Microfinance

EC307 Economic Development

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Lecture 9

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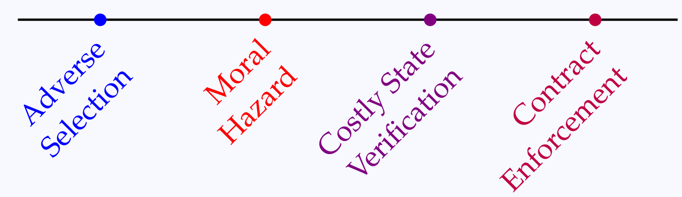
Lender's Contract Prism



Adverse Selection: Ascertaining the borrower's risk type.
$\rightsquigarrow$ *Borrower invests and thus initiates the project*

Moral Hazard: Ensuring that the borrower exerts high effort.
$\circlearrowleft$ *Project concludes and its outcome is realised*

Costly State Verification: Verifying the project's actual outcome

Enforcement: Forcing the borrower to repay

Eswaran Kotwal (1990)

Individual's *ability to smooth consumption* affects her *capacity to bear risk.*

Consumption smoothing requires *wealth* and / or *credit* to trade consumption across time and disengage it from income

- *Wealth* self insures through saving and delays consumption
- *Credit* brings forward future the consumption
- Difficult to smooth consumption when
  1. credit markets rusty
  2. wealth distribution skewed

Rural Credit Markets

1. Segemented with lots of exclusivity
2. Variation in terms of loans – we explore credit ceilings

Model

Two period model with *uncertain income* in each period

Income uncertainty: $z+\sigma$ and $z-\sigma$ with equal probability

		Period 2	
	States	Good	Bad
Period 1	Good	$2(z+\sigma)$	$2z$
	Bad	$2z$	$2(z-\sigma)$

Table: Agent's total lifetime income in all possible states of nature

Agents are *risk averse* and *identical* in all respects

$$U(c^1, c^2) = u(c^1) + u(c^2) \qquad u'() > 0, u''() < 0;$$

other than their respective *credit ceilings* B.

Unconstrained Maximisation

Period 1 Income realisation received

Decision on c^1 period 1 consumption

... implying decision to borrow or save contingent

$$\tilde{c}^1_{bad} \text{ solves } \max_{c^1_{bad}} u(c^1_{bad}) + E\big(u(c^2_{bad})\big)$$

$$\tilde{c}^1_{good} \text{ solves } \max_{c^1_{good}} u(c^1_{good}) + E\big(u(c^2_{good})\big)$$

Period 2 Income realisation received

repay or receieve repayment

c^2 the residual income is consumed in period 2

Constrained Maximisation

Individual credit ceiling is B

Upper bound of relevant rate of B

If bad state is realised in period 1, the $c^*_{bad}(B)$ solves:

$$\max_{c^1} u(c^1_{bad}) + E(u(c^2_{bad}))$$

subject to $b \leqslant B$.

$$c^*_{bad}(B) = \begin{cases} (z - \sigma) + B & \text{for } B < B_c \\ \tilde{c}^1_{bad} & \text{for } B \geqslant B_c \end{cases}$$

If good state is realised in period 1,

$$\tilde{c}^1_{good} \text{ solves } \max_{c^1_{good}} u(c^1_{good}) + E\big(u(c^2_{good})\big)$$

Un/Constrained Maximisation

		Consumption Period 1	Consumption Period 2
States in Period 1	bad	$\tilde{c}^1_{bad}$	Total income - $\tilde{c}^1_{bad}$
	good	$\tilde{c}^1_{good}$	Total income - $\tilde{c}^1_{good}$

Table: Agent's consumption in all states without credit ceiling

		Consumption Period 1	Consumption Period 2
States in Period 1	bad	$c^*_{bad}(B)$	Total income - $c^*_{bad}(B)$
	good	$\tilde{c}^1_{good}$	Total income - $\tilde{c}^1_{good}$

Table: Agent's consumption in all states *with* a binding credit ceiling B

Risk Premium

Expected Utility depends on

z (expected income)

σ (volatility of income)

B (credit ceiling) if $B \leqslant B_c$

- Expected utility is increasing and concave in B till B_c and flat beyond

Certainty equivalent income x is the risk-less income = expected utility from the uncertain income process

$$2U(x) = EU(B, z, \sigma)$$
$$\text{where } x = z - \pi_{risk}$$

x can be broken down into expected income z and risk premium π_{risk}.

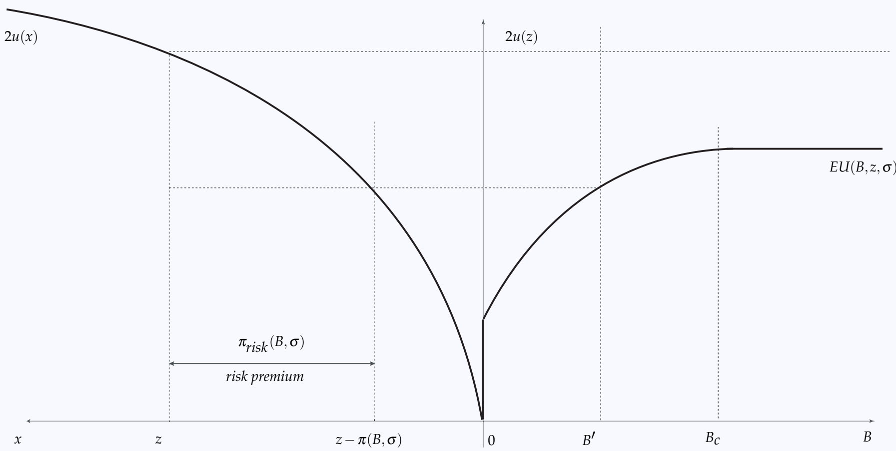


Figure: Obtaining the Risk Premium

Certainty Equivalent Income = Expected Utility

Borrower's Project & Type

- Borrower's project

$$1 \text{ unit of capital} \longrightarrow \begin{cases} x_i & \text{with probability } p_i \\ 0 & \dots (1-p_i) \end{cases}$$

- Borrower type $i = \{s, f\}$

$$\begin{cases} p_s & \text{(Safe type)} \\ p_r & \text{(Risky type)} \dots p_r < p_s \end{cases}$$

- Borrower's type unobservable to lender

Environment

- Impoverished borrower i
  - Risk neutral
  - No wealth
  - Reservation utility is $\bar{u}$
  - proportion of type $r \rightarrow \theta$
  - … type $s \rightarrow 1-\theta$
- Lender
  - Risk neutral
  - opportunity cost of capital ρ
  - Lends in a competitive loan market

First Best: Perfect Information Benchmark

- If the lender knows borrower's type (perfect information environment) then the lender's profit condition would be:

$$r_i = \frac{\rho}{p_i} \qquad i = r, s \qquad \text{(L-ZPC)}$$

… lender charges r and s different rate
… risky type pays a higher interest rate

- Borrower i's expected payoff

$$U_i(r) = p_i(x_i - r_i)$$

Recall that the borrower is risk neutral and thus only cares about her expected payoff.

