Screening as a Unified Theory of Delinquency, Renegotiation, and Bankruptcy

Natalia Kovrijnykh[1] and Igor Livshits[2]

[1]Arizona State University
[2]University of Western Ontario and BEROC

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Motivation

- (Stages of) Default in consumer credit
  - Delinquency: payments are overdue by at least 60 days
  - Some, but not all, delinquent borrowers end up in bankruptcy
  - Lenders sometimes renegotiate with delinquent borrowers to prevent bankruptcy and achieve debt settlement
- There is no (simple) theory that models all these stages
  - More on related literature later

What We Do

- Construct a very simple model where delinquency, renegotiation, and bankruptcy all occur in equilibrium
- Key model ingredient: adverse selection
  - A borrower's bankruptcy cost is her private information
    - Lenders often do not observe personal characteristics that affect a borrower's willingness to pay
- All three phenomena are generated by a simple screening mechanism
- They match the default stages that we think of in reality
  - Some borrowers choose not to repay → become delinquent
  - Lenders renegotiate with some delinquent borrowers → debt settlement
  - In absence of renegotiation, delinquency leads to bankruptcy

What Others Do

- Consumer debt literature
  - Focuses on bankruptcy, but largely abstracts from delinquency, and especially renegotiation
- Sovereign debt literature
  - Focuses on default and (sometimes) renegotiation
  - Seldom distinguishes between ‘delinquency’ and ‘bankruptcy’ ($\sim$ ‘autarky’); default usually means one of the two
- In terms of the modeling approach
  - Our paper is related to the literature on optimal mechanisms of selling a good to heterogeneous risk-averse buyers

What We Do (Continued)

- Comparative Statics
  - Reasonable predictions about how the bankruptcy rate varies with debt and income
- Application: Government intervention in debt restructuring
  - Example: Mortgage Modification Program

Environment

- One lender, one borrower, one period
- Borrower
    - Risk averse, has utility function $u(c)$, $u' > 0$, $u'' < 0$
    - Has income I
    - Owes debt to the lender
        - For simplicity, we abstract from where debt comes from
    - Has the option of declaring bankruptcy
        - Idiosyncratic cost of bankruptcy, $\theta \in \{\theta_L, \theta_H\}$, unobservable to the lender, $\Pr\{\theta = \theta_H\} = \gamma$
        - Bankruptcy yields $v(I, \theta)$ to the borrower, zero to the lender
        - $v(I, \theta_L) > v(I, \theta_H)$ for any I
- Lender
    - Risk neutral
    - Demands repayment

Contracts

- Designed by the lender
- Deterministic contract: repayment R
  - A borrower of type i accepts if and only if $u(I-R) \geq v(I,\theta_i)$
- Two possible equilibria with deterministic contracts:
  - Offer R_L: $u(I-R_L) = v(I,\theta_L) \Rightarrow$ attract both types (pooling)
  - Offer R_H: $u(I-R_H) = v(I,\theta_H) \Rightarrow$ attract only high type (exclusion)
  - Which contract yields higher profits to the lender depends on γ
- The lender can potentially do better by offering a pair of *random* contracts (screening)

Screening Contract

Pair of contracts: R_1, (R_2, p)

- Deterministic contract (for the high type): R_1
- Random contract (for the low type): $R_2 < R_1$ with probability p, bankruptcy with probability $1 - p$
- To maximize the lender's profits:
  - $R_2 = R_L$ and $R_1 = R_S < R_H$, where (given p) R_S solves

$$u(I - R_S) = p \underbrace{u(I - R_L)}_{=v(I,\theta_L)} + (1 - p) \underbrace{u(I - R_H)}_{=v(I,\theta_H)}$$

  - Low type is indifferent b/w accepting (R_L, p) and bankruptcy
  - High type is indifferent b/w accepting R_S and (R_L, p)
  - Note: $p < 1$ only to keep the high type from accepting the contract meant for the low type

Interpretation of a Screening Contract

The lender

- Offers initial repayment
  - High cost borrowers accept it, low cost borrowers do not — consider these borrowers **delinquent**
- **Renegotiates** with delinquent borrowers — offers a lower repayment — but only with some probability
  - The fraction of borrowers with whom the lender does not renegotiate declare **bankruptcy**
  - The others reach debt settlement

The Lender's Problem

$$\max_{p\in[0,1]} \pi(p) \equiv \gamma R_S(p) + (1-\gamma)pR_L,$$

where $R_S(p)$ solves

$$u(I - R_S) = pu(I - R_L) + (1-p)u(I - R_H)$$

- Note: $p = 1$ ($p = 0$) corresponds to pooling (exclusion)
- Denote $p^* = \arg\max_p \pi(p)$

