Costly Contracts and Consumer Credit

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Motivation

   - 1.4 filings per 1,000 adults in 1970 to 8.5 in 2002
   - Similar increase in Canada:
     from 0.2 per 1,000 adults in 1970 to 4.3 in 2002.

2. Unsecured consumer credit risen sharply.
   Lower income HHs borrow more today.

3. Livshits, MacGee + Tertilt (2006) argue 1 and 2 not driven
   by increased uncertainty but by credit market changes.

4. New (improved) lending technologies widely adopted:
   - Credit scoring: more institutions use credit scoring and
     place more weight on scores when evaluating loan
     applications (Engen (2000), Asher (2004)).
   - Faster time to approve loans, etc.
Question

Can better credit technology lead to increase in borrowing and increase in default simultaneously?

What we Do

1. Model endogenous consumer credit contracts with default.
2. Fixed cost of offering contract: bond price and quantity
3. Model improvements in credit technology as ↓ fixed cost
4. See if story qualitatively matches rise in borrowing and default.
5. Compare predictions of model to data.
Lessons

Fixed cost of offering lending contract implies that

1. Finite number of contracts in equilibrium.
2. Each contract serves sub-set of population.
3. Decline in cost of contract leads to more contracts
   (a) More "accurate" risk-based pricing
       Less cross-subsidization from low to high risk borrowers
   (b) Expansion of credit to riskier borrowers
   (c) More defaults
Related Literature

- Credit history and lending
  Chatterjee, Corbae and Rios-Rull (2006)

- Information and extension of credit to riskier borrowers:
  Narajabad (2005)

- More risk-based pricing of consumer loans in US:
  Edelberg (2006)
Simple Model

- Two period endowment economy
- Endowment stochastic in second period.
- Household types differ in risk of endowment
- Exogenous (saving) interest rate.
- Incomplete markets: Non-contingent debt only
- Exogenous bankruptcy rule: Consumers can file
- Fixed cost offering *each* lending contract
- Financial intermediaries (lenders)
  Free entry – can offer contract at cost $\chi$
Model: People

- Risk-neutral borrowers:

\[ c_{i,1} + \beta E c_{i,2} \]

- Endowment:
  - No uncertainty in period 1.
  - In period 2, \( y_i \in \{y_l, y_h\} \).
  - Borrowers differ in probability \( \rho_i \) of good state \( y_h \).
  - \( \rho_i \) distributed uniformly on \([0, 1]\).
  - Expected value of period 2 income of household \( i \)

\[ E_i I_{i,2} = (1 - \rho_i)y_l + \rho_i y_h \] (1)
Financial Intermediaries

- Pay fixed cost $\chi$ to offer *each* contract.
- Contract: $(q, d)$ to multiple customers.
- Cost of funds: risk-free price $\overline{q} = \frac{1}{1+r}$.
- Make loans to households.
- Lenders see signal of household type
  Probability $\alpha$ signal is households true type $\rho^i$:
  Start with $\alpha = 1$
- Can reject applicants.
- Contracts observable by competition and households.
- Cream-skimming possible.
Bankruptcy

- Borrowers can declare bankruptcy in period 2. ⇒ bankruptcy option introduces partial contingency by allowing bankrupts to discharge their debts.

- Cost of bankruptcy
  1. Loose a fraction $\gamma$ of endowment

- Borrowing limits
  1. Risk-free contract: $L_{rf} = \gamma y_l$
     Always repaid.
  2. Risky contract: $L_r = \gamma y_h$
     Repaid with probability $1 - \rho_i$. 
Proposition 1: All contracts offered feature either
1. \( d = \gamma y_l \) (risk-free)
2. or \( d = \gamma y_h \) (risky).

Proposition 2: Every lender offering risky contract rejects an applicant \textit{iff} the expected profit from that applicant is negative: Reject all \( \rho \leq \rho(q) = q \frac{1}{q} \).

