Theory of Credit Markets

"... determining whether there is an important niche for microfinance requires an understanding of how makets 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)

Fall 2010

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:**

$$\begin{aligned} B &= \text{loan size} \\ i &= \text{lending rate} \\ R &= \text{project return (uncertain)} \\ C &= \text{collateral} \end{aligned}$$

- Default occurs if

$$C + R < (1 + i)B$$

- Borrower has **limited liability**

- Two kinds of investment:

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

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

where

$$\frac{1}{2}L_1 + \frac{1}{2}H_1 = \frac{1}{2}L_2 + \frac{1}{2}H_2$$

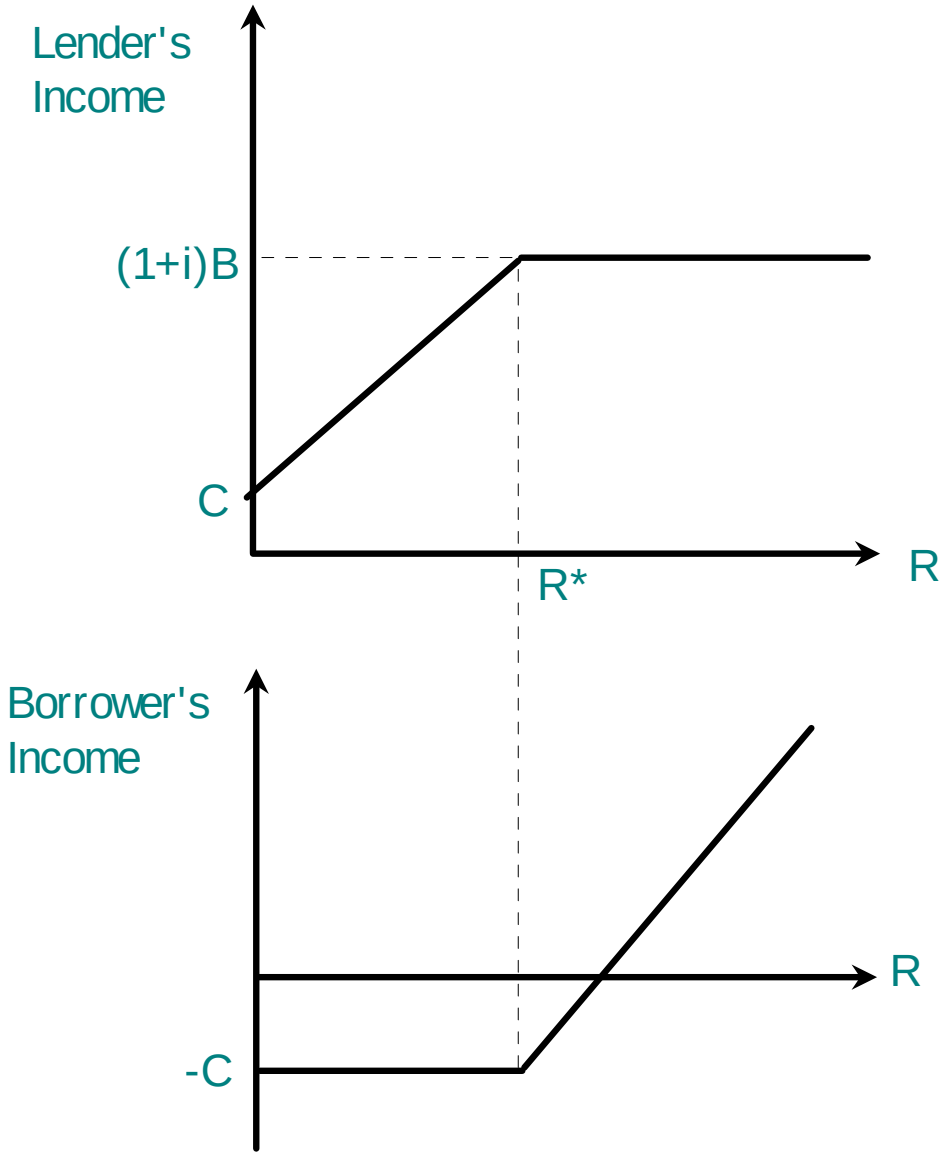


Figure: Payoffs in a Standard Debt Contract

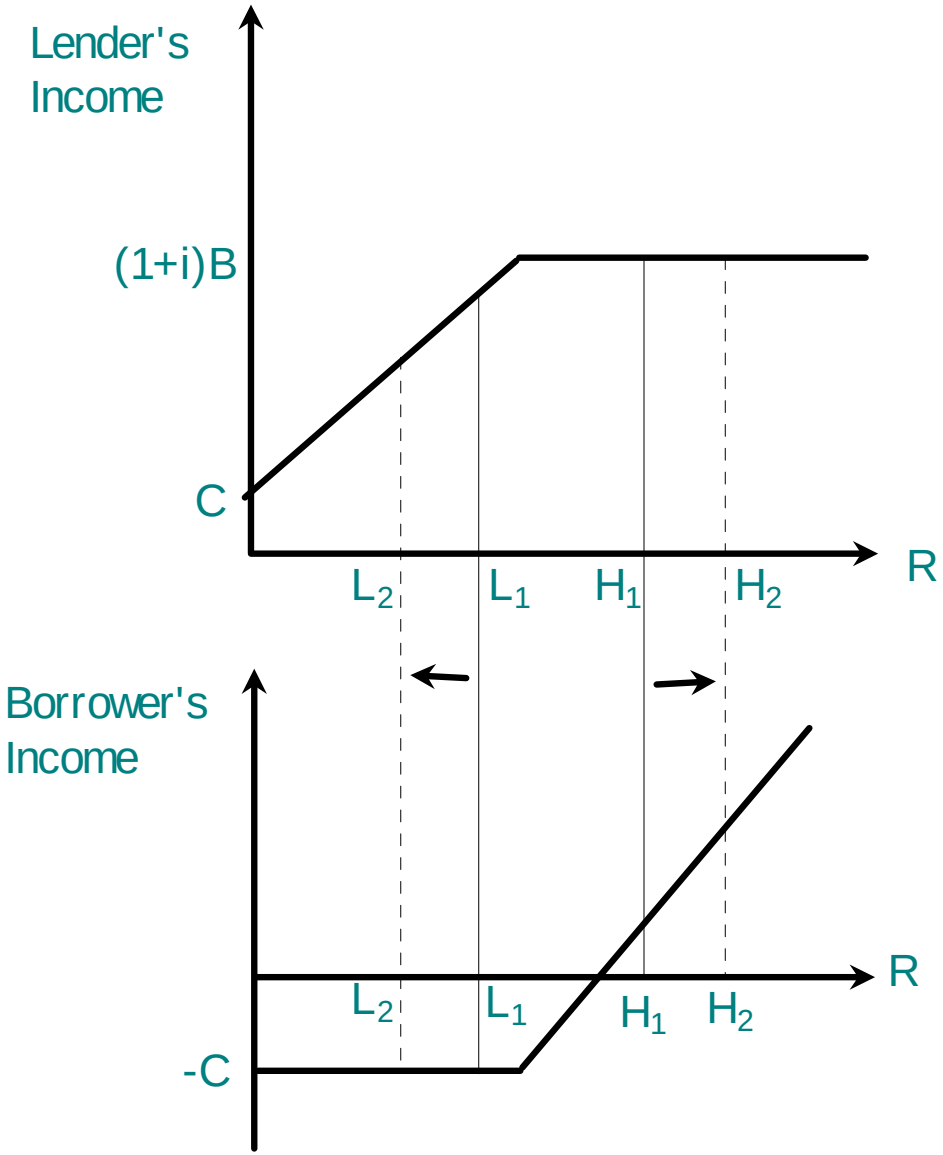


Figure: Mean-Preserving Spread

- 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 efficiecy

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 $\underline{y}$
- 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

$$\underline{y} > k$$

- 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

$$\begin{aligned}
[q + (1-q)p]\, R_b &= k \\
R_b &= \frac{k}{q + (1-q)p} \\
R_b &= k + \frac{(1-q)(1-p)k}{q + (1-q)p} \\
R_b &= k + A
\end{aligned}$$

- Bank's expected profit:

$$\bar{\pi} = \begin{cases} [q + (1-q)p]\, R - k & \text{if } R < \underline{y} \\ pR - k & \text{if } R > \underline{y} \end{cases}$$

