marginal benefit: the gain from getting an additional offer, summed over all possible offers.

- Effort is increasing in z: $e'(z) \geq 0$.

Solution: Lenders (1)

Profits to a cost-k lender who offers a loan with rate R:

$$\pi_k(R) \quad = \quad \big(R(1-\rho)-k\big)P(R)-\chi$$

where $P(R)$ is the probability of making a loan when offering R.

- Probability that borrower z accepts a loan with cost c

$$P_c(c,z) = \begin{cases} \sum_{n=0}^{\infty} \frac{e^{-\alpha z}\alpha_z^n}{n!}\big(1-F_c(c)\big)^n & \text{if } c \le z \\ 0 & \text{if } c > z \end{cases}$$

- Thus, probability that borrower z accepts a loan with rate R

$$P_R(R,z) \quad = \quad \int_{-\infty}^{\infty} P_c(R+a)dF_a(a|R).$$

- Thus, probability that a loan with rate R is accepted:

$$P(R) \quad = \quad \int_{\underline{z}}^{\overline{z}} s(z)P_R(R,z)dM(z).$$

Model: Lenders (2) + Equilibrium

- Lenders' optimal rate satisfies:

$$P(R)\big(1-\rho\big)+\big(R(1-\rho)-k\big)P'(R)=0.$$

  Solution: $R(k)$, increasing in k.

- EQUILIBRIUM:
  - Lenders maximize profits: $R(k)$ function;
  - Free-entry of lenders: marginal lender k^* satisfies

$$\pi_k\big(R(k^*)\big)=\Big(R(k^*)(1-\rho)-k^*\Big)P\big(R(k^*)\big)-\chi=0;$$

  - Borrowers maximize utility: $e(z)$ function;
  - Consistent with each other.

Quantitative Analysis (1)

- From model to data:
  - In the dataset on received offers, all offers are recorded (i.e., arrival rate L_j).
  - Two versions:
    1) No measurement error;
    2) Measurement error η in accepted offers: $E(\eta) = 1$.

- Parametric Assumptions:
  - Borrowers' preferences: $\log z \sim \mathcal{N}(\mu_{z_j}, \sigma_{z_j})$;
  - Product differentiation: $a \sim \mathcal{N}(0, \sigma_{a_j})$;
  - Borrowers' arrival rates: $\alpha = eL_j$;
  - Borrowers' cost of effort: $\beta_{0j} e^{\beta_1}$;
  - Lenders' costs: $\tilde{k} \sim$ Pareto truncated at $\tilde{k}^* = \frac{1-\left(\frac{\tilde{k}_{min}}{\tilde{k}}\right)^{\xi}}{1-\left(\frac{\tilde{k}_{min}}{\tilde{k}^*}\right)^{\xi}}$, where $\tilde{k}_{min}$ is the risk-free rate;
  - Lenders' charge-off rate: ρ_j.

Quantitative Analysis (2)

Minimum Distance:

- Match 34 empirical moments and theoretical moments:
  - Percentiles of distribution of accepted rates (5x4);
  - Percentiles of distribution of differences between offered rates (5);
  - Number of offers (3);
  - Charge-Off Rate in 2008 (1);
  - Fraction of Credit Card Borrowers (4);
  - Average Funding Cost (1).

- Computational issue: Solve functional equations $R(k)$ and $e(z)$.

Identification

- Similar to structural search model of labor markets.
- Lenders' costs from average funding cost.
- L_j from number of offers.
- ρ_j from charge-off rate.
- With this knowledge, we have three mappings:
  1. From distribution $G(k)$ of costs to offer distribution $F_j(R)$;
  2. From offer distribution $F_j(R)$ to distribution $H_j(R)$ of accepted R;
  3. From offer distribution $F_j(R)$ to fraction of borrowers.

  to identify three sets of parameters:
  - **A.** Costs of examination effort;
  - **B.** Product differentiation σ_a.
  - **C.** Preferences μ_z and σ_z.
- Difference between offered rates and accepted rates:
  - **a.** Low examination effort; or
  - **b.** High product differentiation.

  $\longrightarrow$ But **a.** increases dispersion of offers, whereas **b.** decreases it.

  $\longrightarrow$ But **a.** decreases fraction of borrowers, whereas **b.** increases it.

Parameters

Table: Calibrated Parameters

Panel A: No Measurement Error				Panel B: Measurement Error			
μ_{z_1}	3.613	σ_{z_1}	0.131	μ_{z_1}	3.575	σ_{z_1}	0.121
μ_{z_2}	3.518	σ_{z_2}	0.093	μ_{z_2}	3.528	σ_{z_2}	0.111
μ_{z_3}	3.461	σ_{z_3}	0.131	μ_{z_3}	3.447	σ_{z_3}	0.125
μ_{z_4}	3.251	σ_{z_4}	0.337	μ_{z_4}	3.223	σ_{z_4}	0.192
ξ	3.774	$\hat{k}$	10.182	ξ	4.183	$\hat{k}$	9.656
L_1	1.509	L_2	3.779	L_1	1.550	L_2	3.943
L_3	3.219	L_4	2.999	L_3	3.214	L_4	2.983
ρ_1	0.033	ρ_2	0.020	ρ_1	0.040	ρ_2	0.030
ρ_3	0.015	ρ_4	0.011	ρ_3	0.020	ρ_4	0.010
σ_{a_1}	0.105	σ_{a_2}	0.124	σ_{a_1}	0.081	σ_{a_2}	0.121
σ_{a_3}	0.138	σ_{a_4}	0.153	σ_{a_3}	0.156	σ_{a_4}	0.128
β_{01}	8.637	β_{02}	34.714	β_{01}	8.630	β_{02}	42.264
β_{03}	27.001	β_{04}	28.079	β_{03}	29.002	β_{04}	32.478
β_1	1.627	σ_η	0.000	β_1	1.741	σ_η	0.272

- Almost identical parameters.
- Small measurement error relative to variance of R.

