

Competing for Customers: A Search Model of Market for Unsecured Credit

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Unsecured Credit Market in the US _____

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 - Rapid penetration and use of this type of borrowing
- Soaring bankruptcy rate on credit card debt
 - Increasing filings under Chapter 7
 - Increasing fraction of debts charged-off from bank's balance sheets
- Questions about the driving forces behind these patterns

Credit Card Market: Characterization _____

- Contracts
 - Credit limit L , interest rate R
 - Multi-period arrangements on predictable terms (even if not explicitly written into the contract)

Credit Card Market: Characterization ---

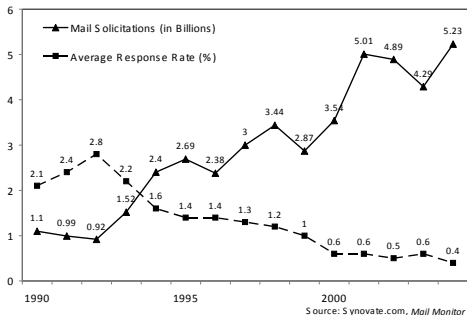
- Key features of credit card market
 - Solicitation main form of customer acquisition
 - 75% of new accounts established are bank initiated contacts (mail, email, phone)

Credit Card Market: Characterization _____

- Key features of credit card market
 - Switching to better deals a common practice
 - Customers do not commit to cards; switching comes at low cost (60% of solicited offers carry an option of a balance transfer)

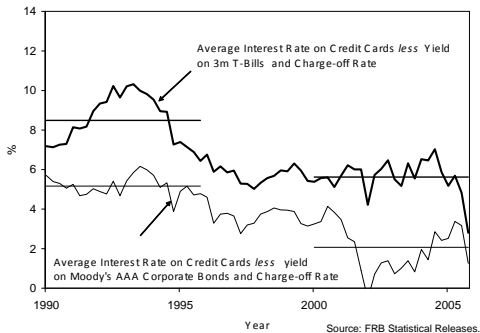
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- Key features of credit card market
 - Evidence for growing competition for customers
 - Rapid growth of solicitations of new customers



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 - Lower average interest premia on credit cards



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Main Objectives of The Paper

- Want to develop tools to analyze markets with these features
- Propose quantitative theory that captures institutional arrangements of the credit card market
 - Long-run relationships
 - Customer acquisition through direct solicitation
- Investigate quantitative implications of the theory
 - Propose comparative statics exercise of reducing matching cost
 - Show theory can generate some of the trends we see

Key Building Blocks of Theory ---

- Contracts
 - Credit limit L , interest rate R
 - Credit card contract long-lasting
 - Bank commitment - contract lasts until consumer switch or default

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- Contracts
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- Customer acquisition
 - Search and matching model of competition for customer
 - Simultaneous arrival of offers
 - Trade-off between prob. of acceptance and ex-post profit

Relation to Literature

- Search theory: Extension of Butters (1977) and Burdett-Judd (1983) to a dynamic environment with heterogeneous agents
 - Novel features: poaching, history dependent pricing
- Other work on unsecured credit:
 - Models with period-by-period, competitive zero profit pricing: Chatterjee, Corbae, Nakajima, Rios-Rull (2006), Livshits, MacGee, Tertilt (2007a), Athreya (2001,2004)
 - Pooling of default risks with a single intermediary: Athreya (2002)
 - Progress in information technology: Narajabad (2007), Livshits, MacGee, Tertilt (2007b), Sanchez (2008)
 - Long-lasting contracts with switching costs: Mateos-Planas and Rios-Rull (2007)

Model

Overview

- Infinite horizon continuous time Bewley economy
 - exogenous risk-free interest rate r^f
- Credit market aids consumption smoothing
- Two types of agents: Households and Banks

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- Infinite horizon continuous time Bewley economy
 - exogenous risk-free interest rate r^f
- Credit market aids consumption smoothing
- Two types of agents: Households and Banks
- Households
 - Face idiosyncratic income shocks, stochastically die
 - Use saving or borrowing on credit cards to smooth consumption
 - Stochastically receive new credit card offers
 - Option of default

