Tracing the Effect of Scores on Small Loan Production

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Barriers to Small Firm Lending

• Large lenders target large borrowers
  – Fixed cost per borrower of collecting information
  – Small firm lending requires “soft information”

• Micro-lenders do not “scale borrowers up”
  – Reasons are not well understood
  – Technology, organization, loan officer/managerial skills, risk, capital?
This Paper

• Measure effect of credit scoring on productivity and output of bank specialized in small firm loans
  – Mechanism?

• Empirical design: randomized introduction of scores in application folders
Setting

• BancaMia
  – For-profit bank in Colombia
  – Focused on micro and small enterprise loans
  – During October 2010 (month prior to RCT)
    • 143 branches
    • 20,219 new loans, US$25.9 million
Client Examples

Garment

Restaurant

Taxi

Retail
Credit Assessment Process

Data Collection/Screening
- Officer visits business, home, neighbors
- Officer decides to bring application to committee
- Inputs data on PDA

Credit Assessment
- Committee in bank branch
- Officer + Manager + 1 Specialist
- Based on collected data, prior credit record, and industry data

Send problem “up”
- Boss rejects
- Approves, sets terms

More Information

Make a decision
- Reject
- Approve, set terms

6.2%
4.8%
89%
100%
(control group)

9/10/2012
Committee Incentives

• Explicit
  – Wage
  – Bonus related to loans issued (not approved):
    • Number of credits issued (+)
    • Value of credits issued (+)
    • % of value late in repayment (-)

• Implicit
  – Firing, promotions
Credit Scores

• Developed by independent third-party consulting firm
• Observable characteristics → historical default probabilities
  – Objective:
    Gender, age, number of years in business, overall indebtedness, house expenditures as % of income, late payments during past 3 years, …
  – Subjective:
    Business knowledge, quality of information provided, stability and diversity of household income, …
Scores and Default Probability
Empirical Relationship

- Sample: 20K+ loans issued in October 2010
- Default = > 60 days late six months after issued
- Note: score ≈ default probability x 10

Local polynomial smooth

kernel = epanechnikov, degree = 0, bandwidth = .05, pwidth = .08
Research Design

Data Collection/Screening
- Officer visits business, home, neighbors
- Inputs data on PDA
- Officer decides to bring application to committee

Credit Assessment
- Committee in bank branch
- Officer + Manager + 1 Specialist
- Based on collected data, prior credit record, and aggregate/industry data

More Information

Send problem “up”
- Boss rejects
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Make a decision
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Trial Design

• Pilot program: eight branches
• Randomize at the application level
• Three groups (observable by committee):
  – C: no score
  – T1: disclose score at the beginning of evaluation
  – T2: withhold score until committee chooses *interim* action, then disclose score and allow committee to revise
Results (1)

- Scores change committee productivity and the organization of loan production
  - Committees spend 16% more time evaluating the average application
    - From baseline of 4.7 minutes
  - Committees make more decisions
    - “Punt” on 6.8 per 100 cases (down from 11 per 100)
    - Reject 2.1 per 100 cases (up from 0.3 per 100)
  - Overall outcomes unchanged
    - Same overall rejection rate and default rate
Which are the Marginal Loans?
Kernel-weighted local polynomial regressions, by Treatment Status

Evaluation Time, by Score

Evaluation Time, by Requested Amount

Probability of Deciding, by Score

Probability of Deciding, by Requested Amount
Trial Design

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• Three groups (observable by committee):
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## Information Content of Score Versus Use of Existing Information

<table>
<thead>
<tr>
<th>Interim Decision</th>
<th>Final decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Existing</td>
</tr>
<tr>
<td>T1</td>
<td>Existing + Score</td>
</tr>
<tr>
<td>T2</td>
<td>Existing + Score</td>
</tr>
</tbody>
</table>
Results 2

- Committees make more interim decisions (before seeing score)
  - Reduces the likelihood that the application is sent to zone manager
  - After seeing score, make even more decisions
  - Over $\frac{1}{2}$ of the effect occurs before seeing scores
Conclusions