Model Fit

Table: Model Fit 1

	Data	Model $\sigma_\eta = 0$	Model $\sigma_\eta > 0$
10th Percentile Accepted Rate, Sub-prime Borrowers	14.39	18.31	14.64
25th Percentile Accepted Rate, Sub-prime Borrowers	17.58	19.44	17.53
50th Percentile Accepted Rate, Sub-prime Borrowers	21.93	21.88	21.53
75th Percentile Accepted Rate, Sub-prime Borrowers	27.80	25.20	26.51
90th Percentile Accepted Rate, Sub-prime Borrowers	30.16	27.95	31.85
10th Percentile Accepted Rate, Near-prime Borrowers	13.20	17.01	13.68
25th Percentile Accepted Rate, Near-prime Borrowers	16.55	18.12	16.42
50th Percentile Accepted Rate, Near-prime Borrowers	20.20	20.46	20.19
75th Percentile Accepted Rate, Near-prime Borrowers	25.72	23.73	24.99
90th Percentile Accepted Rate, Near-prime Borrowers	29.16	26.32	30.06
10th Percentile Accepted Rate, Prime Borrowers	11.56	15.61	12.43
25th Percentile Accepted Rate, Prime Borrowers	14.81	16.58	14.93
50th Percentile Accepted Rate, Prime Borrowers	17.93	18.65	18.41
75th Percentile Accepted Rate, Prime Borrowers	21.90	21.54	22.75
90th Percentile Accepted Rate, Prime Borrowers	28.68	23.97	27.64
10th Percentile Accepted Rate, Super-prime Borrowers	10.79	14.17	11.31
25th Percentile Accepted Rate, Super-prime Borrowers	13.82	15.00	13.49
50th Percentile Accepted Rate, Super-prime Borrowers	16.84	16.72	16.44
75th Percentile Accepted Rate, Super-prime Borrowers	19.54	19.01	19.95
90th Percentile Accepted Rate, Super-prime Borrowers	23.98	21.05	23.95