- Infinite horizon continuous time Bewley economy
 - exogenous risk-free interest rate r^f
- Credit market aids consumption smoothing
- Two types of agents: Households and Banks
- Banks
 - Compete for customers by sending out credit card offers (L, R)
 - Making an offer has fixed cost χ (targeting cost)
 - Offers can be precisely targeted to any household type
 - Profit from interest rate spread $R - r^f$
 - Risks on credit cards: default, death, winning offer by another bank

- Infinite horizon continuous time Bewley economy
 - exogenous risk-free interest rate r^f
- Credit market aids consumption smoothing
- Two types of agents: Households and Banks
- Competition
 - Simultaneous arrival of offers
 - Mixed strategy equilibrium over credit card offers
 - Trade off between acceptance prob. and profitability

Formalization

- Assume cumulative income Y evolves according to

$$dY = \bar{y}dt + \sigma(\bar{y})dz$$

where $\bar{y} \in \{\bar{y}_1, \dots, \bar{y}_n\}$ follows Markov chain with transition matrix $m(\bar{y}'|\bar{y})$ and arrival of switches η ; dz is a Wiener process

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- Credit card: L is credit limit, R is interest rate
- Law of motion for assets

$$da = radt + dY - cdt$$

where: $r = r^f$ if $a \geq 0$, $r = R$ if $a < 0$, $a \geq -L$

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Households

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- State of consumer θ : Assets a , Income \bar{y} , credit card L, R

Households: Optimization Problem

- Consumers choose consumption plans & default decision to maximize

$$V(a, \bar{y}, L, R) = \max E\left\{\int_0^T e^{-\rho t} U(c(t)) dt + e^{-\rho T} V'\right\}$$

subject to

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- $da = (ra + \bar{y} - c)dt + \sigma(\bar{y})dz$
- T is the stopping time associated with discrete change in state
 - arrival of income regime change from \bar{y} to \bar{y}' (Poisson intensity η)

$$V' = \sum m(\bar{y}'|\bar{y})V(a, \bar{y}', L, R)$$

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- $da = (ra + \bar{y} - c)dt + \sigma(\bar{y})dz$
- T is the stopping time associated with discrete change in state
 - arrival of a better credit card offer (Poisson intensity $kp(\theta)$)

$$V' = \int v \mathcal{F}(dv|\theta)$$

- where $\mathcal{F}(v|\theta)$ is the distribution of best nonempty offer

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subject to

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- T is the stopping time associated with discrete change in state
 - death (Poisson intensity δ)

$$V' = 0$$

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subject to

- $da = (ra + \bar{y} - c)dt + \sigma(\bar{y})dz$
- T is the stopping time associated with discrete change in state
 - default: exclusion to autarky and utility cost

$$V' = V^D(\bar{y}) - \varphi$$

Households: Default Decision

- Suppose the consumer has contract L, R . We identify a leaving the set $a \geq -L$ with default. Then,

Lemma For $a = -L$, for any Δt , the process a leaves the set $a \geq -L$ with probability one.

- **It is suboptimal to default at any $a > -L$. Default occurs only on the bound $a = -L$, and more importantly, necessarily occurs then.**

Entry Protocol (Matching)

- Banks choose number and type of offers they send out to each HH-type θ
- Each HH receives a full mailbox of offers at intensity k (e.g. once per month)
- Number of offers in the mailbox is drawn from geometric distribution (simplifying assumption)