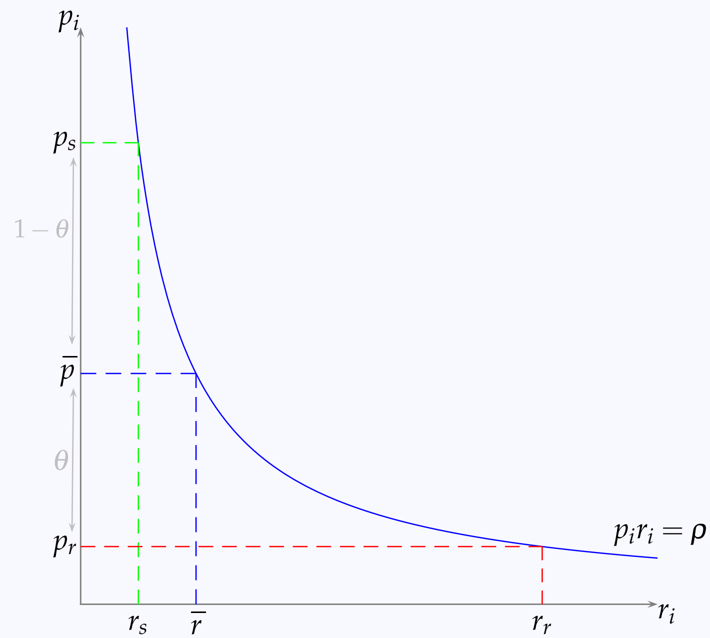


Figure: Perfect Information Benchmark

Socially Viable Project

Socially Viable Project

A project is social viable if the expected output is greater than the social cost, in this case, the opportunity cost of capital and reservation wage in this case.

$$p_i x_i \geqslant \rho + \bar{u}$$

- Under perfect information, all socially viable projects are feasible.
  - The lender would offer the borrowers contracts contingent on their type and all borrowers'projects would be funded.

Second Best: Hidden Information Problem

If the lender is ignorant of the borrower's type, he has the following two options.

either lend to both type - Pooling Equilibrium

… both type pay the same pooling interest rate

$$\bar{p} = \theta p_r + (1-\theta) p_s \qquad \text{(loan repayment probability)}$$

$$\bar{r} = \frac{\rho}{\bar{p}} \qquad \text{(interest rate)}$$

or lend to only one type - Separating Equilibrium

… interest rate for the type left in the market

… Which type do you think this will be?

$$p_r \text{ or } p_s \qquad \text{(loan repayment probability)}$$

$$r_r = \frac{\rho}{p_r} \text{ and } r_s = \frac{\rho}{p_r s} \qquad \text{(resp. interest rates)}$$

Imperfect Information: Adverse Selection

- Stiglitz & Wiess (1981)

$$p_s x_s = p_r x_r = \hat{x}$$

… the expected project outputs (mean) are identical

… the risky project has a greater spread around mean

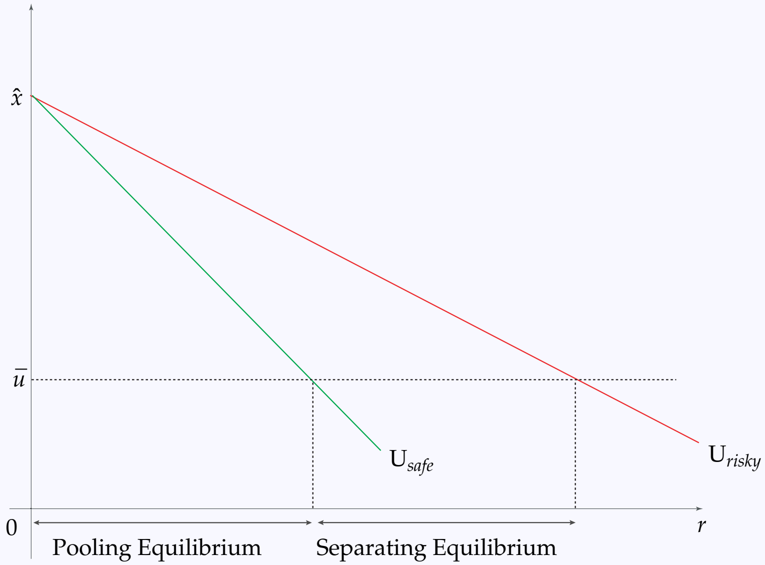
- may lead to a problem of *Under-investment*

  safe type with socially viable projects, i.e.,

$$\hat{x} = p_s x_s \geqslant \bar{u} + \rho$$

…driven out of the loan market

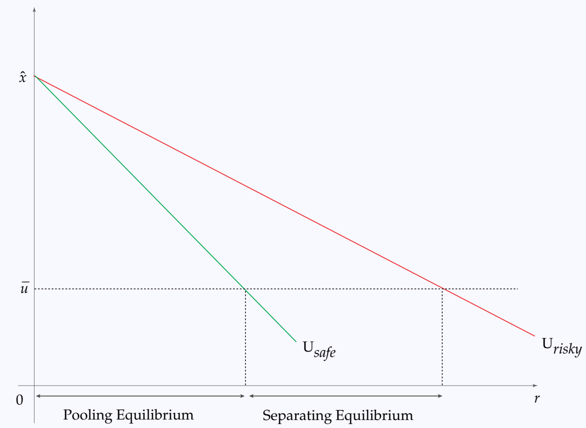
Participation Constraint: Stiglitz & Wiess



Participation Constraint: Stiglitz & Wiess

Borrower's Participation Constraint

$$U_i(r) = \hat{x} - p_i r \geqslant \overline{u} \qquad i = r, s$$



Under-Investment: Stiglitz & Wiess

Safe type borrower's participation constraint:

$$U_s(\overline{r}) = \hat{x} - p_s \overline{r} \geqslant u$$

By substituting for the value of $\overline{r} = \frac{\rho}{\overline{p}}$ this condition becomes

$$\hat{x} \geqslant \frac{p_s}{\overline{p}} \rho + u.$$

Note: $p_s > \overline{p}$ implies that the lower-bound on $\hat{x}$ is *greater* than $\rho + \overline{u}$, the threshold for socially viable projects.

Under-Investment: Exclusion of the Safe type

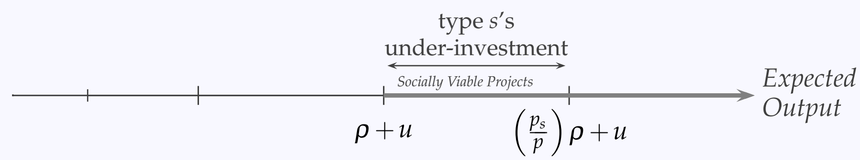


Figure: Safe type's under-investment project range

Under-investment: Some safe agents with socially viable projects i.e.,

$$\overline{u} + \rho < \hat{x} < \overline{u} + \frac{p_s}{\overline{p}} \rho$$

... unable to borrow.

Imperfect Information: Adverse Selection

- De Meza & Webb (1987)

$$p_s x > p_r x$$

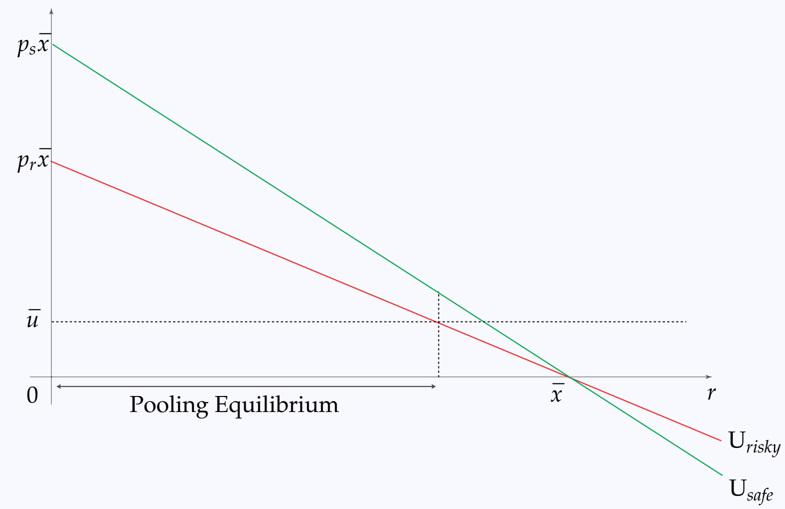
... projects have different mean

... risky project has a lower mean

- may lead to a problem of *Over-investment*

  risky type with projects which are not social viable ($p_r x < \overline{u} + \rho$) may participate in the market at the pooling interest rate.