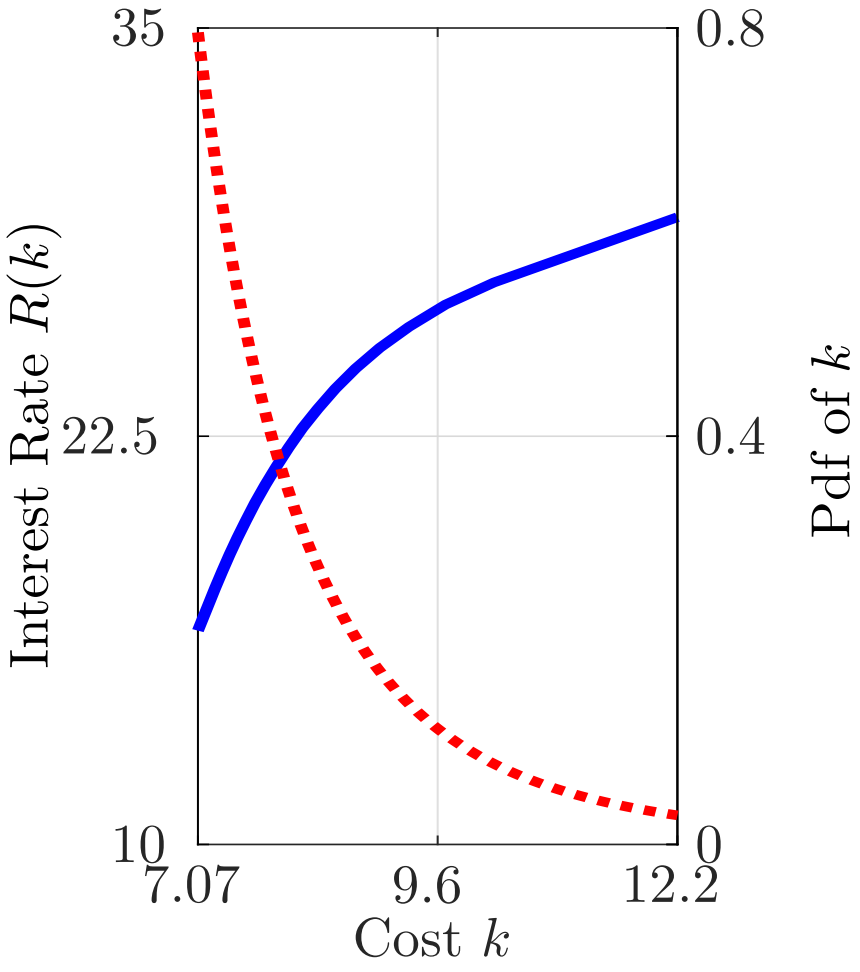
Model Fit

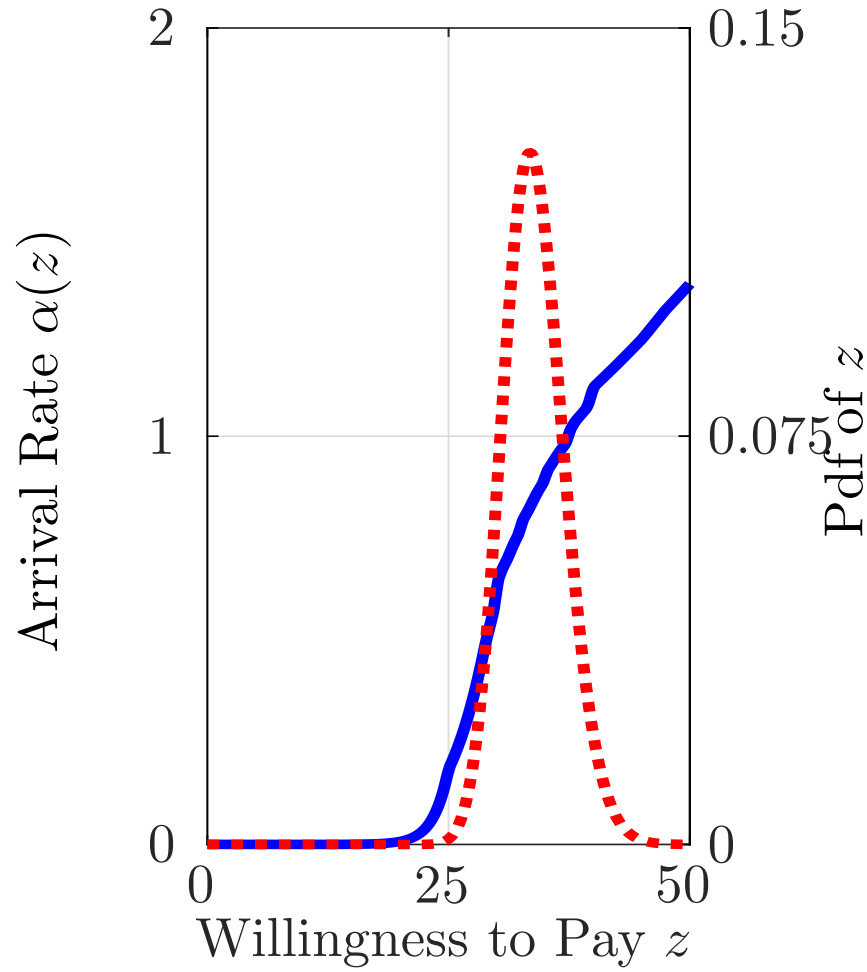
Table: Model Fit 2

	Data	Model $\sigma_\eta = 0$	Model $\sigma_\eta > 0$
Fraction Receiving 2+ Offers (%)	75.00	74.20	74.57
Median Number of Offers Received, Conditional on 2+ Offers	3.00	3.00	3.00
Average Number of Offers Received, Conditional on 2+ Offers	4.00	3.47	3.49
10th Percentile Distribution of Differences in Offered Rates	0.00	1.54	1.19
30th Percentile Distribution of Differences in Offered Rates	2.25	3.68	3.01
50th Percentile Distribution of Differences in Offered Rates	4.34	5.44	4.37
70th Percentile Distribution of Differences in Offered Rates	7.25	7.19	5.81
90th Percentile Distribution of Differences in Offered Rates	9.25	9.27	8.52
Fraction with Credit Card Debt, Sub-Prime Borrowers	54.56	55.87	54.52
Fraction with Credit Card Debt, Near-Prime Borrowers	55.33	56.19	55.29
Fraction with Credit Card Debt, Prime Borrowers	54.00	54.93	54.16
Fraction with Credit Card Debt, Super-prime Borrowers	36.02	36.58	36.17
Charge-Off Rate	4.01	1.90	2.28
Average Funding Cost	7.02	6.07	6.00

Model Implications (1)