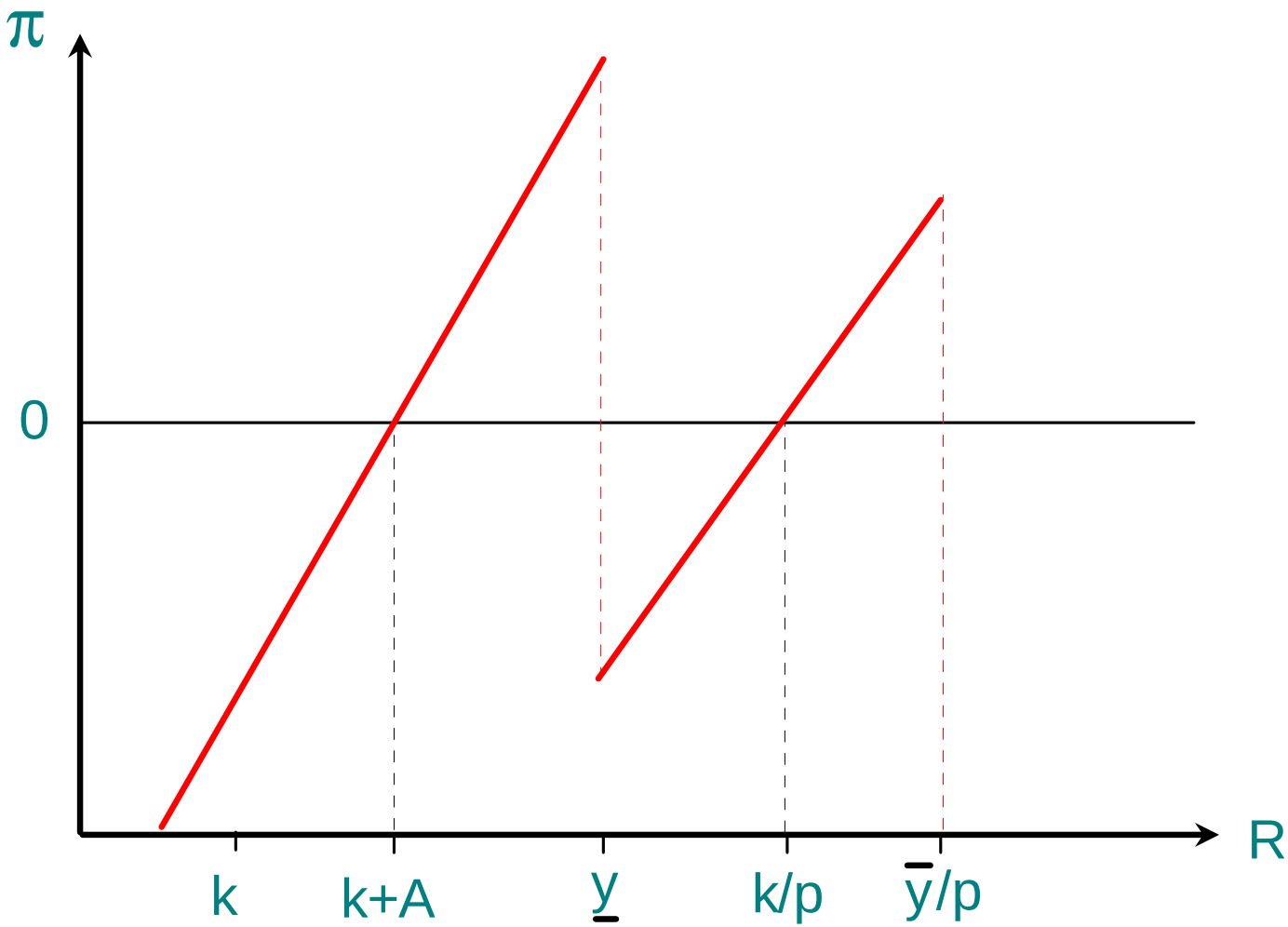


Figure: Bank's expected profit with high value of p

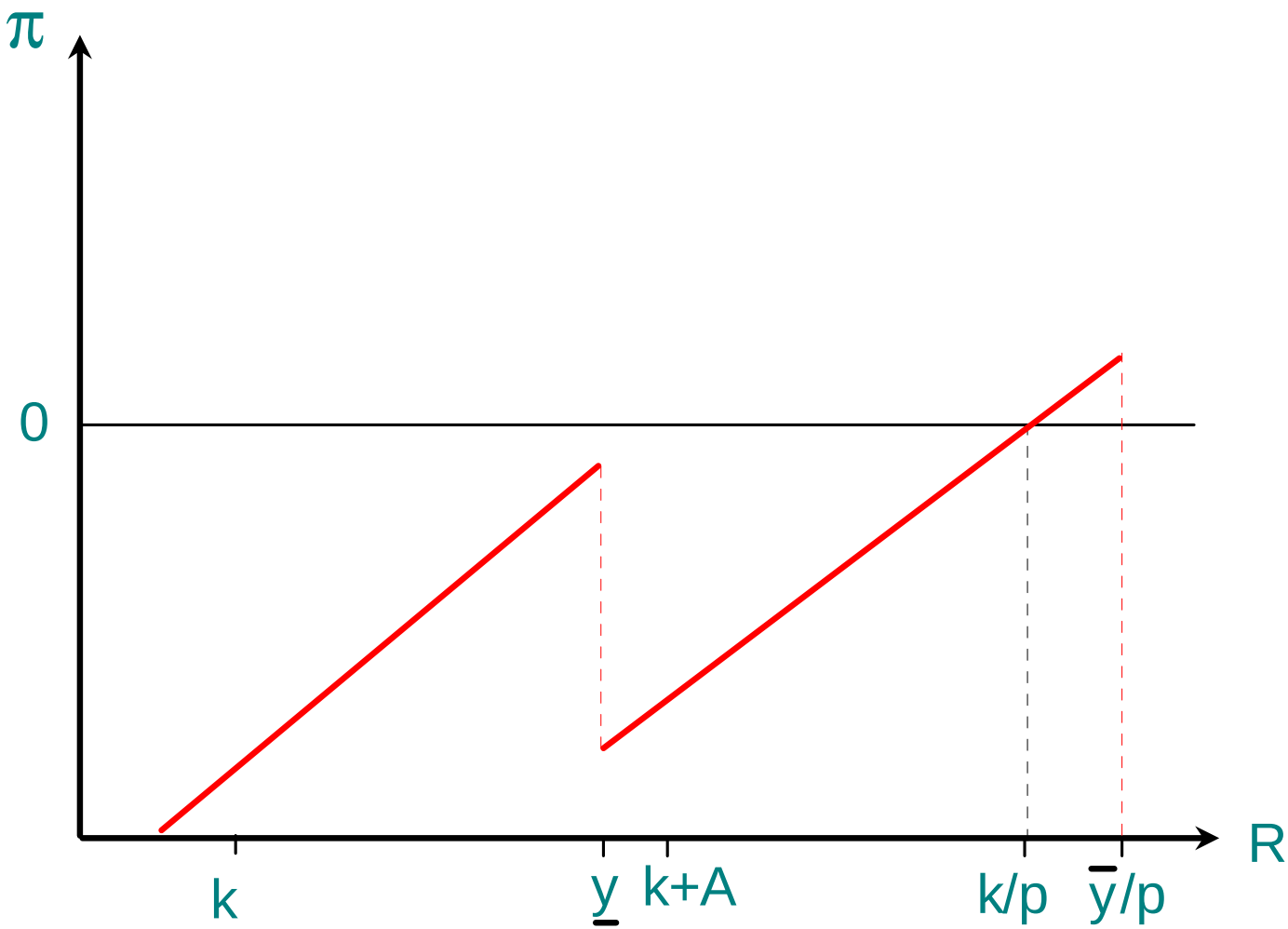


Figure: Bank's expected profit with low value of p

Implications

- Raising interest rates need not always increase profits

$\hookrightarrow$ 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

$\Rightarrow$ banks will only serve risky borrowers

$\hookrightarrow$ this is inefficient (since $\underline{y} > k$) and also inequitable

$\hookrightarrow$ **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: $\underline{y} = \$200$
  Risk type's revenue: $\bar{y} = \$222$ 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: $\underline{y} = \$200$
  Risk type's revenue: $\underline{y} = \$267$ 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 to lender $= k$

Lending contract