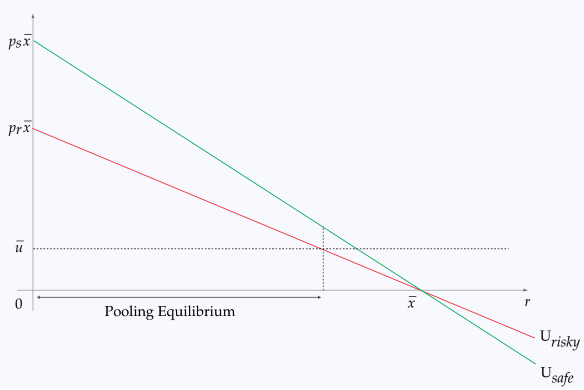
Participation Constraint: De Meza & Webb



Participation Constraint: De Meza & Webb

Borrower's Participation Constraint

$$U_i(r) = p_i(x_i - r) \geqslant \overline{u} \qquad i = r, s$$



Over-Investment: De Mezza & Webb

Risky type borrower's participation constraint:

$$U_r(\overline{r}) = p_r(x - \overline{r}) \geqslant u$$

By substituting for the value of $\overline{r}$ this condition becomes

$$p_r x \geqslant \frac{p_r}{\overline{p}}\rho + u.$$

Note: that the lower-bound on $p_r x$ is *lower* than $\rho + \overline{u}$, the threshold for socially viable projects.

UNDER-INVESTMENT: DE MEZZA & WEBB

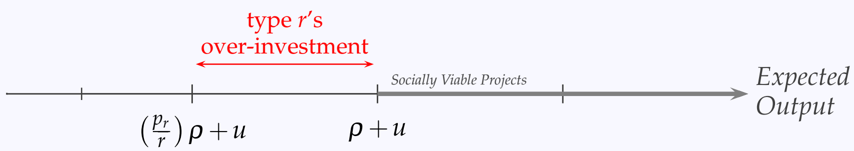


Figure: Risky type's over-investment project range

Over-investment: Risky type agents with projects that are not socially viable ($\bar{u} + \rho > p_r x > \bar{u} + \frac{p_r}{p}\rho$) are able to borrow *(because they are cross-subsidised by the safe type borrowers).*

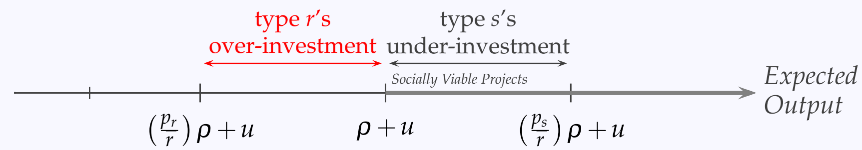


Figure: Under and Over investment Ranges

- **Under-investment:***Range of socially viable projects that are not viable due to imperfect information*

$$\bar{u} + \rho < \bar{x} < \bar{u} + \frac{p_s}{p}\rho$$

- **Over-investment:***Range of socially non-Viable projects that are viable only due to imperfect information*

$$\bar{u} + \frac{p_r}{p}\rho < p_r x < \bar{u} + \rho$$

INVESTMENT PROBLEM IN A ADVERSE SELECTION FRAMEWORK

- Stiglitz & Webb
  Under-investment: Safe type unable to borrow for a range of socially viable projects because at high interest rates, only the risky types willing to borrow.
- De Meza & Webb
  Over-investment: Risky type are able to borrow for a range of non socially viable projects because they are cross-subsidised by the safe type borrowers in a pooling equilibrium.

GROUP LENDING WITH JOINT LIABILITY

Definition (Joint-Liability Group-Lending)

Lender lends to a group with the proviso that each borrower's payoffs contingent on peer's outcome.

- Joint-Liability Group-Contract: (r, c)

Definition (Joint Liability Payment: c)

Payment due if the borrower succeeds but her peer fails

Definition (Positive Assortative Matching)

Groups homogenous in the types of borrowers

Positive Assortative Matching

Proposition (Positive Assortative Matching)

Joint Liability contracts lead to positive assortative matching.

$$U_{ij}(r,c) = p_i p_j (x_i - r) + p_i(1-p_j)(x_i - r - c)$$
$$= p_i(x_i - r) - p_i(1-p_j)c$$

$$U_{rs}(r,c) - U_{rr}(r,c) = p_r(p_s - p_r)c \quad (1)$$
$$U_{ss}(r,c) - U_{sr}(r,c) = p_s(p_s - p_r)c \quad (2)$$

(**??**) > (1)

Positive Assortative Matching and Social Optimum

Paper (Ghatak, 1999, 2000)

Joint Liability Group Lending leads to positive assortative matching solves the problems of under and over-investment.

Assumption (Socially Optimal Matching)

Positive assortative matching maximises the aggregate expected payoffs of borrowers over all possible matches

$$U_{ss}(r,c) - U_{sr}(r,c) > U_{rs}(r,c) - U_{rr}(r,c) \quad ((2) > (1))$$

$$U_{ss}(r,c) + U_{rr}(r,c) > U_{rs}(r,c) + U_{rs}(r,c) \quad \text{(rearranging)}$$

Indifference Curves

Indifference Curve of borrower type i

$$U_{ij}(r,c) = p_i(x_i - r) - p_i(1-p_j)c = \overline{k}$$

$$\left[\frac{dc}{dr}\right]_{U_{ii}=\text{constant}} = -\frac{1}{1-p_i}$$

s type's indifference curve steeper

$$\left|-\frac{1}{1-p_s}\right| > \left|-\frac{1}{1-p_r}\right|$$

Indifference Curves of the two types

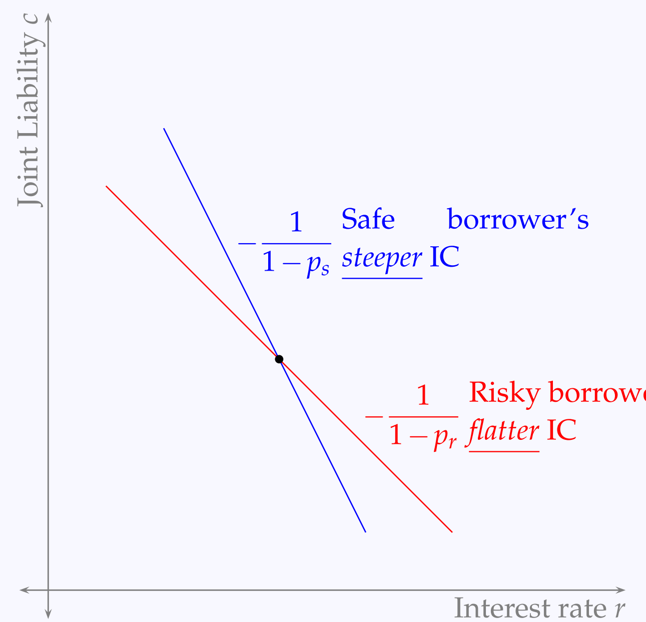


Figure: Risky and Safe Types' Indifference Curves

Lender's Problem

- Lender offers group contracts (r_r, c_r) and (r_s, c_s) which maximise the borrower's payoff subject to the following constraint"s:

$$r_r p_r + c_r(1-p_r)p_r \geqslant \rho \quad \Rightarrow \quad \frac{dc}{dr} = -\frac{1}{1-p_r} \qquad \text{(L-ZPC}_r\text{)}$$

$$r_s p_s + c_s(1-p_s)p_s \geqslant \rho \quad \Rightarrow \quad \frac{dc}{dr} = -\frac{1}{1-p_s} \qquad \text{(L-ZPC}_s\text{)}$$

$$U_{ii}(r_i, c_i) \geqslant \bar{u}, \qquad i = r, s \qquad \text{(PC}_i\text{)}$$

$$x_i \geqslant r_i + c_i \qquad i = r, s \qquad \text{(LLC}_i\text{)}$$

$$U_{rr}(r_r, c_r) \geqslant U_{rr}(r_s, c_s) \qquad \text{(ICC}_{rr}\text{)}$$

$$U_{ss}(r_s, c_s) \geqslant U_{ss}(r_r, c_r) \qquad \text{(ICC}_{ss}\text{)}$$

Abbreviations

L-ZPC$_i$	Lender's Zero Profit Condition for type i
PC$_i$	Participation Constraint for type i
LLC$_i$	Limited Liability Constraint for type i
ICC$_{ii}$	Incentive Compatibility Constraint for group i, i

Separating Equilibrium in Group Lending

- (L-ZPC$_s$) and (L-ZPC$_r$) cross at $(\hat{r}, \hat{c})$

Proposition (Separating Equilibrium)

For any joint liability contract (r, c)

i. *if* $r_s < \hat{r}$, $c_s > \hat{c}$, *then* $U_{ss}(r_s, c_s) > U_{rr}(r_s, c_s)$
ii. *if* $r_r > \hat{r}$, $c_r < \hat{c}$, *then* $U_{rr}(r_r, c_r) > U_{ss}(r_r, c_r)$

- Safe groups prefer *high* joint liability payment *low* interest rates
- Risky groups prefer low joint liability payments high interest rate
- Different interest rates for different types – back to the perfect information environment

Separating Equilibrium in r-c space

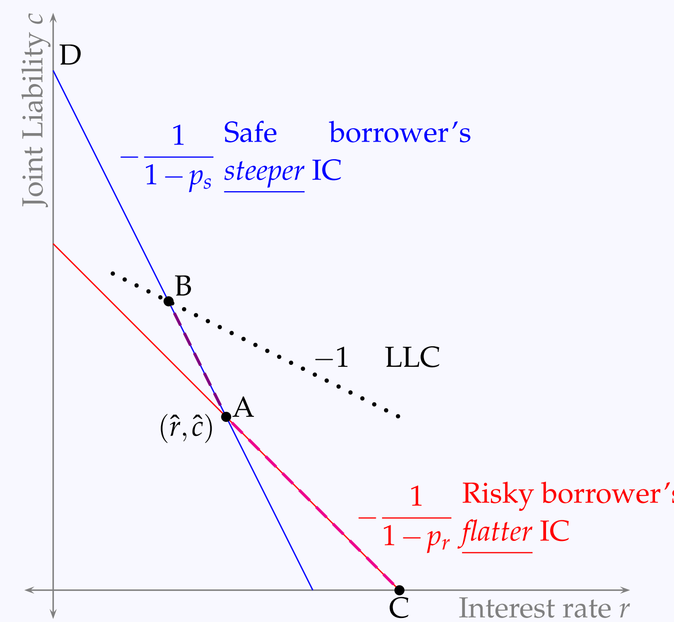


Figure: Separating Joint Liability Contract

CONTRACTS

Separating Contract

- Safe: Segment BA
- Risky: Segment AC

Pooling Contract

- $(\hat{c}, \hat{r})$ at A

Conditions: Projects sufficiently productive to satisfy the Limited Liability Condition (LLC) along respective contract segments.

Under-investment:

Bring back the safe borrowers with socially productive investment.

Over-investment:

Risky borrowers with socially productive investment drop out.

Consumption Adverse Selection Moral Hazard Enforcement Aniket

MORAL HAZARD: PROJECT CHOICE MODEL – STGLITZ (1990)

Borrowers

- Risk neutral
- Wealth-less
- Choose between safe and risky project

Project	Successful		Failure		Investment		Interest
	Prob.	Output	Prob.	Output	Sunk-Cost	Scale	
Risky	p_r	$\beta_r L$	$1-p_r$	0	α	L	rL
Safe	p_s	$\beta_s L$	$1-p_s$	0	0	L	rL

Consumption Adverse Selection Moral Hazard Enforcement Aniket

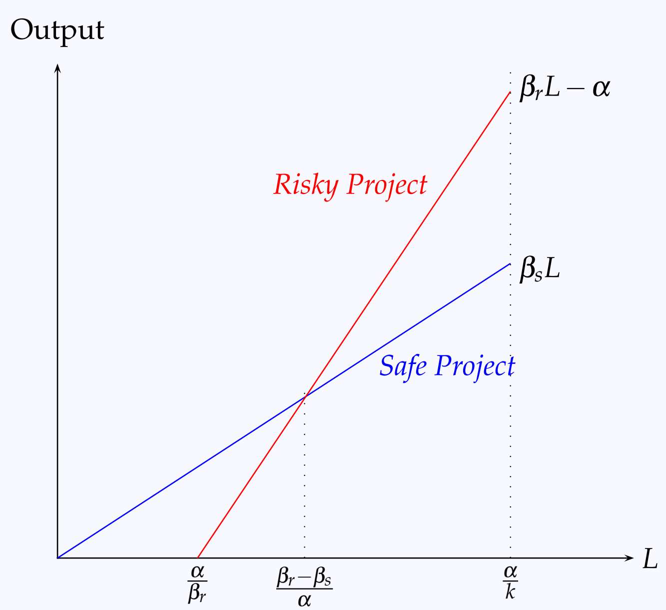


Figure: Safe and Risky Projects

Consumption Adverse Selection Moral Hazard Enforcement Aniket

BORROWER'S PAYOFF FROM THE TWO PROJECTS

Safe Project: Lower expected marginal return & 0 sunk cost

$$V_s = p_s(\beta_s L - rL)$$

Risky Project: Higher expected marginal return & α sunk cost

$$V_r = p_r(\beta_r L - rL) - \alpha$$

Assumption

$$p_r \beta_r - p_s \beta_s = k$$

... difference in expected marginal return constant

Individual Lending Switch Line

Switch Line: Locus of contracts (r, L) along which the borrower is indifferent between risky and safe project

$$V_r > V_s$$

$$p_r(\beta_r L - rL) - \alpha > p_s(\beta_s L - rL)$$

$$L > \frac{\alpha}{\Delta pr + k} \qquad \text{(Output threshold)}$$

Northeast of the switch line: Sunk cost investment α is overwhelmed by increased expected marginal productivity of risky project k and saving on the expected interest rate payment Δpr.

