Theory of Credit Markets

"... determining whether there is an important niche for microfinance requires an understanding of how markets work and how the informal sector fills the gaps — and of how and where markets and the informal sector come up short." de Aghion and Morduch (2005)

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Overview

- Credit market transactions typically involve **asymmetric information**

- Nature of credit market institutions reflects private–sector response to this market failure

  - formal sector vs. informal sector responses differ

- Significant entry in informal sector, BUT

  - informational constraints
  - market segmentation
  - “local” market power
  - monopolistic competition

- Role for government, but must recognize informational disadvantages

  - need “institutional innovation”
A Standard Debt Contract

Simple Example:

\[ B = \text{loan size} \]
\[ i = \text{lending rate} \]
\[ R = \text{project return (uncertain)} \]
\[ C = \text{collateral} \]

Default occurs if

\[ C + R < (1 + i)B \]

Borrower has limited liability
Two kinds of investment:

1. Safe: \[ R = \begin{cases} L_1 & \text{with prob. } \frac{1}{2} \\ H_1 & \text{with prob. } \frac{1}{2} \end{cases} \]

2. Risky: \[ R = \begin{cases} L_2 & \text{with prob. } \frac{1}{2} \\ H_2 & \text{with prob. } \frac{1}{2} \end{cases} \]

where

\[ \frac{1}{2}L_1 + \frac{1}{2}H_1 = \frac{1}{2}L_2 + \frac{1}{2}H_2 \]
Figure: Payoffs in a Standard Debt Contract
Figure: Mean-Preserving Spread
A mean–preserving increase in risk makes the borrower better off and the lender worse off.

This conflict leads to three types of agency problem:

- Adverse Selection
- Ex ante moral hazard — excessive risk taking
- Ex post moral hazard — enforcement problems
Agency Problems

- Reasons for absence of formal credit in rural / village economies
  - A result of **limited liability** (lack of collateral) and **asymmetric information**
  - Even when titled land is available, formal banks may not accept it as collateral

- Two main rationales for government intervention
  - Efficiency: are productive investments not being undertaken?
  - Distribution: is access to credit equitable?
  - there need not be a trade-off between equity and efficiency
Adverse Selection

Example (Aghion and Morduch p. 37-43)

- Investment requires $B = 1$, but borrowers have no wealth
- A fraction $q$ of borrowers are “safe”: earn certain output $y$
- A fraction $1 - q$ of borrowers are “risky”:

\[
\text{Output} = \begin{cases} 
\bar{y} & \text{with probability } p \\
0 & \text{with probability } 1 - p
\end{cases}
\]

- Bank cannot distinguish borrower types
- Equal expected return: $p\bar{y} = \underline{y}$.
- Gross cost to bank per $1$ lent $= k$, where $y > k$

- Bank must choose a gross lending rate $R = 1 + i$
How does the bank’s expected profit vary with $R$?

- Given $R$, the bank’s expected return per dollar lent is 
  \[ q + (1 - q)p \] \[ R \]

- Define the “break-even” value of $R$ as $R_b$
  \[ \left[ q + (1 - q)p \right] R_b = k \]
  \[ R_b = \frac{k}{q + (1 - q)p} \]
  \[ R_b = k + \frac{(1 - q)(1 - p)k}{q + (1 - q)p} \]
  \[ R_b = k + A \]

- Bank’s expected profit:
  \[ \bar{\pi} = \begin{cases} 
  \left[ q + (1 - q)p \right] R - k & \text{if } R < y \\
  pR - k & \text{if } R > y
  \end{cases} \]
Figure: Bank’s expected profit with high value of $p$
Figure: Bank’s expected profit with low value of $p$
Implications

- Raising interest rates need not always increase profits
  - at high rates, less risky borrowers drop out of the market

- If $p$ falls, the bank may not be able to break even at a rate low enough for safe borrowers
  - banks will only serve risky borrowers
  - this is inefficient (since $y > k$) and also inequitable
  - credit rationing
Numerical Example

- Loan size needed: $100
- Lender’s cost of capital per $100 lent: $k = $140$
- Borrower’s opportunity cost: $45$
- Fraction of safe borrowers: $q = 0.5$
Scenario 1

- Safe types revenue: $\bar{y} = 200$
  - Risk type’s revenue: $\overline{\bar{y}} = 222$ with probability $p = 0.9$

→ are these investments efficient?

- Break-even gross interest rate satisfies:

$$[0.5 + 0.5 \times 0.9]R_b = 140$$

which implies

$$R_b = \frac{140}{0.95} = 147.4$$

→ bank must charge 47.4% interest to break even

- Will the investments be undertaken?

→ Safe borrower’s profit $= 200 - 147.4 = 52.5 > 45$

→ Risky borrower’s profit $= 0.9(222 - 147.4) = 67.4 > 45$
Scenario 2

- Safe types revenue: $y = $200
- Risk type’s revenue: $y = $267 with probability $p = 0.75

→ are these investments efficient?

- Break-even gross interest rate satisfies:

\[
[0.5 + 0.5 \times 0.75]R_b = 140
\]

which implies

\[
R_b = \frac{140}{0.875} = 160
\]

→ bank must charge 60% interest to break even

- Will the investments be undertaken now?