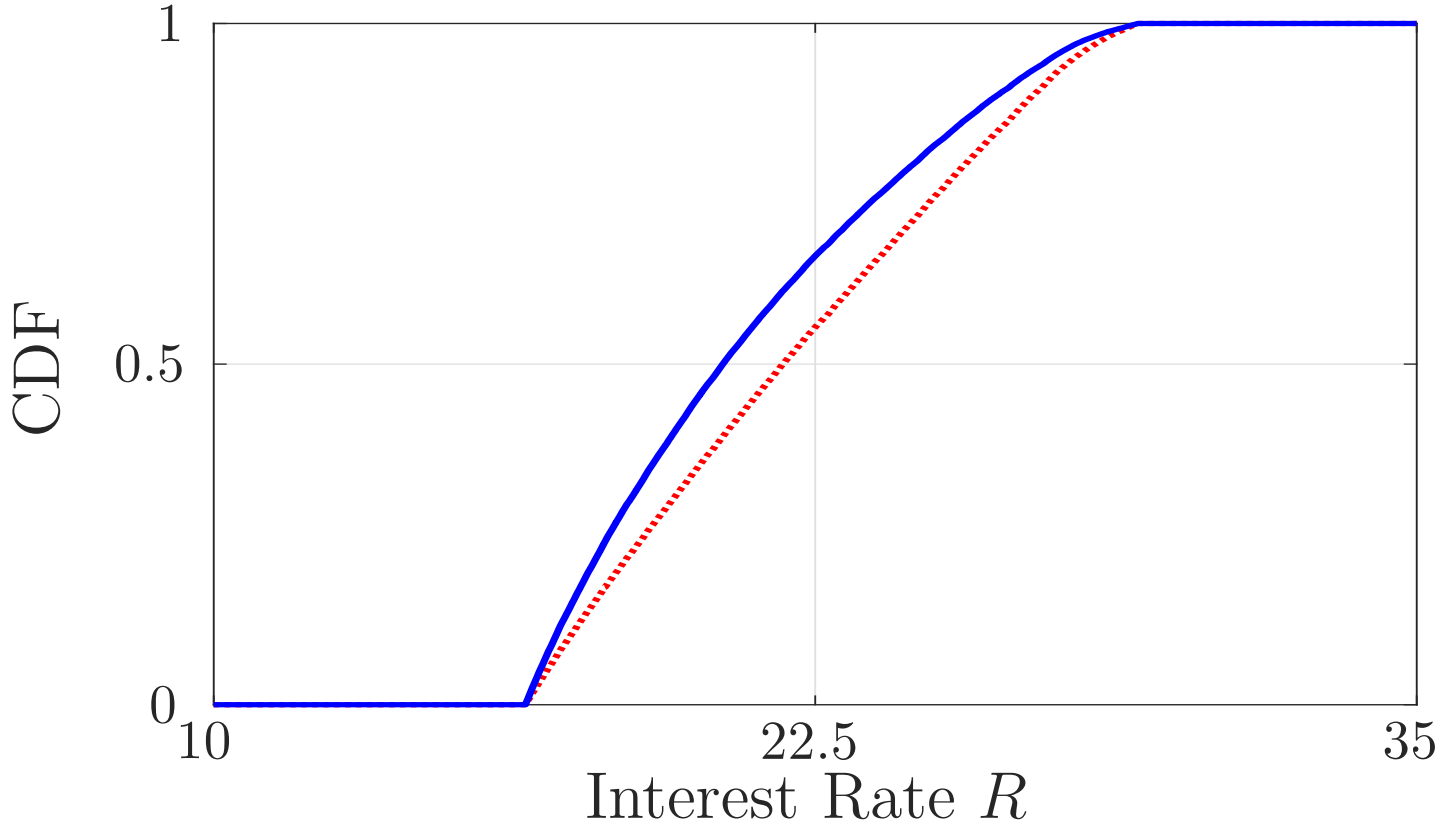
Focus on Near-Prime Borrowers





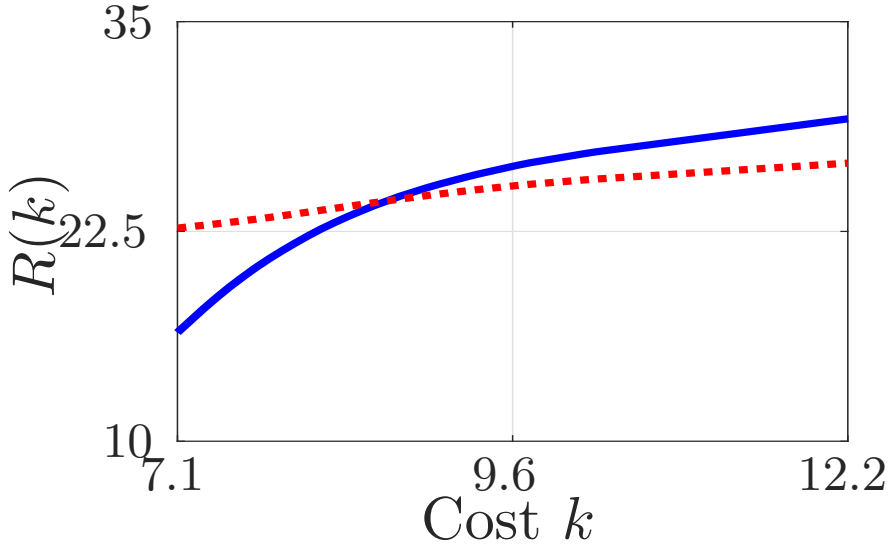
- Large potential gains from trade.
- Low search effort.

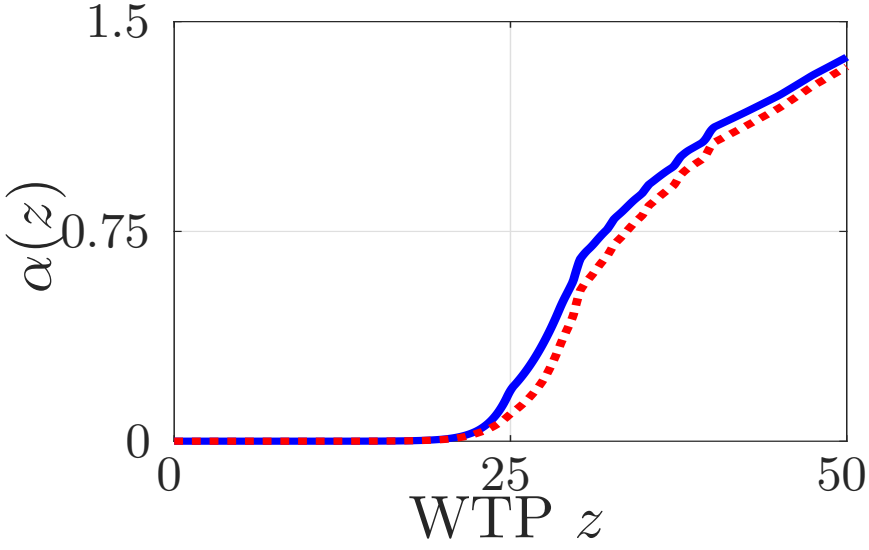
Model Implications (2)