Consumption Adverse Selection Moral Hazard Enforcement Aniket

Figure: Switch Line

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Lender's Zero Profit Condition

Risk adjusted interest rate

$$r = \frac{\rho}{p_i} \qquad i = s, f \qquad \text{(L-ZPC)}$$

Optimal Contract (r^*, L^*): Switch line & (L-ZPC)

Maximum loan size & Interest Rate

$$L^* = \frac{\alpha}{\Delta p \left(\frac{\rho}{p_s}\right) + k}$$

$$r^* = \frac{\rho}{p_s}$$

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Consumption Adverse Selection Moral Hazard Enforcement Aniket

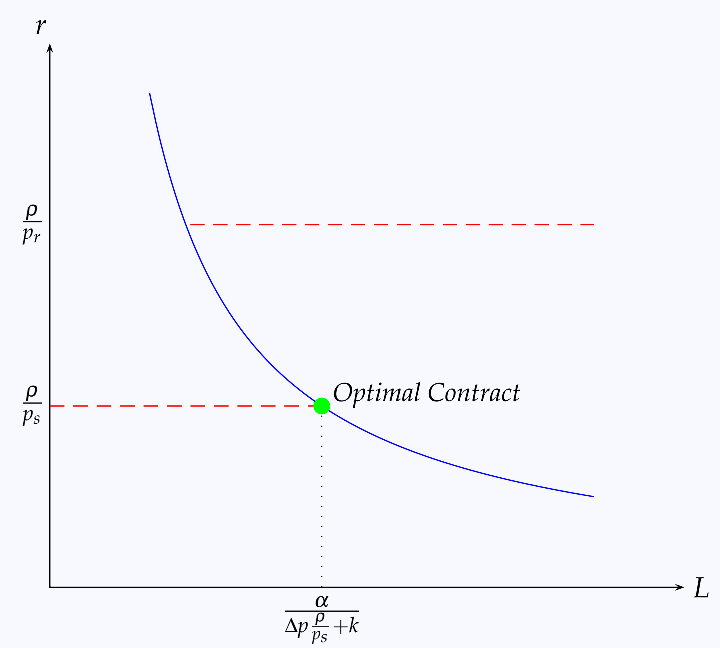

Figure: Switch Line and Optimal Contract under Individual Lending

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Group Lending

Borrower's payoffs

$$V_{ss} = p_s(\beta_s L - rL) - p_s(1-p_s)cL$$
$$V_{rr} = p_r(\beta_r L - rL) - \alpha - p_r(1-p_r)cL$$

Joint liability payment c incurred with probability $p_i(1-p_i)$

- Payoffs ↓ due to the joint liability payment c
- Payoffs ↑ due to larger loans

Group Lending Switch Line

Group Lending Switch Line:

$$L = \frac{\alpha}{\Delta pr + k - \Delta p(p_s + p_r - 1)c}$$

Lender's Zero Profit Condition:

$$r = \left(\frac{\rho}{p_s}\right) - \left(\frac{1-p_s}{p_s}\right)c$$

Maximum Loan Size in Group Lending:

$$L^* = \frac{\alpha}{\Delta p\left(\frac{\rho}{p_s}\right) + k - \varphi c}$$

where $\varphi = \Delta p\left(\frac{1-p_s}{p_s} + (p_s + p_r - 1)\right)$

- Joint liability payment lets borrowers get larger loans

… L^* is increasing in c

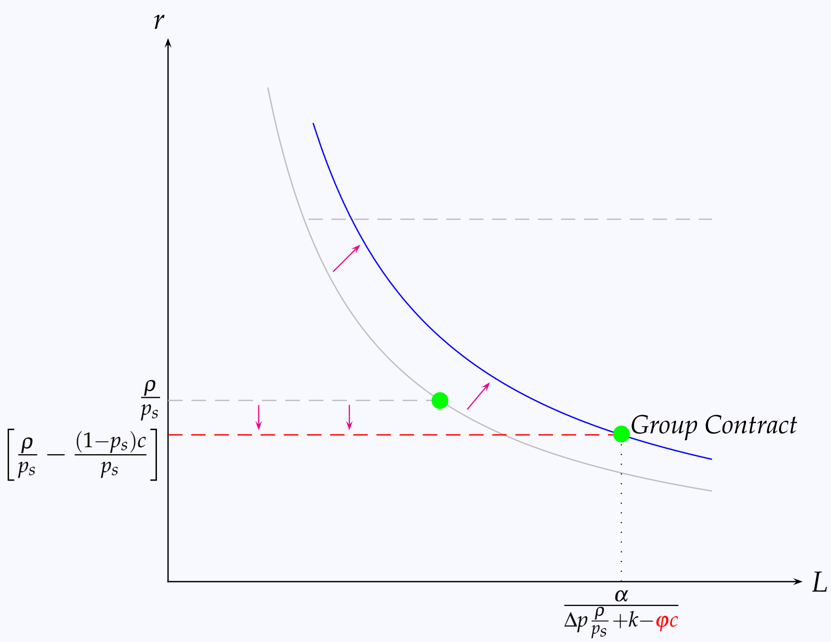


Figure: Switch Line and Optimal Contract under Group Lending

Project Choice Summary

Lender curtails loan size to prevent borrowers undertaking risky loans with significantly high sunk cost

Individual liability loans

1. Borrower pay ρ
2. Lower risk exposure
3. Small Loans

Joint liability group loans

1. Borrower pay ρ
2. Higher risk exposure
3. Larger Loans

May explain why we find the poorer section of our society are not able to undertake profitable investment

Borrowers interact cooperatively and not strategically amongst themselves

Can lender do better by making the borrowers interact strategically amongst themselves

First Best

Project: $-1 \rightarrow \begin{cases} x & \ldots \pi^i \\ 0 & \ldots 1-\pi^i \end{cases}$