Intuition: Expected present value of repayment \( \frac{\rho}{q} \) ⇒ "riskiest" household accepted by contract makes no contribution to overhead cost \( \chi \).
Equilibria: Characterization

- Free entry into intermediations determines “supply” of equilibrium contracts
- Zero profit condition
  \[
  \int_{\rho_n}^{\rho_{n-1}} (\rho_i q - q_n) \bar{L} di - \chi = 0
  \]
  \( (2) \)
- Household participation decision determines “demand” for contracts
  If top (lowest risk) household in interval participates, then all HH in interval find participation beneficial.
Equilibria: Characterization

**Proposition 3:**  Finitely many \((N)\) risky contracts offered. Each contract \((q_n, \gamma y_h)\) serves borrowers in interval \(\rho \in (\rho_n, \rho_{n-1}]\), where

\[
\rho_n = 1 - n\sqrt{\frac{2\chi}{y_h \gamma q}}
\]

\[
q_n = \bar{q}\rho_n
\]

If risk-free contract \((q_f, \gamma y_l)\) offered, serves borrowers with \(\rho \in [0, \rho_N]\).

\[
q_f = \bar{q} - \frac{\chi}{y_l \gamma \rho_N}
\]
Fixed Cost ($\chi$) and Contract Coverage

- Length of interval served by each contract increasing in $\chi$.
- Number of risky contracts is (weakly) decreasing with $\chi$.

$\Rightarrow$ For large enough $\downarrow \chi$, number of risky contracts offered $\uparrow$
Fixed Cost ($\chi$), Borrowing and Defaults

- Total borrowing and defaults depend upon fraction of population covered by risky contract.
- Measure HH served by risky contracts: \( \sum_{n=1}^{N} (\rho_{n-1} - \rho_n) \)

\[
\Rightarrow \text{For small changes in } \chi, \sum_{n=1}^{N} (\rho_{n-1} - \rho_n) \text{ may } \uparrow \text{ or } \downarrow
\]

\text{but for sufficiently large } \downarrow \chi, \sum_{n=1}^{N} (\rho_{n-1} - \rho_n) \uparrow
Implications of Decline Fixed Cost ($\chi$)

- Sufficiently large $\downarrow \chi \Rightarrow N \uparrow$
  - Fraction of HH with risky loans $\uparrow$
    - item Total borrowing $\uparrow$
  - Defaults $\uparrow$
  - Borrowing by lower income (riskier in model) HHs $\uparrow$

- $\chi \downarrow \Rightarrow$ smaller "pools" $\Rightarrow$ cross-subsidization $\downarrow$.
  Why?: Lowest risk household "subsidizes" highest risk households in each pool $\rho \in (\rho_n, \rho_{n-1}]$
  $\Rightarrow$ more accurate risk-based pricing.
Other Implications of Decline Fixed Cost ($\chi$)

- More disperse interest rates and average borrowing interest rate ↑:
  Expansion of credit to higher risk HH

- ↓ overhead costs and ↓ overhead costs as % total borrowing. Decreases less than $\chi$ due to more contracts.
Comparing Predictions to Data

- Model predicts technological progress that lowers cost of offering loan contracts should lead to

1. More contracts
   Focus on interest rates as measure of more contracts
   Use Survey of Consumer Finance data on number of interest rate for credit cards.

2. Increased use of risky credit by lower income (riskier) households

   Edelberg (2006) documents that interest rate more closely linked to HH risk characteristics in 90s than in 80s.
More Contracts?

- Increase in number of different credit card interest rates reported by households.

<table>
<thead>
<tr>
<th>Year</th>
<th>All HH</th>
<th>HH with Debt</th>
</tr>
</thead>
<tbody>
<tr>
<td>1983</td>
<td>78</td>
<td>47</td>
</tr>
<tr>
<td>1995</td>
<td>142</td>
<td>118</td>
</tr>
<tr>
<td>1998</td>
<td>136</td>
<td>115</td>
</tr>
<tr>
<td>2001</td>
<td>222</td>
<td>155</td>
</tr>
<tr>
<td>2004</td>
<td>211</td>
<td>145</td>
</tr>
</tbody>
</table>

Source: Survey of Consumer Finance.
Anecdotal evidence: Increase in different credit cards contracts.

- Distribution of reported interest rates more disperse.
Other Comparative Statics?

- Shift in risk free rate:
  Decline in risk-free rate leads to increase in number of contracts
  Avg bond price of existing borrowers ↑
  Avg bond price of all borrowers changes little due to expansion of credit to riskier households.

- This may help to explain puzzle of credit card interest rate not declining after T-bill rate declined in 80s?
Conclusion: What Next

- Simple model of fixed cost of contracts can qualitatively generate key features of consumer credit markets over past 25 years.
- Further work needed to document (empirically) changes in consumer credit contracts.
- Extensions: Imperfect signals
  - May help generate robust equilibria with adverse selection?
  - Allow us to analyze implications of better credit evaluation technology – credit scoring stories.