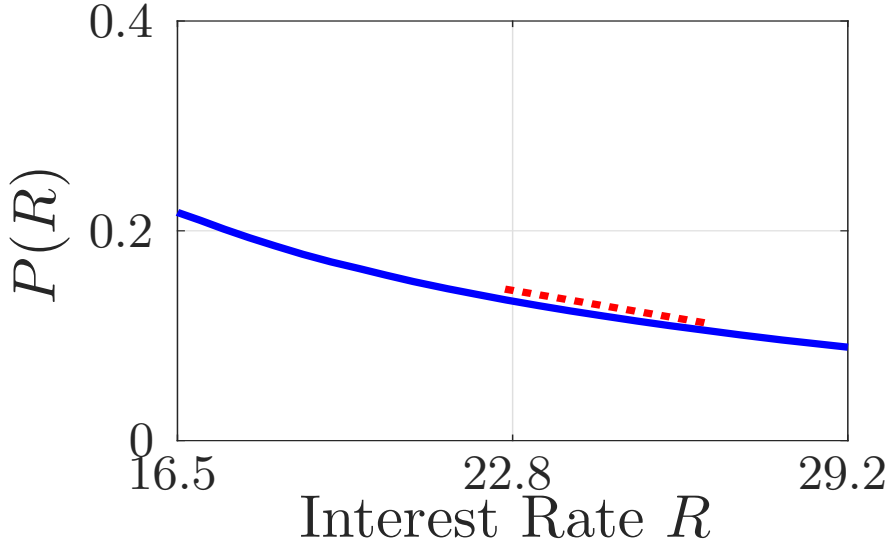


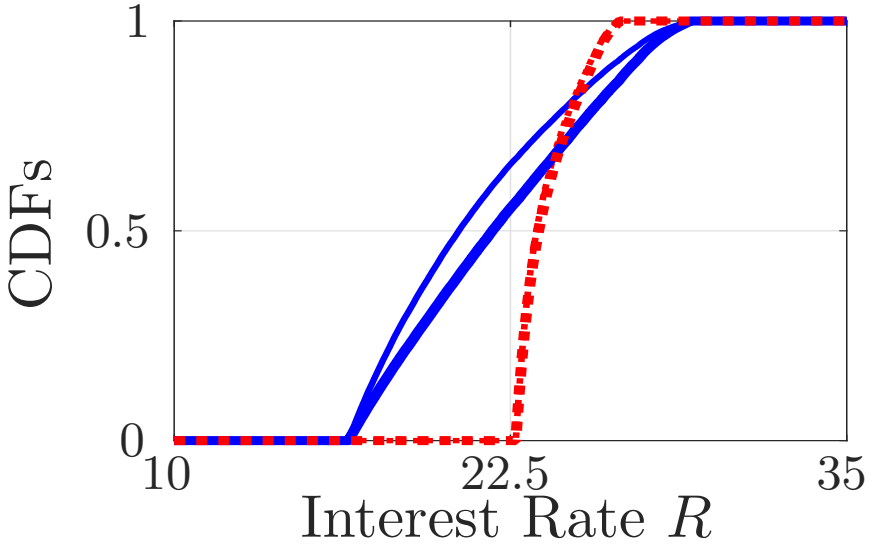
- Small difference between accepted rates (solid line) and offered rates (dashed line);
  $\longrightarrow$ Due to low examination effort.