Borrower chooses π^i
where $\pi^h > \pi^l$
Private Benfits B with π^l

Borrower's Participation Constraint

$$\pi^h(x-r) \geqslant 0$$

Lender's Zero Profit Constraint

$$r \geqslant \frac{\rho}{\pi^h}$$

Figure: First Best

Second Best

Borrower's Participation Constraint

$$\pi^h(x-r) \geqslant 0$$

Lender's Zero Profit Constraint

$$r \geqslant \frac{\rho}{\pi^h}$$

Borrower's Incentive Compatibility Constraint

$$\pi^h(x-r) \geqslant \pi^l(x-r) + B$$
$$x - r \geqslant \frac{B}{\Delta\pi}$$

Figure: Second Best

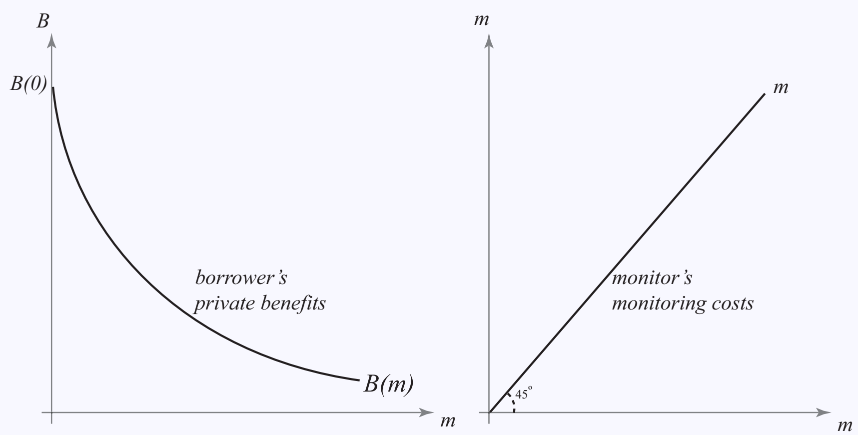


Figure: Monitoring Function

Delegated Monitoring

Borrower's Participation Constraint

$$\pi^h(x-r) \geqslant 0$$

Lender's Zero Profit Constraint

$$r \geqslant \frac{\rho}{\pi^h}$$

Borrower's Incentive Compatibility Constraint

$$\pi^h(x-r) \geqslant \pi^l(x-r) + B$$
$$x - r \geqslant \frac{B}{\Delta\pi}$$

Monitor's Incentive Compatibility Constraint

$$\pi^h w - m \geqslant \pi^l w$$
$$w \geqslant \frac{m}{\Delta\pi}$$

Figure: Delegated Monitoring

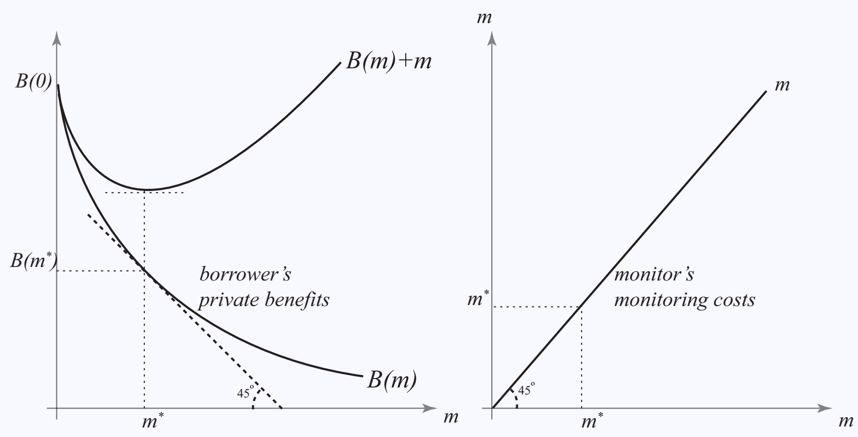


Figure: Optimal Monitoring Level

Simultaneous Group Lending

Multi-task environment: Monitoring and exerting effort

Borrower's payoff + when both projects succeed. Otherwise 0.

The contract space is determined by the following two constraints.

1. The individual borrower's ICC for high effort when her peer exerts high effort and both choose m.

$$\pi^h\pi^h(x-r)-m \geqslant \pi^l\pi^h(x-r)+B(m)-m$$

2. The group's collective compatibility condition such that the group has the incentive to undertake both tasks collectively.

$$(\pi^h)^2(x-r)-m \geqslant (\pi^l)^2(x-r)+B(0)$$

$\twoheadrightarrow$ $r \leqslant x-\frac{1}{\pi^h\Delta\pi}\max\left[B(m),\ \alpha(B(0)+m)\right]$ where $\alpha=\frac{\pi^h}{\pi^h+\pi^l}$

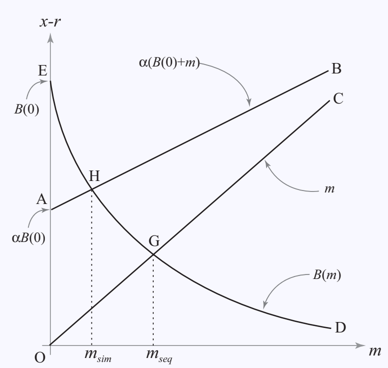


Figure: Monitoring Intensities in Group Lending

Sequential Group Lending: Aniket (2006)

- Borrower 1 gets the loan while Borrower 2 is waiting for loan
- $\rightsquigarrow$ Borrower 2 only gets loan if the Borrower 1 succeeds
- $\curvearrowright$ Contract space determined by following constraints:

$$r \leqslant x-\frac{1}{\pi^h\Delta\pi}\max\left[B(m), m\right]$$

Only the more expensive individual task has to be incentivised
Group's collective incentive constraint does not have to satisfied.

- *Borrowers are interacting strategically and not co-operatively*

Borrower's obtain lower rents and a larger surplus is created

Sequential Group Lending with almost Perfect Information

- As monitoring becomes more efficient, we get closer to the first best world or to *almost* perfect information.

Simultaneous Lending

- Payoff driven down to $\alpha B(0)$
- Far from First Best

Sequential Lending

- Payoffs driven down to 0.
- First Best

- Lender is able to reduce rent by lending sequentially
- A greater range of project would be financed under sequential lending

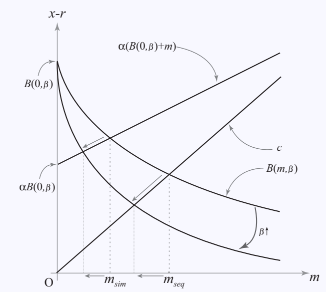


Figure: Monitoring Intensities as Monitoring Efficiency Increases

Conclusions

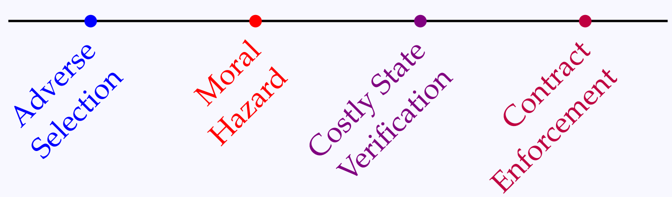
Stiglitz (1990)

- Shows that cooperative group lending increases loan size

Aniket (2006)

- With almost perfect information, cooperative group lending relatively inefficient
- shows sequential lending lower the productivity threshold to finance the projects
  - Especially useful if poorest have extremely low productivity project

Lender's Contract Prism



Adverse Selection: Ascertaining the borrower's risk type.
⇝ *Borrower invests and thus initiates the project*
Moral Hazard: Ensuring that the borrower exerts high effort.
↻ *Project concludes and its outcome is realised*
Costly State Verification: Verifying the project's actual outcome
Enforcement: Forcing the borrower to repay

Loan Contract & Strategic Default

Lender offers borrower the following contract:

1.	Loan amount	1
2.	Interest rate	r
3.	Duration	…*1 time period*

After output realisation, borrower chooses:

Involuntary Default: Insufficient output for repayment.

… *borrower has no option but to default*

Strategic Default: Sufficient output for Repayment obligations

… *borrower chooses to default*

Assume away *Involuntary Default* to focus on *Strategic Default*.

Output realisation is always greater than r

Contract Enforcement

Interaction between the *lender(s)* and *wealth-less borrower(s)* in the context of credit markets.

Explore the interaction between between borrower's limited ability to enforce contracts and borrower's incentive to default strategically.

Ideal world: Lender has *unlimited ability to enforce contacts*, i.e., punish strategic defaulters → Obtains repayment with certainty.

Limited enforcement capability → lender obtains repayment in the cases where the punishment exceeds the borrower's benefit from defaulting.

Enforcement Set Up & Penalty Function

Project: 1 unit of capital investment yields x. x is distributed on $[\underline{x}, \overline{x}]$ according to the distribution function $F[x]$.

Intuition: There is some external factor beyond the control of the borrower affecting the value of the project output.

If the borrower could affect the value,
it would be a moral hazard environment.