→ Safe borrower’s profit = $200 - 160 = 40 < 45

→ Risky borrower’s profit = 0.75 \times (267 - 160) = 80.3 > 45
Since safe types drop out, the break-even interest rate satisfies:

\[ 0.75R_b = 140 \]

which implies

\[ R_b = 186.7 \]

Do the risky borrowers stay in the market?

**Risky borrower’s profit:**

\[ 0.75 \times (267 - 186.7) = 60.2 > 45 \]

yes, but earn less than if safe types remained
Ex ante Moral Hazard

Example

- Suppose borrower can affect riskiness via his/her effort
- Projects require $1 investment
- Non-shirker generates output $y$ for sure
- Shirker generates

\[
\text{output} = \begin{cases} 
  y & \text{with prob. } p \\
  0 & \text{with prob. } 1-p 
\end{cases}
\]

- Cost of providing effort = $c$
- Gross interest rate = $R$
- Cost of funds to lender = $k$
Lending contract

- To ensure borrower supplies the required effort, $R$ must satisfy
  
  $$(y - R) - c \geq p(y - R)$$
  
  → incentive compatibility constraint

- lender’s maximum achievable lending rate
  
  $$R \leq R^* = y - \frac{c}{1 - p}$$

- if $R^* < k$, this loan will not be made, even if $y - k > c$
Enforcement Problems
(Ex post moral hazard)

Example

- Assume $1 is invested
- Capital cost $= k$
- Project is always successful and yields $y$
- Borrower can provide collateral $w$
- If borrower absconds, lender can obtain collateral with probability $s < 1$
  $\rightarrow$ reflects property rights and enforcement through legal system
Lending Contract

- Borrower’s incentive constraint:

\[ y + w - R \geq (1 - s)(y + w) + sy \]

\[ \Rightarrow \text{lender’s maximum feasible repayment:} \]

\[ R \leq R^* = sw \]

- If \( sw < k \), this loan will not be made, even if \( y > k \)

\[ \Rightarrow \text{improving property rights and court systems may be critical to allowing the poor to access formal credit} \]
Formal Sector Responses to Agency problems

- It is often prohibitively costly for formal sector banks to assess individual riskiness of small rural loans
  ⇒ better to engage in “indirect screening”

- Two main forms:
  (1) Credit Rationing
  (2) Increased collateral requirements
Interest Rate

\[ S(r) \]

\[ D(r) \]

\[ L \]

\[ L(r) \]

Excess Demand
Figure: Role of Collateral
Informal Sector Responses: “direct screening”

- Limit lending to known borrowers and expend resources to screen applicants/enforce loans

- Example institutions
  - Geography and Kinship
  - Trade–credit interlinkages
  - Rotating Savings and Credit Associations (ROSCAs)
  - “Usufruct” loans

- Screening costs + borrower loyalty + free entry
  ⇒ monopolistic competition + market segmentation

- Formal sector banks have cost disadvantage
Why Trade–Credit Interlinkages?

- Hidden interest — in Islamic societies explicit charging of interest is often forbidden / shunned

- Reduced screening costs

- Enforcement of repayment

- Creation of Efficient Surplus

\[ \frac{p^*}{1 + r^*} = \frac{p}{1 + r} \]
**Figure:** Efficient Situation

Loans, $L$

Value of Output

Efficient Surplus

Cost of Funds from Formal Sector

$(1+r)L$

$pF(L)$

$A$

$B$

$L^*$
Loans, L
Value of Output

\[ pF(L) \]

Cost of Funds from Informal Lenders

\[ (1+r^*)L \]

\[ (1+r)L \]

\[ A \]

\[ B \]

\[ C \]

\[ D \]

\[ E \]

\[ L \]

\[ L^* \]

Figure: Access Restricted to Informal Lenders
Figure: Recreation of Efficient Surplus through Trade–Credit Interlinkage
Direct Screening Costs as a Basis for Monopolistic Competition
Irfan Aleem (1993) — Chambar, Pakistan

- General procedure:
  1. applications from known borrowers
  2. make further enquiries $\rightarrow$ 50% rejected
  3. small “test” loan $\rightarrow$ takes a year to get main loan

  $\Rightarrow$ low default rate $\rightarrow$ 2.7% (10% for new lenders)
  $\Rightarrow$ “relationship–specific capital” $\rightarrow$ borrower loyalty.
Calculation of Lender’s Costs

Screening costs per loan = value of 1.5 days + transportation costs = 6.5% of loan size

50% rejection rate ⇒ 2 × screening costs per loan

The cost of funds = 30%

Premium for bad debt

Interest on delinquent loans

Marginal Cost (% of loans recovered):

\[ MC = AVC = 48\% \]
**Average Cost:**

\[ MC + \text{fixed cost of establishment} / \text{total lending}: \]

- Lending only: \( AC = 79\% \)
- Joint activity: \( AC = 68\% \)

**Interpretation**

- Perfect Competition? \( r = 79\%, \text{ but } MC = 48\% \).
- Monopoly? \( r = 79\%, 68\% < AC < 79\% \).
- Monopolistic competition?
Interest

AC

MC

Loans

Figure: Assumed Cost Structure
Figure: Short-run before entry
Figure: Short-run Profits
Figure: Long-run Equilibrium after Entry