Comparative Statics: $\sigma_a' = 30\sigma_a$

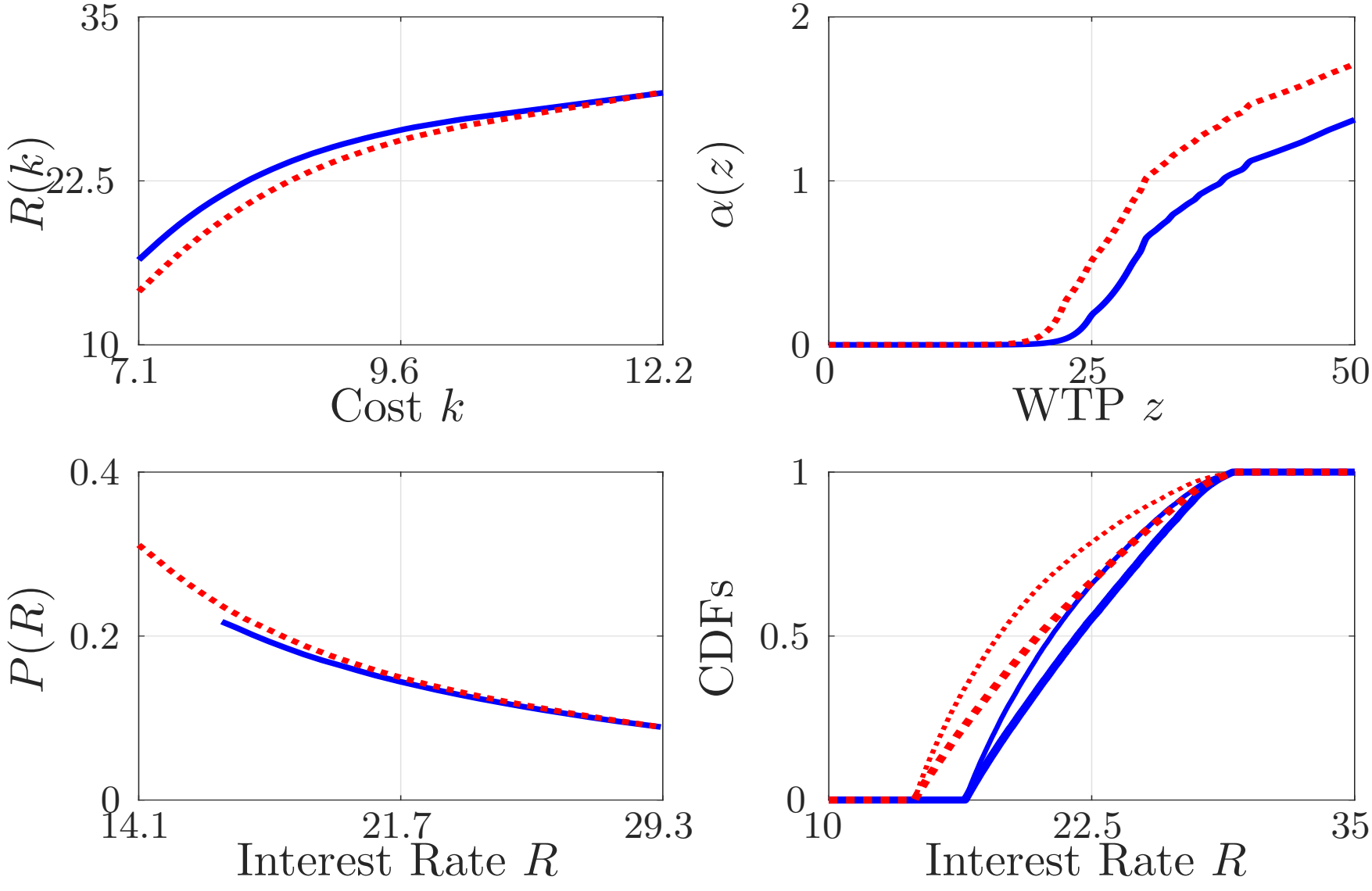








Comparative Statics: $\beta_0' = .7\beta_0$



Policy Experiments

- Inspired by interventions post 2008 recession in several markets for consumer financial products.

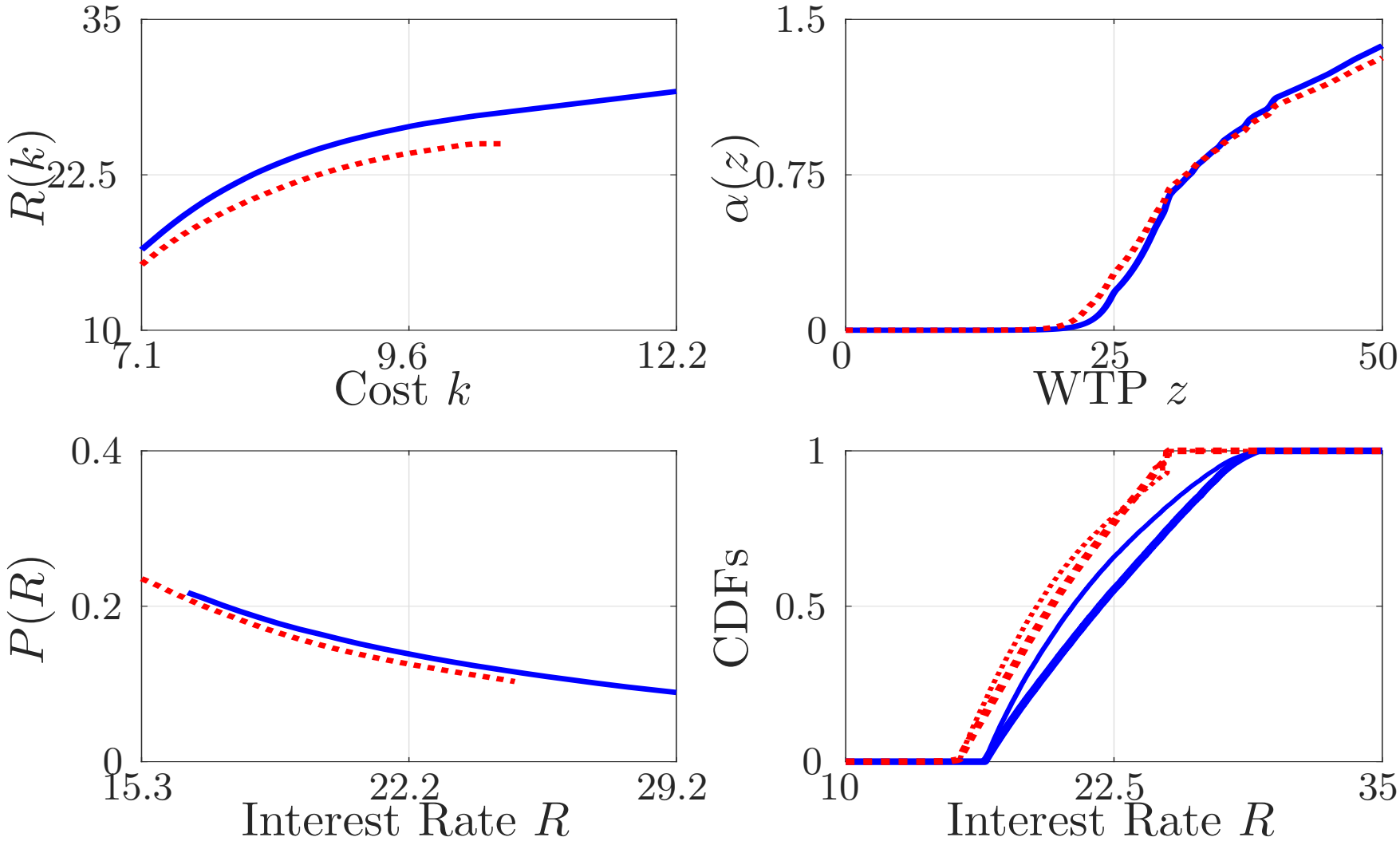
  1. Price Caps
     (Fershtman and Fishman, 1994;
     Armstrong, Vickers, and Zhou, 2009).
     Potentially negative effect on search effort and on equilibrium distributions.