$$P(\text{number of offers} = n) = p^n(1 - p)$$

- Households look at them, and choose the best one

Banks

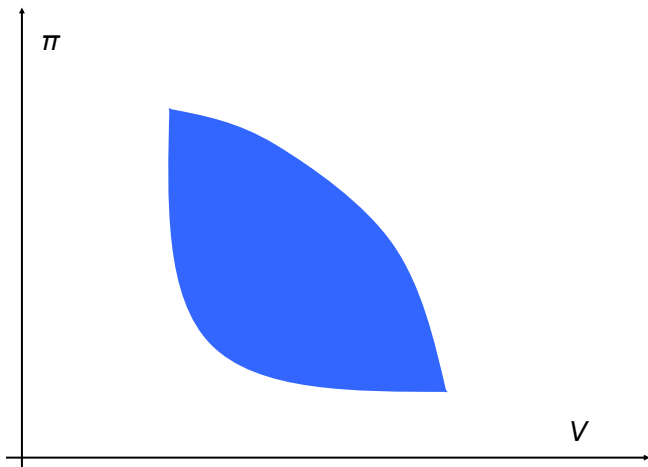
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- Choose which L, R to offer to each type
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- A contract L, R to consumer with (a, \bar{y}) gives
 - profit $\pi = \pi(a, \bar{y}, L, R)$
 - utility $v = V(a, \bar{y}, L, R)$
- Convenient to specify contracts in utility space

- Derive $\pi(a, \bar{y}, L, R)$ from a given contract
- Derive profit maximizing way of delivering utility v
- Since CRS economy, zero profit condition determines scale
- Zero profit condition plus entry protocol assumption
 - scale parameter $p(\theta)$
 - mixing strategy $F(v|\theta)$

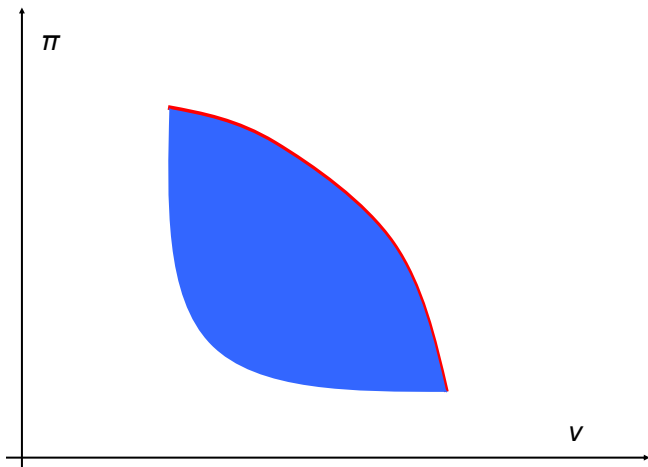
Bank's Problem: Graphical Illustration _____

Fix type: $\theta = (a, \bar{y}, \text{current}(L, R))$



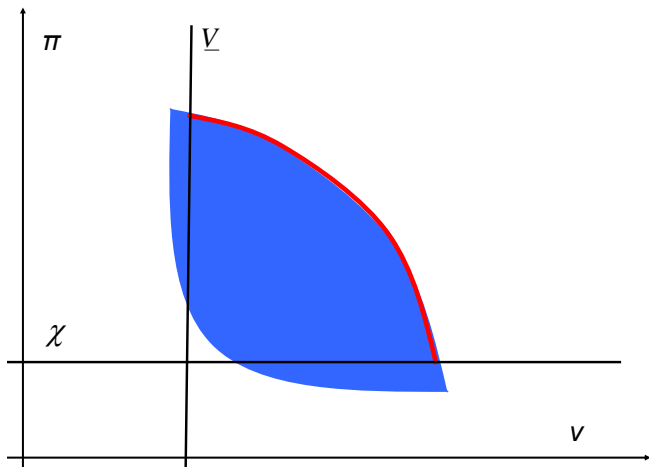
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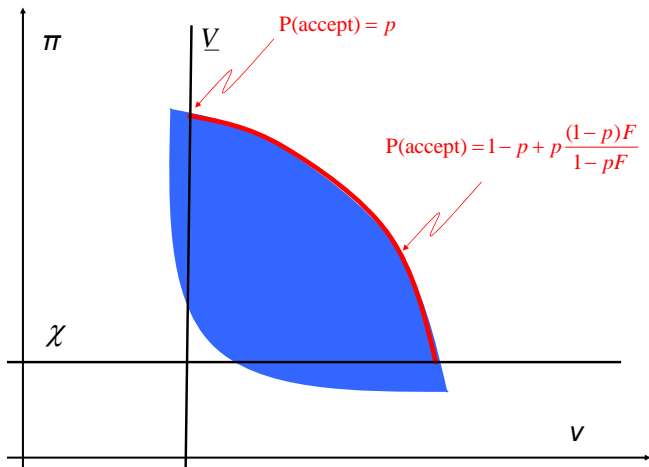
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Equilibrium