- To ensure borrower supplies the required effort, R must satisfy

$$(y - R) - c \geq p(y - R)$$

$\hookrightarrow$ incentive compatibility constraint

$\Rightarrow$ 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 $s < 1$

$\hookrightarrow$ reflects property rights and enforcement through legal system

Lending Contract

- Borrower's incentive constraint:

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

$\hookrightarrow$ lender's maximum feasible repayment:

$$R \leq R^* = sw$$

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

$\Rightarrow$ improving property rights and court systems may be critical to allowing the poor to access formal credit

Formal Sector Responses to Agency problems

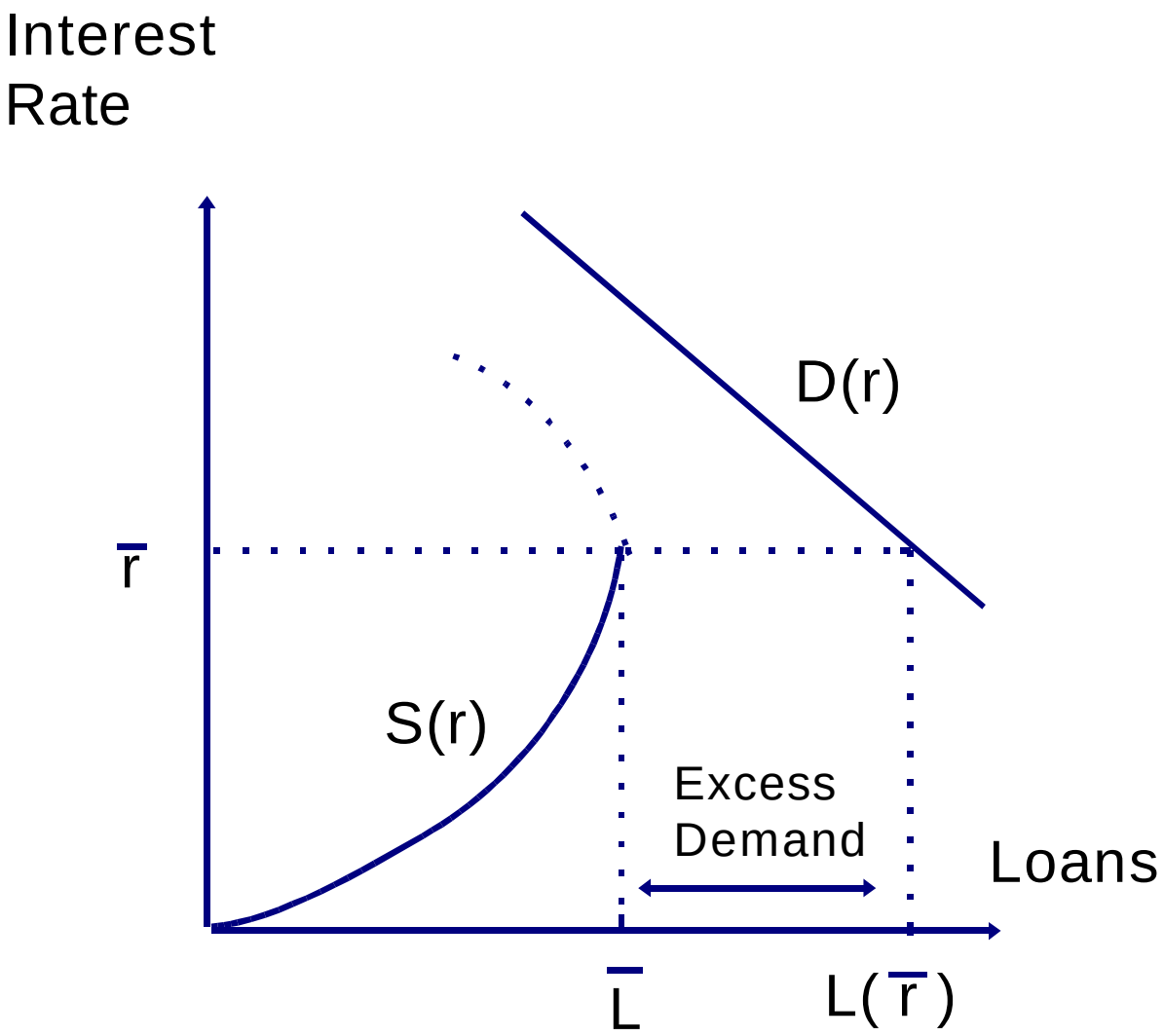
- It is often prohibitively costly for formal sector banks to assess individual riskiness of small rural loans