  2. Higher Entry Cost/Lower Competition
     (Janssen and Moraga-González, 2004)
     Potentially positive effect on search effort and on equilibrium distributions.

Policy Experiment 1: Price Caps

- Set price cap to $R = 25$ percent.
- Lenders must satisfy zero-profit condition $\pi(R) \geq 0$:
  $\longrightarrow$ Highest-cost lenders exit;
  $\longrightarrow$ Adjust arrival rate L_j of offers proportionally.

Policy Experiment 1: Price Caps



- Low-Valuation borrowers examine more offers,
- High-Valuation borrowers examine fewer offers.

Policy Experiment 1: Price Caps

Table: Market Outcomes and Welfare with a Price Cap

	Sub-	Near-	Prime	Super-
Average Number of Offers per Borrower	0.87	0.93	0.99	1.00
Average Accepted Rate	0.88	0.90	0.98	1.00
Standard Deviation of Accepted Rates	0.70	0.81	0.94	1.00
Fraction of Borrowers	0.97	1.01	1.01	1.00
Consumer Surplus	1.11	1.18	1.05	1.00
Lender Profits	0.47	0.62	0.92	1.00
Welfare	0.97	1.03	1.01	1.00

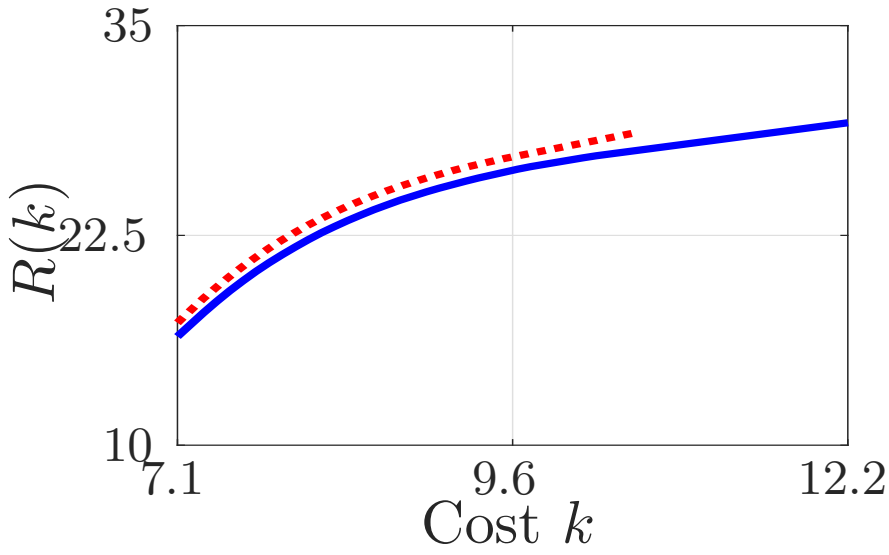
Notes: Ratios to baseline outcomes.