Equilibrium Contract

Claim 1

1. If the borrower is risk neutral, then $p^* \in \{0, 1\}$, i.e., screening is always dominated by either pooling or exclusion
2. If the borrower is risk averse, then $p^* \in (0, 1)$ for some parameter values
   - In particular, if the lender is indifferent between pooling and exclusion, then the equilibrium contract is a screening one

Introduce Debt Level:

- A borrower owes debt D to the incumbent lender
  - The lender cannot ask for a repayment in excess of D
- Previously analyzed "debt overhang" case whenever $D > R_S^*$
- The lender's problem is now

$$\max_{p \in [0,1], R_S^D} \gamma R_S^D + (1-\gamma) p R_L^D,$$

subject to

$$u(I - R_S^D) \geqslant p u(I - R_L^D) + (1-p) u(I - R_H)$$

and

$$R_S^D \leqslant D$$

where $R_L^D = \min\{R_L, D\}$

Optimal Contract in the General Case

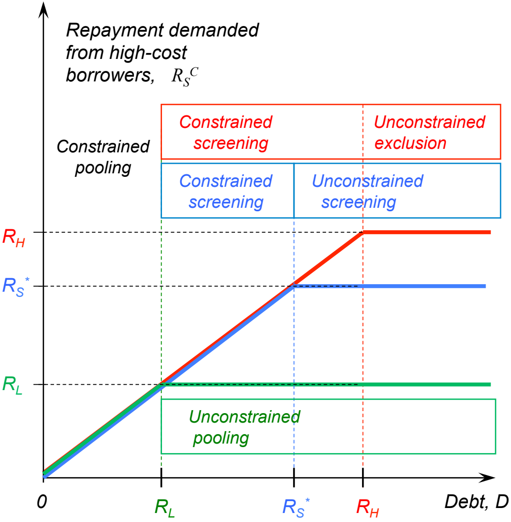
Proposition

(i) If $D \geqslant R_S^*$, then there is debt overhang and the lender offers $(R_S^*, (R_L, p^*))$ that solves the unconstrained problem.

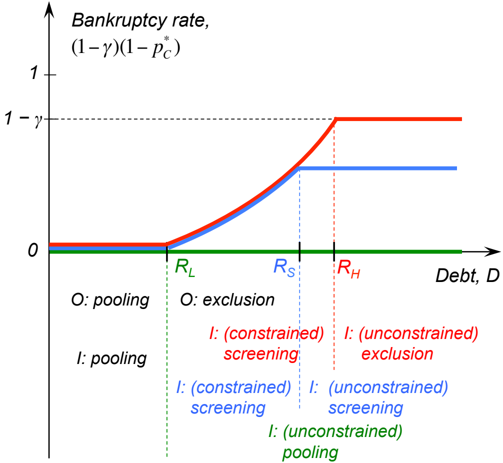
(ii) If $D \leqslant R_L$, then the lender demands repayment D, and all borrowers fully repay their debt.

(iii) If $D \in (R_L, R_S^*)$, then the lender performs screening: offers $R_S^D = D$ to the high-cost borrowers and R_L with probability $p_D^* > p^*$ to the low-cost borrowers.

Equilibrium Contracts Under Competition

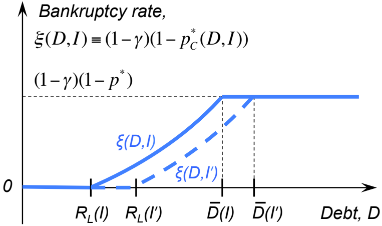


Equilibrium Under Competition



Bankruptcy Rate: Comparative Statics

- Bankruptcy rate ξ is increasing in debt, D ✓
- Comparative statics of ξ with respect to I
  - Example: $u(c) = \frac{c^{1-\sigma}-1}{1-\sigma}, \quad v(I,\theta) = u((1-\theta)I)$
- Within *monopolistic screening*, ξ is constant in I
- But debt threshold for monopoly is increasing in I
  - Competition is more likely to be relevant for higher I, and the bankruptcy rate is lower with competition ✓



Government Intervention in Mortgage Market

- Modeling private sector debt restructuring is crucial for understanding the effects of government intervention
- Example: Mortgage Modification Program
  - HAMP (Home Affordable Mortgage Program) in 2009
  - Aimed at lowering the foreclosure rate (and the deadweight loss associated with it)
- We will analyze effects of such a program through the lens of our model
  - Intervention may have unintended consequences if its design is naive and ignores the effect on private restructuring