$\Rightarrow$ better to engage in "indirect screening"

- Two main forms:

(1) Credit Rationing

(2) Increased collateral requirements


Interest
Rate
D(r)
$\bar{r}$
S(r)
Excess
Demand
Loans
$\bar{L}$
$L(\bar{r})$

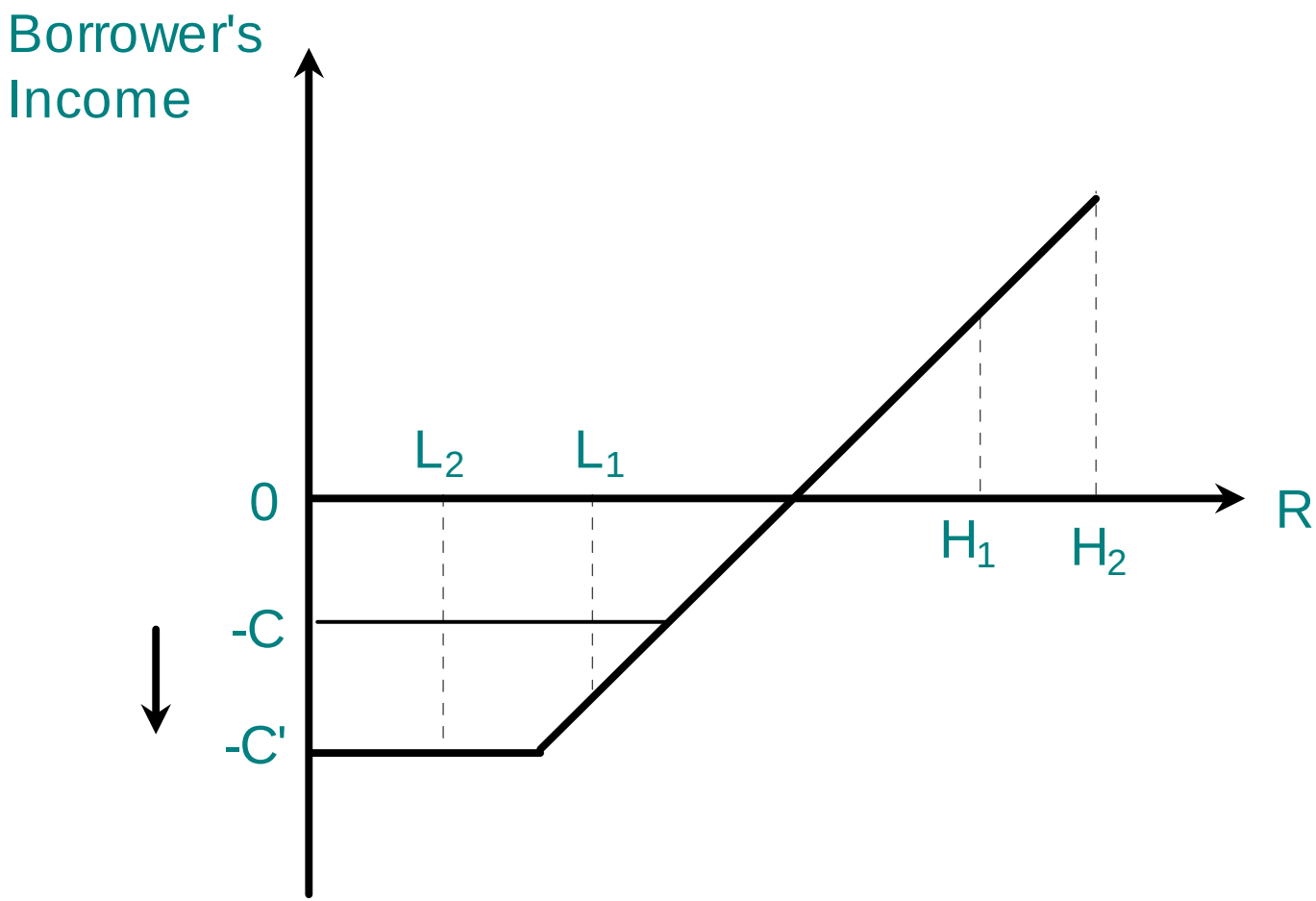


Figure: Role of Collateral

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

$\hookrightarrow$ set combination of low rate of interest, $r^* < \underline{r}$, and low purchase price, $p^* < p$, to induce efficient production by borrower, where