• Scores improve committee output and effort
  – Substitute for costlier alternatives (use of “specialist” time, collecting additional information in the field)

• Scores lower the cost of producing the largest and smallest loans
  – Potential to change the loan size composition of the portfolio
  – No effect on infra-marginal loans

• Two distinct mechanisms
  – More information
  – Use information more effectively (e.g. monitoring, standardization, confirmation)
Thank You!
## Application Characteristics and Final Outcomes by Committee Choice

Without scores (Control Group)

<table>
<thead>
<tr>
<th></th>
<th>Decide (n = 298)</th>
<th>Send Up (n = 16)</th>
<th>More Info (n = 21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requested Amount (US$)</td>
<td>1,443 1,170</td>
<td>2,480 2,126</td>
<td>2,476 1,994</td>
</tr>
<tr>
<td>Credit Risk Score</td>
<td>0.152 0.069</td>
<td>0.155 0.060</td>
<td>0.137 0.047</td>
</tr>
<tr>
<td>First Loan (Dummy)</td>
<td>0.154</td>
<td>0.125</td>
<td>0.048</td>
</tr>
<tr>
<td>Time to decision by Committee (min)</td>
<td>4.608 3.188</td>
<td>5.438 3.405</td>
<td>5.105 4.508</td>
</tr>
<tr>
<td>Loan Issued (Dummy) *</td>
<td>0.752</td>
<td>0.750</td>
<td>0.333</td>
</tr>
<tr>
<td>In Default after 6 Months (Dummy) **</td>
<td>0.031</td>
<td>0.000</td>
<td>0.143</td>
</tr>
</tbody>
</table>

* Loan appears in BancaMia’s central information system as issued
** Conditional on loan being issued
Framework
(Garicano 2000 + agency)

• For each application, committee faces trade-off between
  – Solving problem itself with available/new information (cost of making mistake, effort)
  – Sending problem “up” to expert (communication cost, cost of looking incompetent)

→ In equilibrium: committee sends difficult problems up

• Effect of score on committee output
  – Improves committee information
    → Reduces likelihood of mistake → more (marginal) decisions
  – Standardization reduces cost of communication
    → More problems sent to boss → fewer (marginal) decisions
  – Makes problem difficulty observable
    → Only hard problems sent to boss → more (marginal) decisions
  – Ex ante effect on information collection
    → Sign ambiguous: complements or substitutes?
## Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>Control (n = 335)</th>
<th>Treatments (T1, T2) (n = 1,086)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Requested Amount (USD)</td>
<td>1,551.5</td>
<td>1,321.4</td>
<td>1,552.7</td>
</tr>
<tr>
<td>Credit Risk Score</td>
<td>0.151</td>
<td>0.068</td>
<td>0.156</td>
</tr>
<tr>
<td>First Application (Dummy)</td>
<td>0.146</td>
<td>0.068</td>
<td>0.153</td>
</tr>
</tbody>
</table>

### Panel A. Ex Ante Loan Characteristics

### Panel B. Committee Outcomes

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation Time (Minutes)</td>
<td>4.68</td>
<td>3.28</td>
</tr>
<tr>
<td>Committee Approves/Rejects (Dummy)</td>
<td>0.890</td>
<td>0.940</td>
</tr>
</tbody>
</table>

### Panel C. Committee Outcomes, Conditional on Reaching decision

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loan Approved (Dummy)</td>
<td>0.997</td>
<td>0.985</td>
</tr>
</tbody>
</table>

### Panel D. Final Outcomes, Conditional on Loan Issued

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disbursed Amount/Requested Amount</td>
<td>0.959</td>
<td>0.382</td>
</tr>
<tr>
<td>In Default after 6 Months (Dummy)</td>
<td>0.033</td>
<td>0.040</td>
</tr>
</tbody>
</table>
Application Characteristics
Cumulative Distributions

1. Score

2. Requested Amount

K-S test p-value = 0.816

K-S test p-value = 0.942
Evaluation Time by Score and Amount
Kernel-weighted local polynomial regressions, by Treatment Status

Evaluation Time, by Score

Evaluation Time, by Amount

9/10/2012