- Consumer policy $c(\theta)$ and value $V(\theta)$
- Bank's values $\pi(\cdot)$, $\Pi(v|\theta)$
- Bank's mixing strategy over v , $F(v|\theta)$ with support $[\underline{v}(\theta), \bar{v}(\theta)]$
- Scale parameter $p(\theta)$ and probability of acceptance of offer v

$$P_A(v|\theta) = (1 - p(\theta)) + p(\theta) \frac{(1-p(\theta))F(v|\theta)}{1-pF(v|\theta)}$$

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such that given $p(\theta)$ and $F(v|\theta)$:

- $V(\theta)$ and $c(\theta)$ solve the consumer problem
- The zero profit condition for marginal offer holds

$$P_A(v|\theta)\Pi(v|\theta) \leq \chi \text{ for all } v$$

with equality if $v \in [\underline{v}(\theta), \bar{v}(\theta)]$

Equilibrium Must Be in Mixed Strategies ---

- No pure strategy equilibrium
- Suppose all banks offer v
 - acceptance probability less than one
 - deviation: undercut by offering $v + \varepsilon$ and get accepted for sure

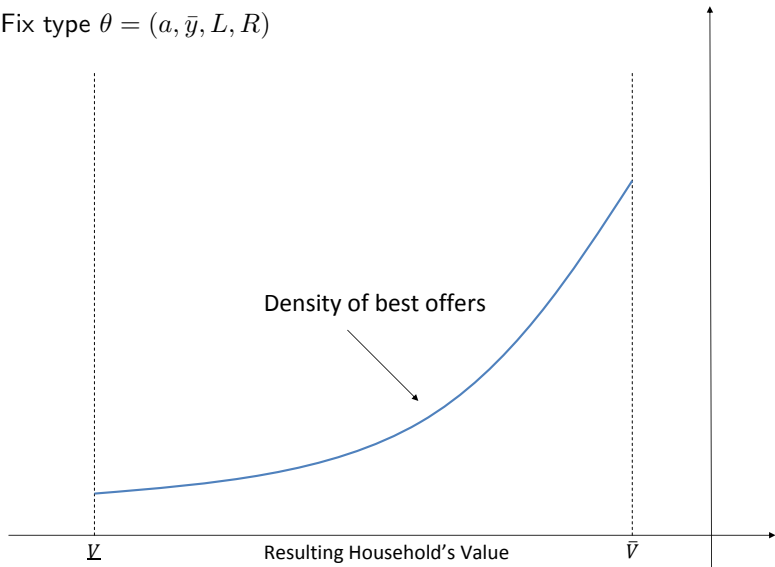
Model's Qualitative Implications

Novel Qualitative Features of Theory ---

- Equilibrium price dispersion
households with same characteristics get different deals
- Poaching of other bank's customers
banks steal customers from other banks
- History dependent pricing
over life-cycle household climb towards better deals