$$\frac{p^*}{1+r^*} = \frac{p}{1+\underline{r}}$$

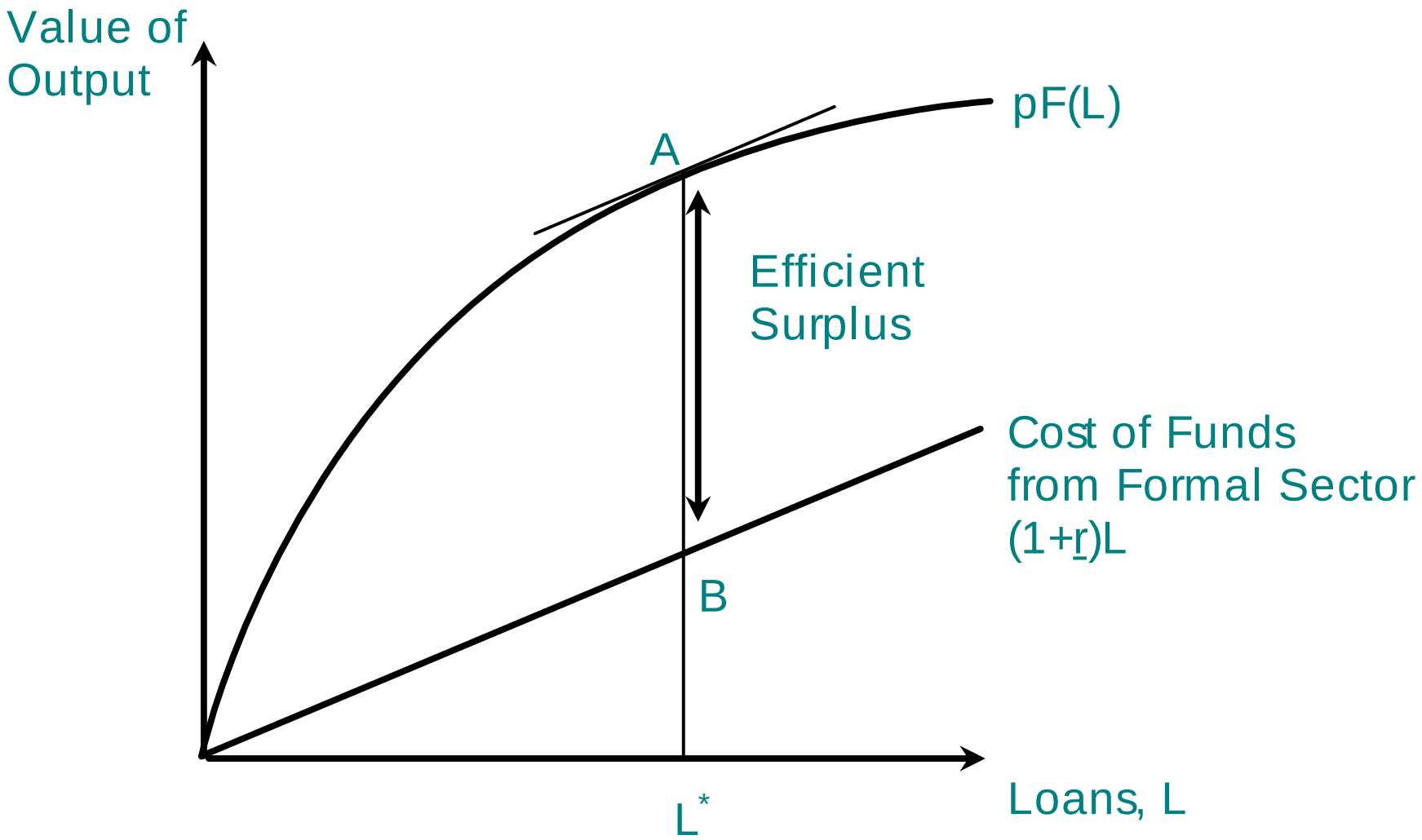


Figure: Efficient Situation

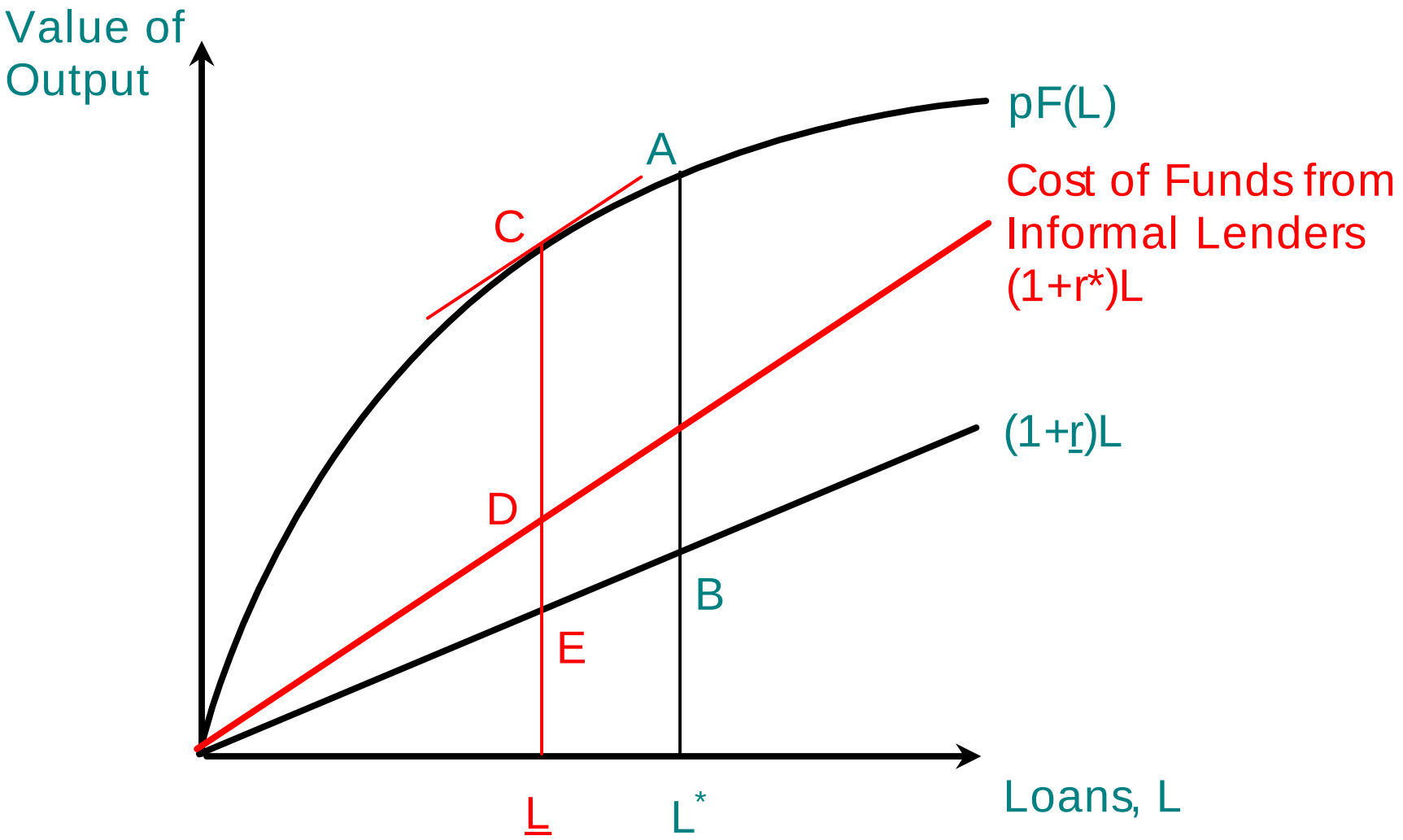


Figure: Access Restricted to Informal Lenders

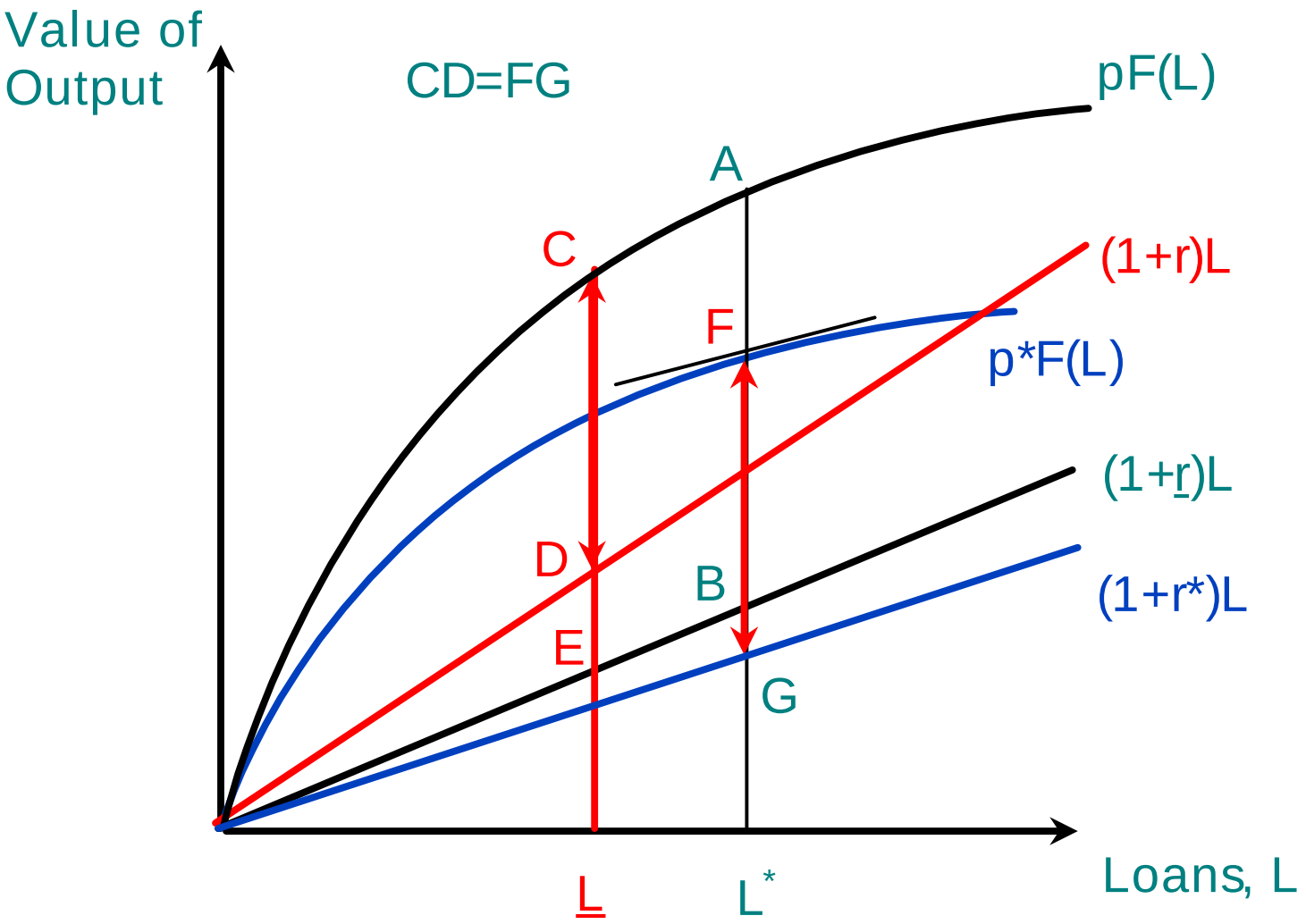


Figure: Recreation of Efficient Surplus through Trade–Credit Interlinkage

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 $\longrightarrow$ 50% rejected

(3) small "test" loan $\longrightarrow$ takes a year to get main loan

$\Rightarrow$ low default rate $\longrightarrow$ 2.7% (10% for new lenders)

$\Rightarrow$ "relationship–specific capital" $\longrightarrow$ 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 $\Rightarrow 2\times$ screening costs per loan

↪ The cost of funds = 30%

↪ Premium for bad debt

↪ Interest on delinquent loans

$\Rightarrow$ **Marginal Cost** (% of loans recovered):

$$MC = AVC = 48\%$$

- **Average Cost:**

↪ MC + fixed cost of establishment / total lending:

$$\begin{aligned} \text{Lending only} &: AC = 79\% \\ \text{Joint activity} &: AC = 68\% \end{aligned}$$

- **Interpretation**

↪ Perfect Competition ? $r = 79\%$, but $MC = 48\%$.

↪ Monopoly ? $\Rightarrow r = 79\%$, $68\% < AC < 79\%$

↪ monopolistic competition ?

