A Quantitative Theory of Information and Unsecured Credit

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Changes in Debt and Default

- Increase in total holdings of unsecured credit
Changes in Debt and Default

- Increase in total holdings of unsecured credit
- Increase in bankruptcy filings
Chapter 7 Filings / Population over 16

Chapter 7 Filings Per Capita

[Graph showing the trend of Chapter 7 Filings Per Capita from 1980 to 2005.]
Changes in Debt and Default

- Increase in total holdings of unsecured credit
- Increase in bankruptcy filings
- Increase in debt discharged by filers

- **Mean Income of Filers**
  - 1981: $20,000
  - 1991: $22,000
  - 1997: $19,000

- **Median Income of Filers**
  - 1981: $25,000
  - 1991: $21,000
  - 1997: $23,000

- **Mean Unsecured Debts**
  - 1981: $25,000
  - 1991: $22,000
  - 1997: $24,000

- **Median Unsecured Debts**
  - 1981: $15,000
  - 1991: $18,000
  - 1997: $20,000
Changes in Debt and Default

- Increase in total holdings of unsecured credit
- Increase in bankruptcy filings
- Increase in debt discharged by filers
- Increase in dispersion in rates
Distribution of Interest Rates on Positive Credit Card Balances

- 2004
- 1995
- 1983
Changes in Debt and Default

- Increase in total holdings of unsecured credit
- Increase in bankruptcy filings
- Increase in debt discharged by filers
- Increase in dispersion in rates
- Increase in good borrower discount
Motivation

"Borrower Quality" Discount

FICO Score

Percentage Point Discount from High Risk Yield

Athreya, Tam, Young (FRB, UVa, UVa)
Main Question

- Can improvements in information account for these facts?
Related Work

- **Symmetric information:**
  - Narajabad (2007): better signals, more default
  - Drozd and Nosal (2008): marketing cost

- **Asymmetric information:**
  - Chatterjee, Corbae, and Ríos-Rull (2006): theory of credit scores
  - Sánchez (2008): screening contracts, infinite horizon
  - Livshits, MacGee, and Tertilt (2007): cheaper to differentiate borrowers, more contract variety, more default

- **Our paper:**
  - Lifecycle
    - Borrowing by the young often long-term
    - Default is lifecycle phenomenon
  - Asymmetric information – signalling game
Basic Setup

- $J$ overlapping generations
- Uninsurable idiosyncratic earnings risk
- Individualized pricing of loans
- Informational friction - lenders may not observe state vector of household
- General equilibrium, production economy
Timeline

\begin{align*}
\text{Default} & \quad \text{Not default} \\
\text{Cost } \Delta \text{ and } \lambda \text{ to file} & \\
b = 0 & \\
m' = 1 & \\
\text{Prob. } 1 - \xi & \\
b' & \\
e' & \\
\nu' & \\
\lambda' & \\
m'' = 1 & \\
\text{Prob. } \xi & \\
b'' & \\
e'' & \\
\nu'' & \\
\lambda'' & \\
m''' = 0 & \\
\text{Default} & \\
\text{Not default} & \\
\text{age } j & \\
\text{age } j + 1 &
\end{align*}
Pricing function:

\[ q(b, l) = \begin{cases} \frac{1}{1+r} & \text{if } b \geq 0 \\ \frac{(1-\hat{\pi}^b)\psi_j}{1+r+\phi} & \text{if } b < 0 \end{cases} \]

Full information:

\[ \hat{\pi}^b = \sum_{e',\nu',\lambda'} \pi_e(e'|e) \pi_\nu(\nu') \pi_\lambda(\lambda'|\lambda) d(b(a,y,e,\nu,\lambda,j,m), e',\nu',\lambda') \]

Partial information:

\[ \hat{\pi}^b = \sum_e \sum_{\nu} \sum_\lambda \Pi' \Pr(e,\nu,\lambda|b,y,j,m) \]

\[ \Pi' = \left[ \sum_{e'} \sum_{\nu'} \sum_{\lambda'} \pi_e(e'|e) \pi_\nu(\nu') \pi_\lambda(\lambda'|\lambda) d(b, e',\nu',\lambda') \right] \]
The Game

- Anonymous market assumption
- Households post desired borrowing (signaling) \( b \)
- Intermediaries post \( q \) for given \( b \) and are committed
- Households take highest \( q \) for their desired \( b \) (Bertrand competition)
Off-Equilibrium Beliefs