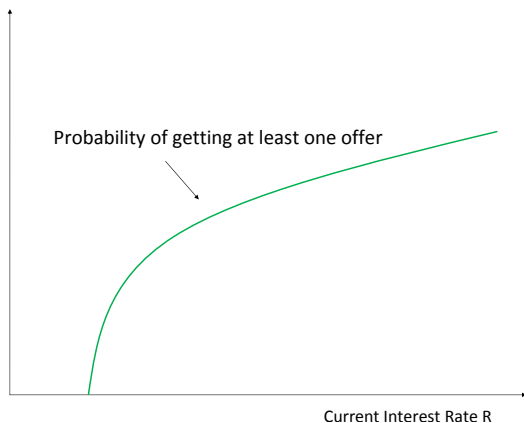
Equilibrium Price Dispersion

- Fix type $\theta = (a, \bar{y}, L, R)$



Poaching of Customer's of Other Banks _____

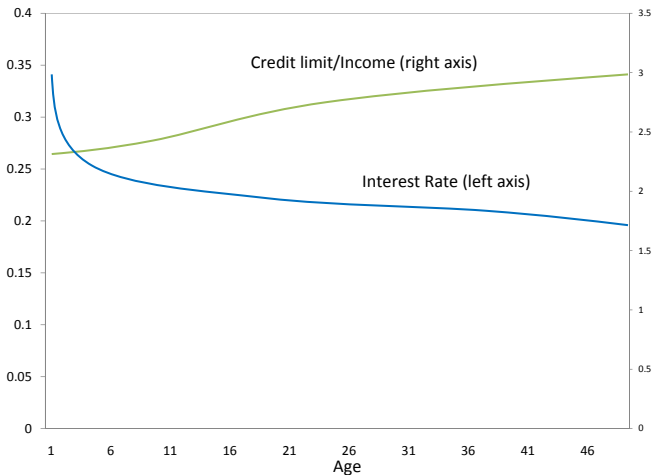
- Fix a, \bar{y}, L , vary R



- Poaching of other bank's customers
 - customer more attractive target the worse is current contract

History Dependent Pricing

- Average contract
 - quality climbs over life-cycle as long as good credit history



Model's Quantitative Predictions

Outline

- Parameterization
- Quantitative experiment of reducing χ
- Mechanism
 - Why our model implies increased bankruptcy filings while standard model doesn't (Livshits et al. (2007a))

Parameterization

- Cost of *successful* solicitation in 2004 is set equal to \$100
 - gives $\chi = 0.001$
- Target debt/income ratio of 5% in 1990 to obtain cost of *successful* solicitation in 1990
 - gives $\chi = 0.0017$
- Is a reasonable number?
 - Implies growth of technology of 3.3% annually since 1990
 - Number of solicitations grows by a factor of 3.6 between 1990 and 2004 (data: factor of 3)

Parameterization

- Preferences (CRRA utility)

Risk aversion $\gamma = 2$

Discount factor $\rho = 0.06$

- Income

Discretized version of the process from Guvenen (2005)

- Risk free rate $r^f = 2.5\%$ - average return on T-bills over postwar
- Set utility cost of default to match debt to income ratio of 10% in 2004

Parameterization

Model Parameters		Value
Discount factor	β	0.06
Risk free rate	r^f	2.5%
Arrival rate of death	ρ	0.02
Arrival rate of offer draw	k	12
Targeting cost	χ	0.001
Income process	\bar{y}_l	0.6
	\bar{y}_h	2.13
	$\sigma(\bar{y})$	$\{0.3\bar{y}_l, 0.3\bar{y}_h\}$
	η	1
	$m(\bar{y}' \bar{y})$	$\begin{bmatrix} 0.95 & 0.05 \\ 0.05 & 0.95 \end{bmatrix}$
Stigma	φ	12.5

Fall in Targeting Cost Can Generate Trends

- Increased penetration and use of credit cards

STATISTIC	DATA		MODEL	
	1990-1995	2000-2005	HIGH χ	LOW χ
% with credit card	56%	71%	24%	46%
% revolving balance	51.7%	55%	31%	35%

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- Growth of solicitations
 - Data 3-fold increase Model: 3.6-fold increase

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- Chargeoff rate
 - Data increase 3.5% to 4.9% Model: decrease 8.3% to 7.1%