Interest

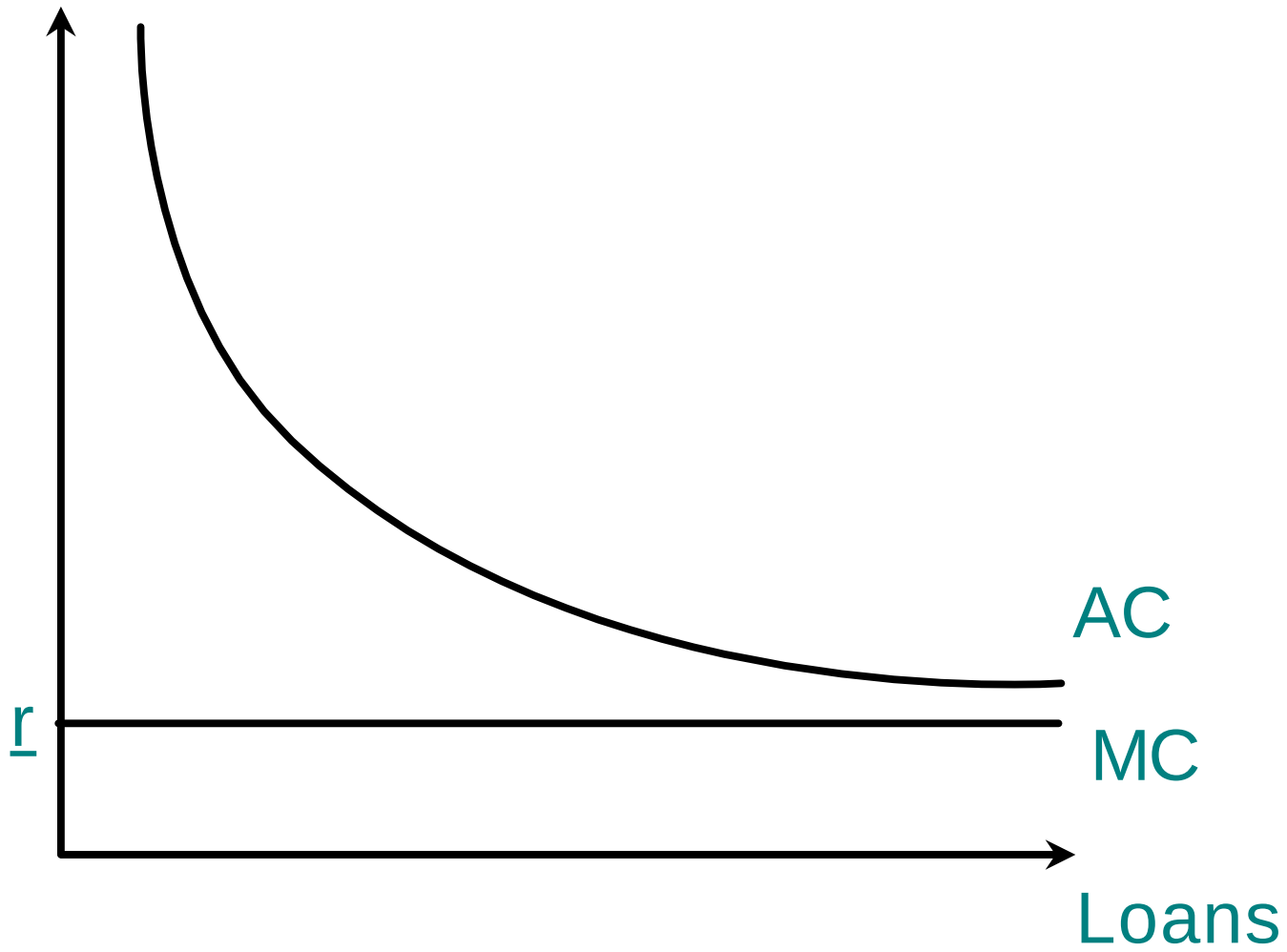


Figure: Assumed Cost Structure

Interest

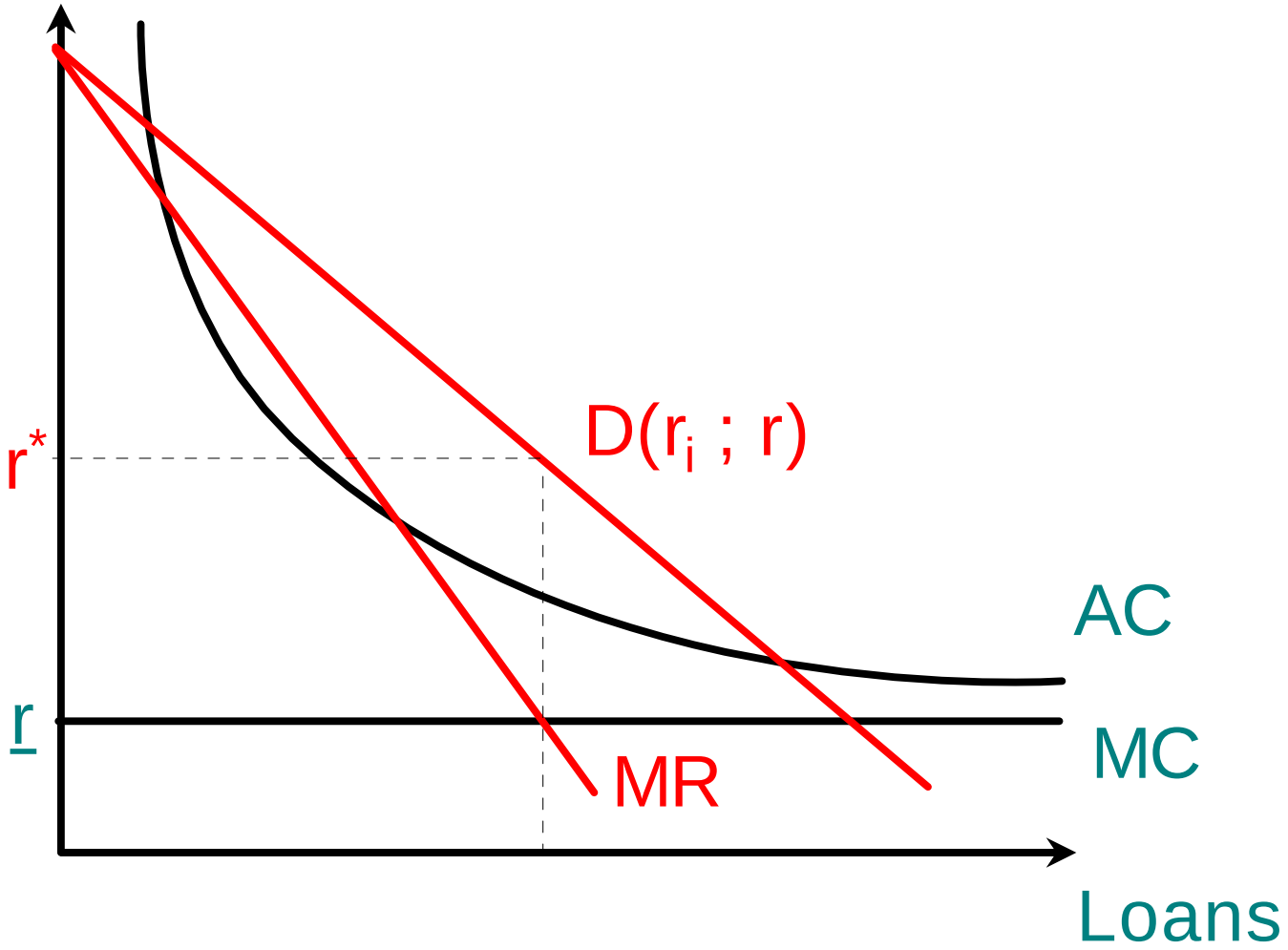


Figure: Short-run before entry