Government Intervention in the Model

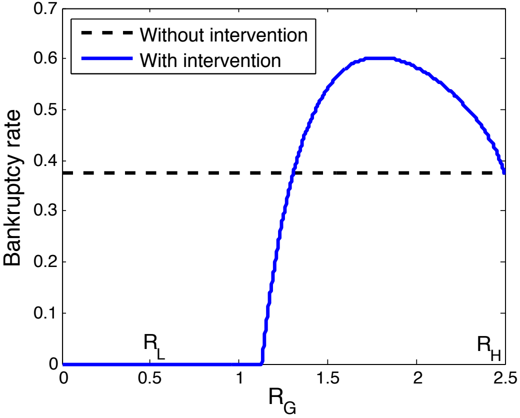
- Government intervention in our model:
  - Government steps in if bankruptcy (foreclosure) is initiated
  - Offers repayment R_G with probability p_G
  - If accepted, the repayment is transferred to the lender
- Suppose the laissez-faire outcome is unconstrained screening
- Key insights:
  1. The policy can be effective,
     even when government appears to be inactive
  2. The policy can have the opposite effect from the one intended
     — lead to more foreclosures in equilibrium

Note: In our model, intervention is never Pareto improving, since equilibrium is constrained Pareto efficient (the government is subject to the same frictions)

Deterministic Government Intervention ($p_G = 1$)

- If $R_G \geqslant R_H$, the intervention is irrelevant
  - Outcomes same as in *laissez-faire* benchmark
- If $R_G \leqslant R_L$, the intervention is completely successful
  - Intervention is similar to lowering debt level below R_L
  - induces "constrained pooling": the lender demands R_G, everyone repays (no delinquencies, no foreclosures)
- If $R_G \in (R_L, R_H)$, the intervention
  - may be completely successful while appearing irrelevant
    - R_G slightly greater R_L induce pooling
    - lender demands $R_L < R_G$, no foreclosures
  - or may "backfire" — increase foreclosure rate
    - when R_H is close to I, small probability of bankruptcy is enough to induce high-cost borrowers to pay
    - intervention is akin to lowering R_H

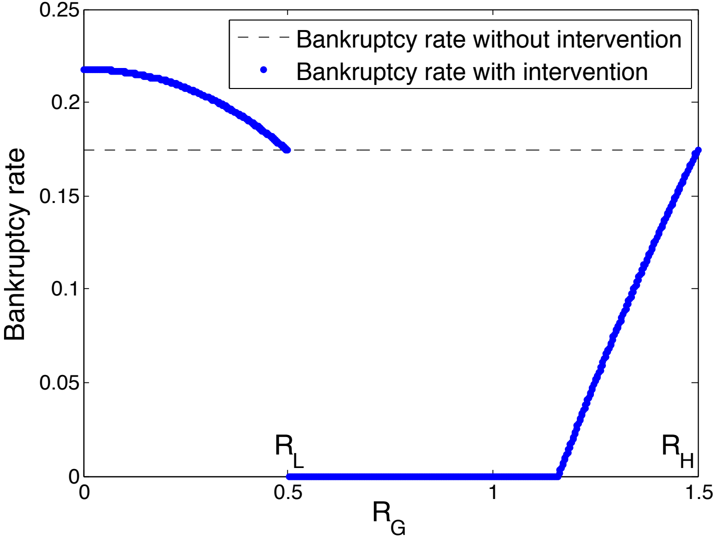
Government Intervention: Numerical Example



Random Intervention: Additional Insights

1. The intervention can be ineffective
   although the government is busy preventing foreclosures
   - Consider $R_G = R_L$ and $p_G \leqslant p^*$
   - The lender adjusts p to offset the intervention
   - The resulting foreclosure rate is same as laissez-faire
2. The program can backfire
   although the government's offer is accepted when offered
   - Consider $R_G < R_L$ and $p_G \leqslant p^*$
   - Affects the lender's ability to extract repayment
     not just from the high type, but also from the low type
   - As screening (renegotiation) becomes more costly,
     the lender may decrease p so much that
   - the resulting foreclosure rate increases instead of decreasing

Government Intervention: Numerical Example



Conclusions

- We constructed a simple model with adverse selection
- Delinquency, renegotiation, and bankruptcy all occur in equilibrium as a result of a simple screening mechanism
- Our model generates reasonable comparative statics with respect to debt and income
- Explicitly modeling private debt restructuring is crucial for analyzing the effects of government intervention

Government Intervention: Numerical Example