Project Examples

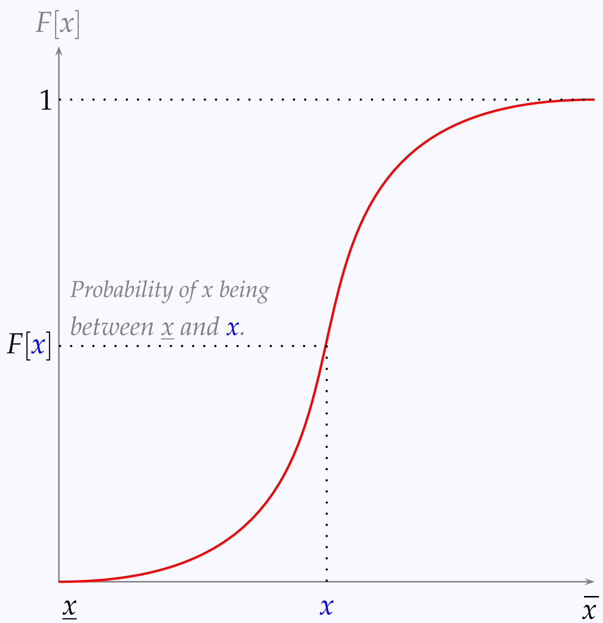
A buyer in the UK borrows and buys a flat in London
The value of the flat in the future depends on the housing market and is beyond the control of the buyer.

A farmer in Kenya borrows and buys a buffalo
The output of the buffalo depends on the price of the milk in the local market which is beyond the farmer's control.

- Lender's Penalty: In case of a threat of default on the borrowing, the lender can penalise the borrower by confiscating the project output, i.e., the flat or the buffalo.
- The higher the value of the flat or milk, the more reluctant the borrower is to

… *part with the project*
… *default on the loan*

Distribution of x



Set Up & Penalty Function

Project: 1 unit of capital investment yields x. x is distributed on $[\underline{x}, \overline{x}]$ according to the distribution function $F[x]$.

Penalty Function $p(x)$: *the output contingent penalty that the lender can impose on the borrower(s) once the project has been completed and the output x has been realised.*

Penalty Function

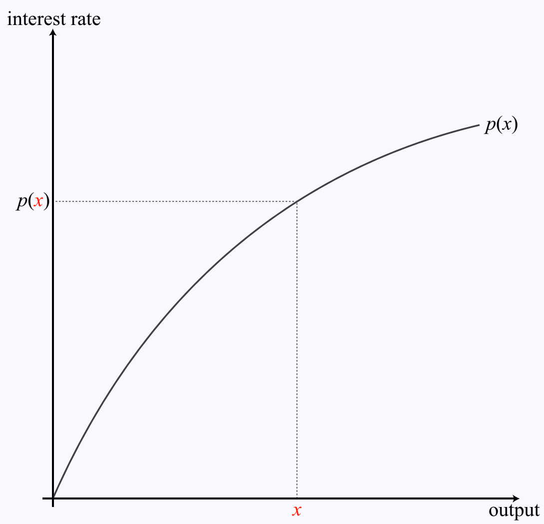


Figure: Penalty Function

Threshold Function

Threshold Function $\phi(r)$: *Given r, it gives the threshold output beyond which the borrower would choose to repay. Conversely, if the project output is below this threshold output, the borrower would choose to default strategically.*

Inverse of the penalty function.

Threshold Function

Figure: Penalty and Threshold Function

Threshold Output

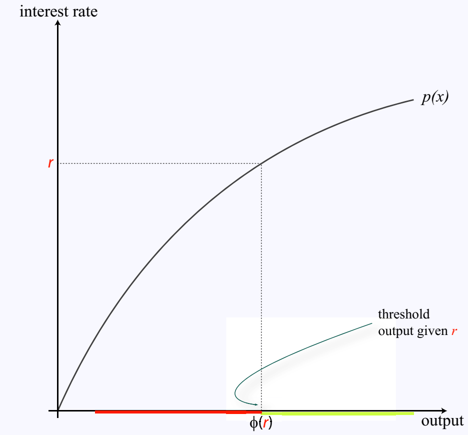


Figure: Threshold Output

– Under individual lending, the loan repayment has the following pattern

Case	Project output range	Loan status
A	Greater than $\phi(r)$	Repay
B	Otherwise	Default

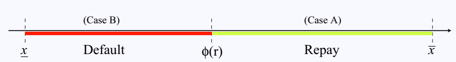


Figure: Default and Repayment Regions

Individual Lending Repayment Rate:

$$\Pi_I(r) = 1 - \underbrace{F[\phi(r)]}_{\text{Default Rate}} \qquad \Pi_I'(r) < 0$$

Group Lending without Sanction

Groups are composed of two ex ante identical, B1 and B2.

Group Contract:

The group gets 2 unit of investment capital for the project

The group has a collective repayment obligation of $2r$ once the projects are completed.

Joint-Liability: Both borrowers are penalised if this repayment obligation is not met by even one borrower.

Loan repayment pattern under group lending:

Case	Project output range	Group Loan status
C	At least one greater than $\phi(2r)$	Repaid
D	Both between $\phi(r)$ and $\phi(2r)$	Repaid
E	Otherwise	Not Repaid

Group Lending Repayment Rate:

$$\Pi_G(r) = 1 - \underbrace{\left\{F[\phi(2r)]\right\}^2}_{\text{Case C}} + \underbrace{\left\{F[\phi(2r)] - F[\phi(r)]\right\}^2}_{\text{Case D}}$$

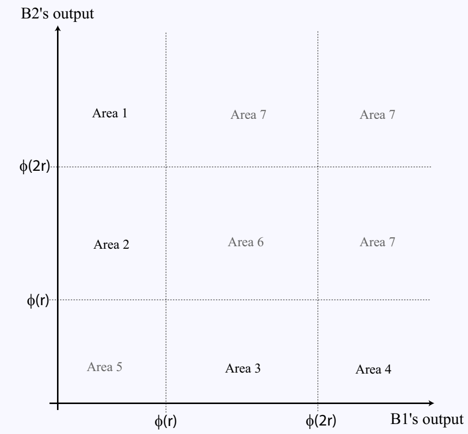


Figure: Advantages and Disadvantage of Group Lending

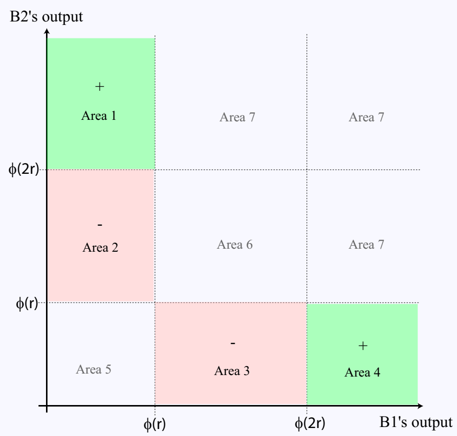


Figure: Advantages and Disadvantage of Group Lending

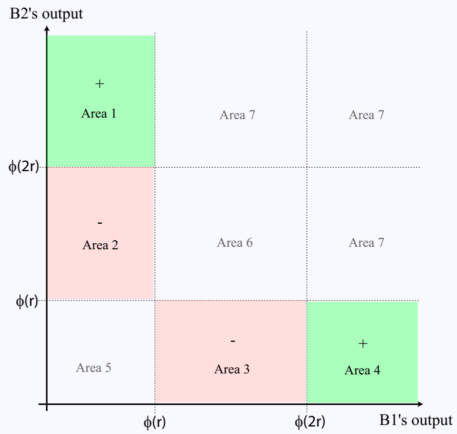
Figure 25 allows us to compare group lending with individual lending.

+ Under Area 1, B1 would have defaulted under individual lending. The loans are repaid under group lending. Similarly for Area 4 for B2.
– Under Area 2, B2 would have repaid under individual lending but does not pay under group lending due to joint liability. Similarly for Area 3 for B1.