- Given $q(b)$, there exists stationary distribution $\Gamma^*$
- For each observable, find largest debt level $b$
- For $b < b$ set $q = 0$ (always default) as OEB
## Calibration

<table>
<thead>
<tr>
<th>Calibration</th>
<th>Model</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge/Income Ratio</td>
<td>0.306</td>
<td>1.000</td>
</tr>
<tr>
<td>Fraction of Borrowers</td>
<td>0.126</td>
<td>0.125</td>
</tr>
<tr>
<td>Debt/GDP Ratio</td>
<td>0.023</td>
<td>0.007</td>
</tr>
<tr>
<td>Default Rate</td>
<td>1.44%</td>
<td>1.20%</td>
</tr>
<tr>
<td>Interest Rate</td>
<td>1.02%</td>
<td>1.00%</td>
</tr>
</tbody>
</table>
### Aggregate Stats

#### Unsecured Credit Market Aggregates

<table>
<thead>
<tr>
<th>Metric</th>
<th>FI</th>
<th>PI</th>
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Pricing Functions

Unlucky | age=29,coll

Median | age=29,coll

Lucky | age=29,coll

Athreya, Tam, Young (FRB, UVa, UVa)
Pricing Functions

Unlucky | age=29, coll (High $\lambda$)

Median | age=29, coll

Lucky | age=29, coll

Athreya, Tam, Young (FRB, UVa, UVa)
$\text{Var}(q|b < 0)$
Default over States

![Graph showing default over states with different states: Low ν, Medium ν, High ν, and two lines for λ = H and λ = L.](image)
Default over Lifecycle
## Average Interest Rate | Whole Econ

<table>
<thead>
<tr>
<th></th>
<th>$b &lt; 0, m = 0$</th>
<th>$b &lt; 0, m = 1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>$b$ $q$</td>
<td>$b$ $q$</td>
</tr>
<tr>
<td>Coll</td>
<td>0.3026 0.9062</td>
<td>0.1348 0.8706</td>
</tr>
<tr>
<td>HS</td>
<td>0.1009 0.8563</td>
<td>0.0495 0.8160</td>
</tr>
<tr>
<td>NHS</td>
<td>0.0378 0.8372</td>
<td>0.0303 0.7963</td>
</tr>
</tbody>
</table>
Pricing Functions

![Price function graph | age=29, coll]

- Price function | age=29, coll

- Graph showing the relationship between $b_{-1}$ and $q$. The graph indicates a step function where there is a sharp increase from 0 to 1 as $b_{-1}$ increases from -0.05 to -0.04.
Pricing Functions

- Rates go immediately from $r + \phi$ to $\infty$
- Risk-free borrowing is also restricted
- Unsecured credit market disappears (lemons problem)
Where Does All the Credit Go?

- Assume $q^0$ is pricing function (risk-free borrowing)
- Bad borrowers would default, raising premium
- Good borrowers reduce borrowing
- Bad borrowers are identified, premiums rise, borrowing falls
- Good borrowers must reduce borrowing again
- Continues until debt is essentially risk-free
Consumption Smoothing

![Graph showing mean consumption over age]

- FI
- PI
- NBK

E(log(c|age, coll))

Age

Results
Consumption Smoothing
Consumption Smoothing

![Graph showing consumption variability | coll]

- FI
- PI
- NBK

V(log(c|age, coll))

Age range: 25 to 60

Consumption variability increases with age for all models, with FI showing the highest variability, followed by NBK and then PI.
## Welfare Gain

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<th>HS</th>
<th>NHS</th>
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<tr>
<td>$PI \rightarrow FI$</td>
<td>1.05%</td>
<td>0.61%</td>
<td>0.59%</td>
</tr>
<tr>
<td>$PI \rightarrow NBK$</td>
<td>3.21%</td>
<td>1.24%</td>
<td>1.19%</td>
</tr>
<tr>
<td>$FI \rightarrow NBK$</td>
<td>2.16%</td>
<td>0.63%</td>
<td>0.60%</td>
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Summary

- Improved information can account for behavior of unsecured credit
  - more default and more debt
  - dispersion in interest rates
  - good borrower discount
- Improved information makes all households better off
- Bankruptcy rate not informative for desirability of bankruptcy reform
Ongoing work

- Understand consequences of banning information
  - Equal Credit Opportunity Act (US)
  - Data Protection Directive (EU)
  - Race Relations and Sex Discrimination Acts (UK)

- Hirshleifer Effect is less information sometimes better?