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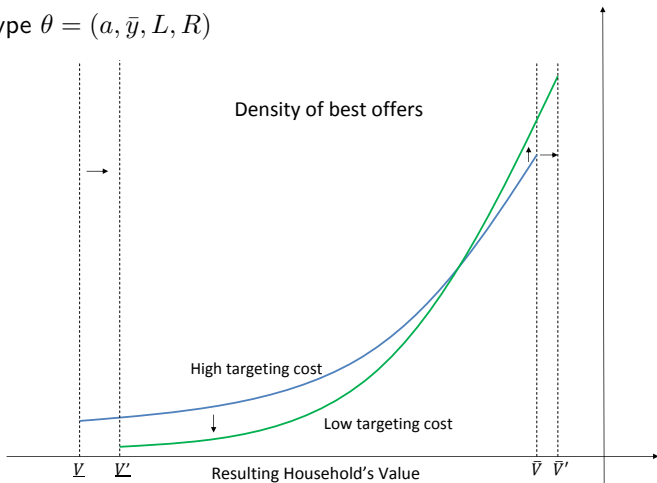
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 - better deals for consumers: lower price dispersion
 - increased targeting
 - intensive & extensive margin
 - more poaching
- Result: More revolvers, less savings
 - drives up debt & bankruptcy

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Lower Price Dispersion

Fix type $\theta = (a, \bar{y}, L, R)$



- Reducing the targeting cost χ

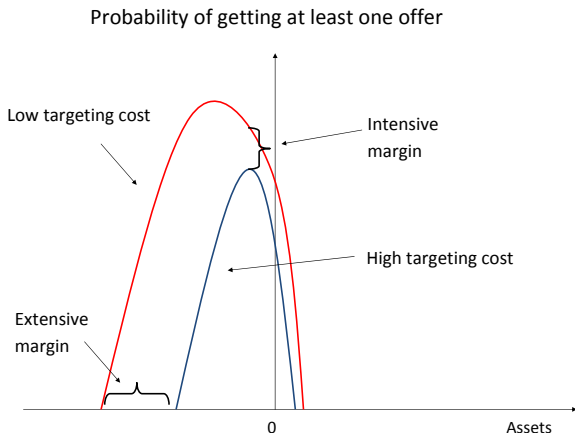
→ more competition: more surplus goes to the consumer

Mechanism: Primary Force _____

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 - better deals: lower price dispersion (conditional)
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 - **intensive & extensive margin**
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- Consumers: More revolvers, less savings
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Increased Targeting: Intensive & Extensive Margin

Fix \bar{y}_l, L, R



- Reducing the targeting cost
 - More types get new credit

Mechanism: Primary Force ---

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More Poaching

Fix a, \bar{y}, L , vary R

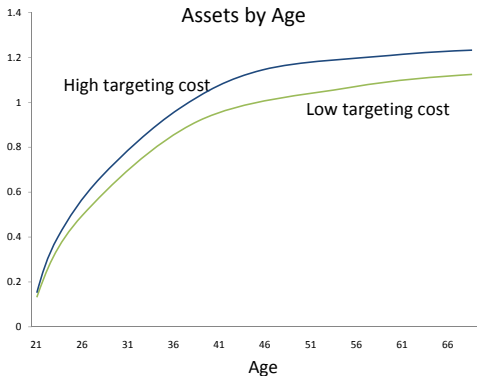


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- **Consumers: More revolvers, less savings**
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More Revolvers, Less Saving



- Fraction of revolvers goes up
- Less self insurance more bank 'insurance'
- This drives debt and bankruptcy

Mechanism: Lack of Offsetting Forces _____

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- Standard model: Offsetting forces to primary force
 - bankruptcy rate unchanged
- Two reasons why they are dampened here
 - Access to credit (25%)
 - consumers get access to credit earlier in life
 - Long-lasting contracting (85%)
 - conditionally, contracts are similar because matches last longer
conditional bankruptcy risk similar
 - more persistent dispersion drives precautionary savings
good risks that get poor deal escape to self-insurance

Conclusion

- Theory of unsecured credit with features of cc-market we see
- Effects of technological progress broadly consistent with key trends
- Novel Predictions for increased competition and poaching
- Counterfactual charge-offs
- Applies to other contexts, can be used to evaluate policies