Interest

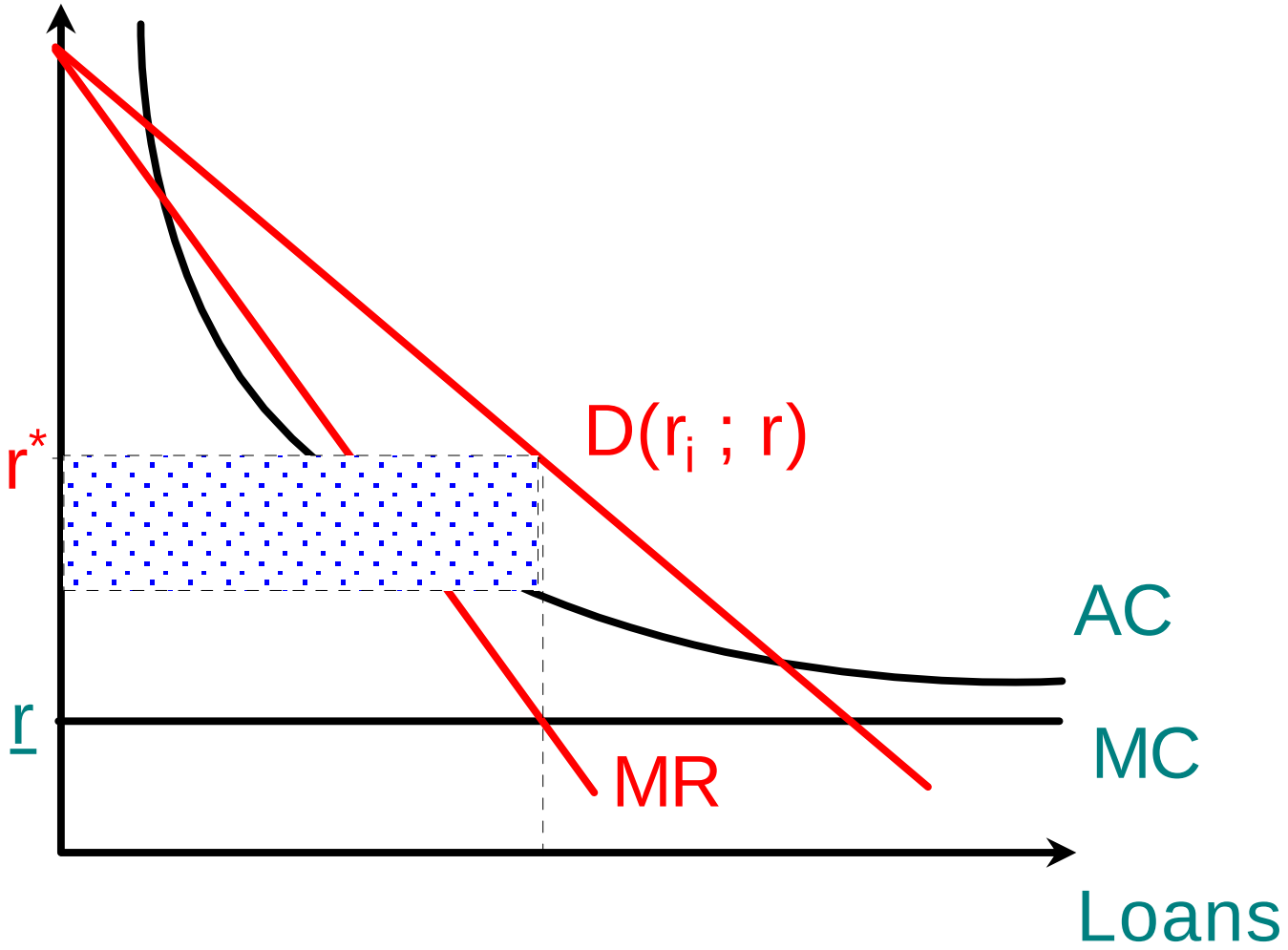


Figure: Short–run Profits

Interest

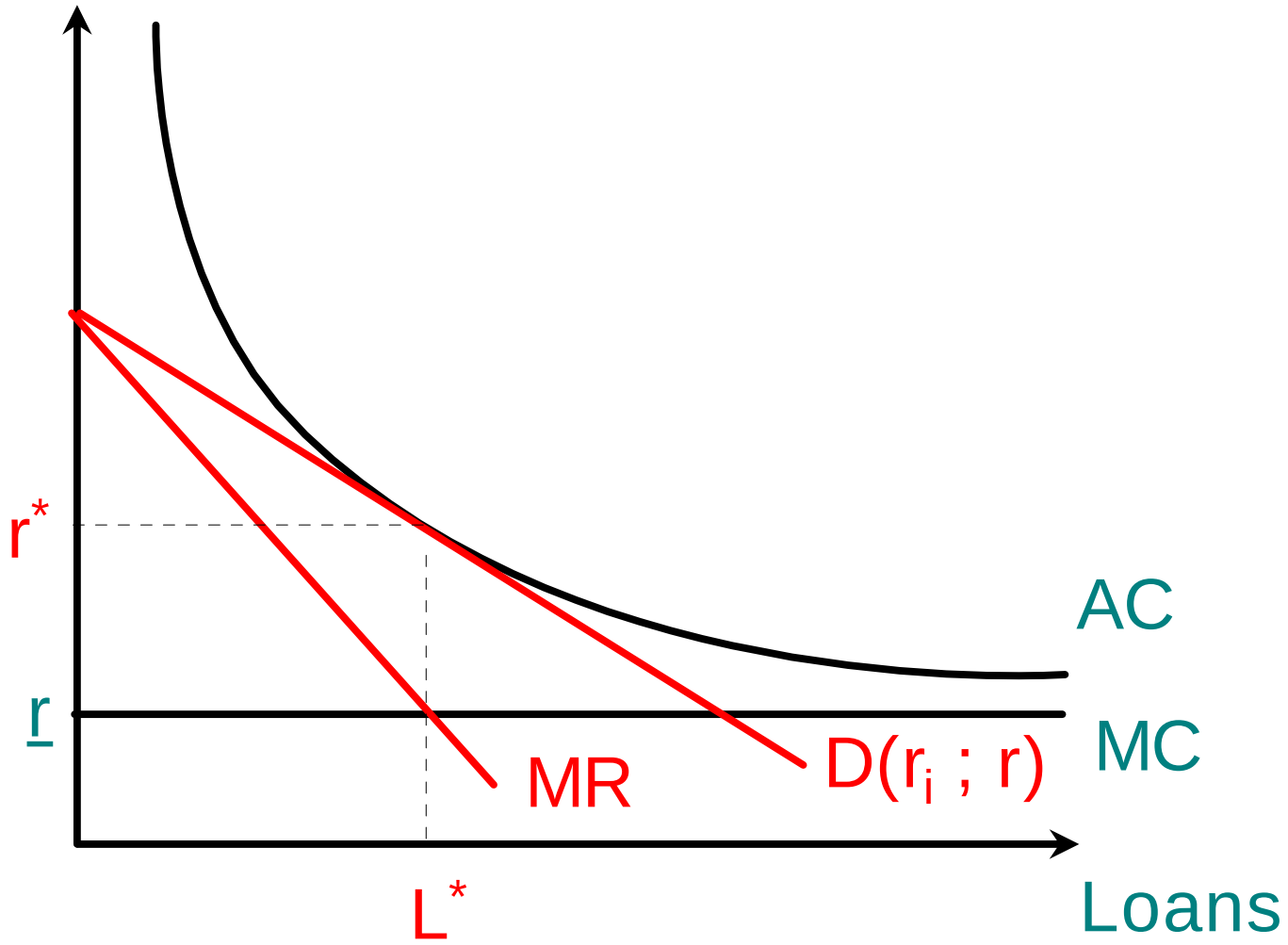


Figure: Long–run Equilibrium after Entry