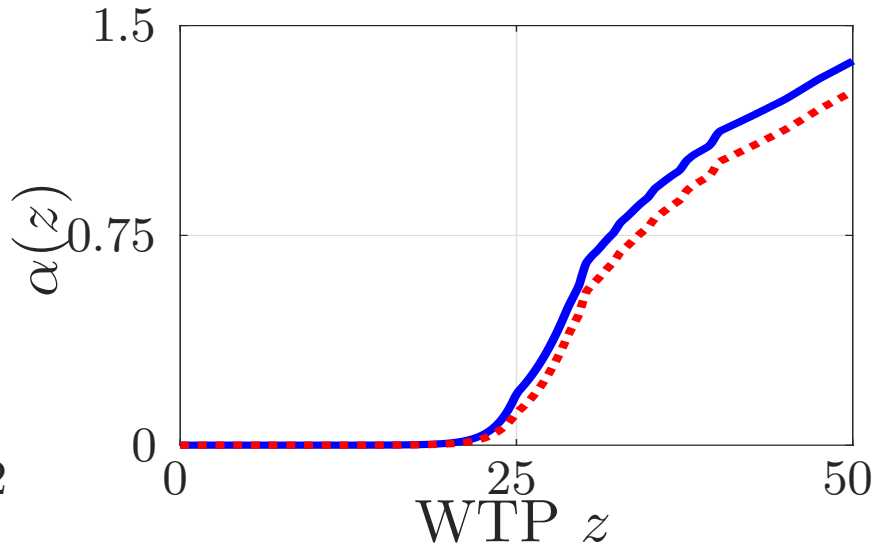
Policy Experiment 2: Entry Cost

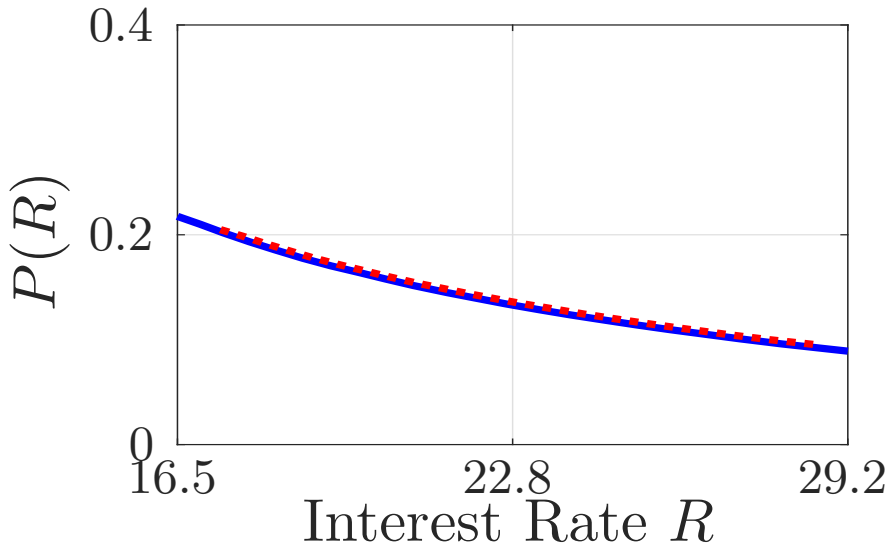
- Economic Questions:
  - Is the effect of price caps due to exit of high-cost lenders?
  - More generally, can increase in fixed costs replicate price caps?

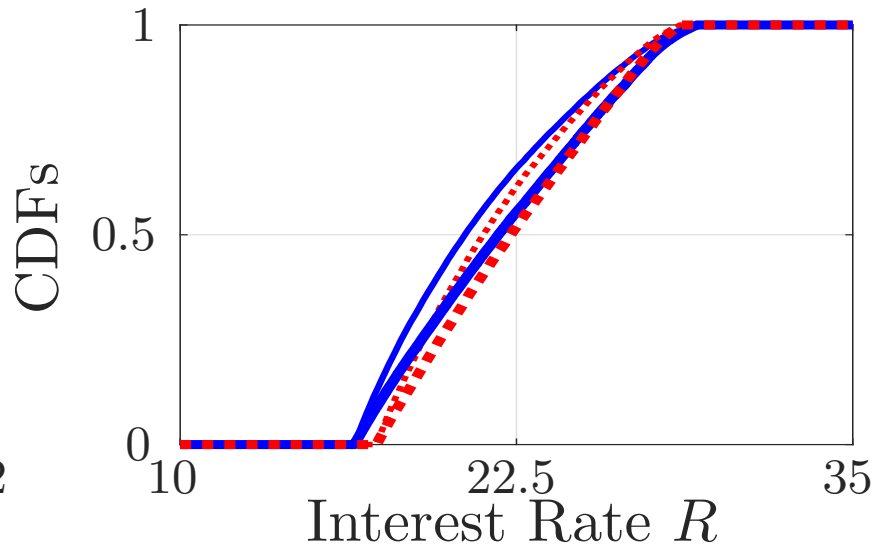
- Use model to:
  - Increase χ such that number of lenders L_j is identical to the price cap case.
  - $R(k)$ is unrestricted—i.e., no cap.

Policy Experiment 2: Entry Cost









- Different effect on interest rates.

Policy Experiment 2: Entry Cost

Table: Market Outcomes and Welfare with Higher Compliance Costs

	Sub-	Near-	Prime	Super-
Average Number of Offers per Borrower	0.87	0.93	0.99	1.00
Average Accepted Rate	1.00	1.03	1.00	1.00
Standard Deviation of Accepted Rates	0.83	0.91	0.99	1.00
Fraction of Borrowers	0.89	0.91	0.99	1.00
Consumer Surplus	0.86	0.85	0.98	1.00
Lender Profits	0.39	0.62	0.95	1.00
Welfare	0.75	0.79	0.97	1.00

Notes: Ratios to baseline outcomes.

Conclusions

- Large dispersion in interest rates on credit cards.
- Search model with endogenous search effort + product differentiation.
- Calibration does a reasonable job at matching accepted rates, offered rates and aggregate charge-offs.
  $\longrightarrow$ High and dispersed rates due to low search effort.
- We use the model to do policy experiments: interest rate caps and higher entry costs.
  - Caps reduce interest rate and increase consumer surplus.
    Large redistribution of surplus from lenders to borrowers, small aggregate welfare effects.
  - Higher fixed costs reduce consumer surplus, lender profits, and aggregate welfare.

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