Area 5: Official penalty is not strong enough to give either borrower incentive to repay.

Area 6: Both borrowers prefer repaying r to incurring official penalties.

Area 7: The group always repays back since repaying $2r$ is better than incurring official penalties.



- Under Area 1, B1 (B2) would have defaulted under individual lending. The loans are repaid under group lending.
- Under Area 2, B2 would have repaid under individual lending but does not pay under group lending due to joint liability.

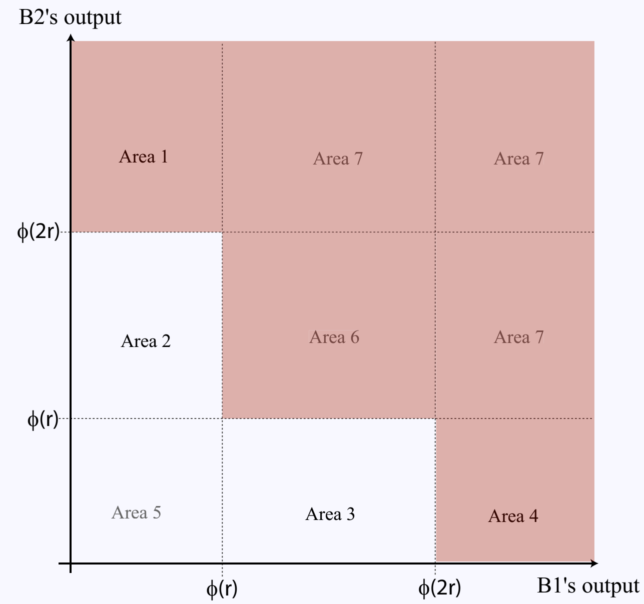


Figure: Repayment Area in Group Lending without Social Sanction

Group Lending with Social Sanction

Analyse the group member's ability to social sanction each other, which can be used to amplify the effect of lender's penalty.

Group members impose a negative externality on each other when one group member would like to pay off her own loan but defaults because her peer is going to default.

Social Sanction s: *If a group member imposes a negative externality on her peer, she faces a social sanction s in response.*

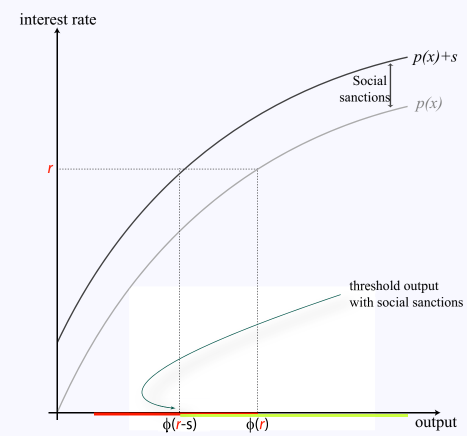
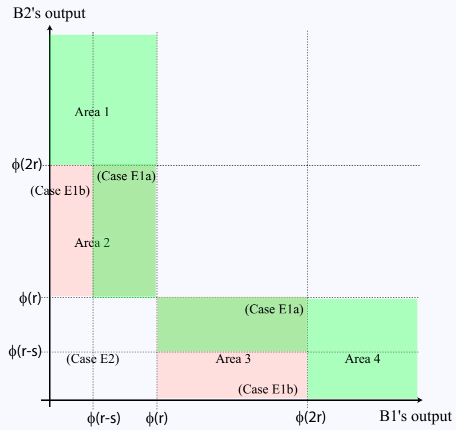


Figure: Threshold Output with Social Sanctions



$$\Pi_{G_S}(r) = 1 - \left\{F[\phi(r)]\right\}^2 - 2F[\phi(r-\bar{s})]\left\{F[\phi(2r)] - F[\phi(r)]\right\}$$

(Repayment Rate with Social Sanctions)

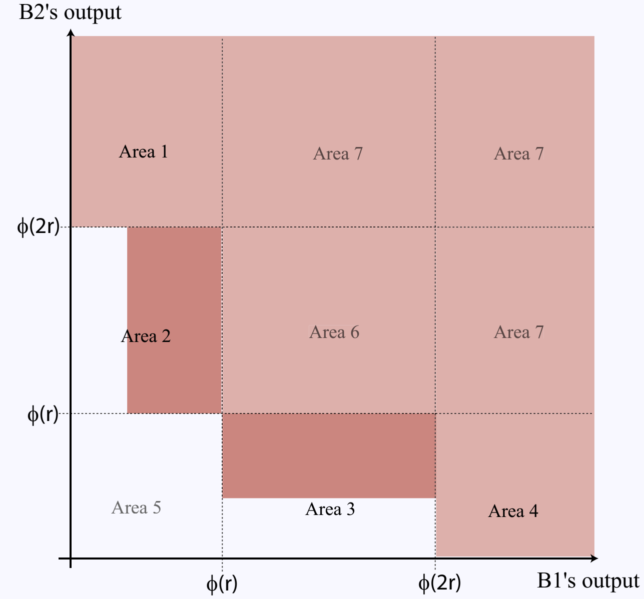


Figure: Repayment Area in Group Lending with Social Sanction

Under harsh social sanctions, i.e., the repayment rate reduces to

$$\lim_{s \to r} \Pi_{G_S} = 1 - \{F[\phi(r)]\}^2$$

It should be easy to check that Π_{G_S} is greater than Π_G and equal to Π_I.

With sufficiently strong social sanction, a borrowing group enforces repayment rate which is better than individual lending and group lending without social sanctions.

Group Lending without social sanction:

- *Advantage:* Borrower with high output pay for borrowers with low output
- *Disadvantage:* Borrowers with moderate output may default even though they would have repaid in individual lending

Related Ideas

- *Rai, A. S. & Sjöström T. (2004)*: Reducing the deadwieight punishment when the lender cannot distinguish between involuntary and strategic default.
- *Jain, S. & Mansuri, G. (2003)*: The lender uses the local money lender's capabilities by setting very tight repayment schedules.
- Exercise based on *Ghatak and Guinnane (1999)*: Analyses the enforcement problem in a much simpler setup using risk averse borrowers.

Wealth

Microfinance lenders across the world require that borrower repay much before the completion of the project

Periodicity: Frequency of loan repayment

Periodicity used by microfinance institutions to compensate for lack of collateral

Force borrower to acquire stake in their own projects

Borrower need to have some wealth to be able to borrow.

Savings

Poor have extremely volatile income streams

Require savings instruments to be able to

Smooth consumption
Self-insure
Save towards lumpy investments

Poor are offered no saving instruments in the rural credit market

Moneylender lends but does not take any saving deposits. Why?

Covariate Risks
Transaction Costs

How can Microfinance institutions help?

Casestudy in Haryana, India

- *Case-study of a Microfinance Institution in Harayana*

  Documents the innovative design features of India's new national microfinance programme.

- Lender offers saving opportunities

  ...by *restricting* loans to the group

  ...creates intra-group competition for loans

- Individuals can join a *group* as either a borrower or a saver
  - Borrower partly self-finance's the buffalo
  - Saver co-finance's the borrower's project

    ...and gets a premium interest rate on her savings

- We observed
  - *Intra-group income heterogeneity*
  - *savers were poorer than borrowers*

Role of Savings in Microfinance: Aniket 2006a

Offering saving opportunities in group lending would lead to *negative assortative matching* along *wealth* lines:

Rich and poor match in the same group.

Could potentially initiate a chain where the poor who get wealthier match with the other poor people and uplift them out of poverty