Development Economics

Slides 13

Debraj Ray, NYU

Credit Markets

- **Formal sector**:
  - State or commercial banks.
  - Require collateral, business plan
  - Usually lend to registered firms or small businesses
  - Usually charge the lowest rates of interest
  - Often give directed credit to “priority sectors”:
  - (exports, agriculture, small business)

Credit Markets

- **Informal sector**:
  - Moneylender, trader, landlord, shopkeeper …
  - Better information, better enforcement capabilities (multi-market)
  - Specific abilities to take certain types of collateral
  - Can price out distortions via multi-market contact
- **Quasi-formal organizations**:
  - Grameen Bank, microfinance NGOs
  - Sometimes use group liability to avoid default
  - Rigid repayment schedules
  - Working capital rather than fixed capital loans

The Fundamental Imperfections of Credit Markets

- **Limited collateral implies limited liability**:
  - affects who seeks credit (adverse selection)
  - affects how credit is used (moral hazard)
  - affects repayment incentives (strategic default)
  - affects lender-borrower combinations (segmentation)
- **An Example**.
  - Projects A and B, startup cost 100,000.
  - Rates of return 5% and 20% (revenues 105,000 and 120,000).
  - Bank rate of interest 10%
  - Perfect coincidence of interest between bank and borrower.

The Fundamental Imperfections of Credit Markets

- **Example**, contd.
- Change A to: 140,000 w.prob. $3/4$, 0 w.prob. $1/2$.
- Expected return is just the same as before: 5%.
- Assume limited liability (effectively same as limited collateral).
- Now bank strictly prefers Project B.
- But the borrower strictly prefers Project A! (Why?)
- Problem goes away if borrower fully repays in every contingency.
- **Two interpretations** of the example:
- The bank attracts type A borrowers (adverse selection)
- The borrower diverts money to type A projects (moral hazard)

Risk Premia

- **How about charging higher interest rates to compensate?**
- Say $p =$ prob. repay, $r =$ interest rate, $i =$ safe rate:
- Then $p(1+r) = 1+i$, or

$$r = \frac{1+i}{p} - 1.$$

The problem is that r affects the repayment probability!

- **Digression**: In fact, sometimes a deliberate ploy by lender.
- Lender valuation of collateral V_ℓ, borrower valuation V_b.
- Borrower prefers to repay if $L(1+i) < V_b + F$,

  where $L =$ loan size, $i =$ interest rate, $F =$ default cost.

- **Digression**, contd.
- Lender wants his money back if

$$L(1+i) > V_\ell$$

- Thus loan repayment in the interest of both parties if

$$V_b + F > V_\ell.$$

- On the other hand, if

$$V_b + F < V_\ell,$$

  then interest rate may be adjusted to facilitate collateral seizure.

- (Note: analysis works best for inelastic loans.)
- **The choice of the interest rate affects default itself.**

Adverse Selection Over Borrower Projects

- **Borrowers differ in "riskiness".**
- Project return Y varies in riskiness; mean unchanged.
- Startup cost of project: B, borrow at rate r, collateral C.
- **Limited liability** in loan repayment; repay if

$$Y + C \geq (1 + r)B.$$

- So borrower's return if project pays off Y is given by

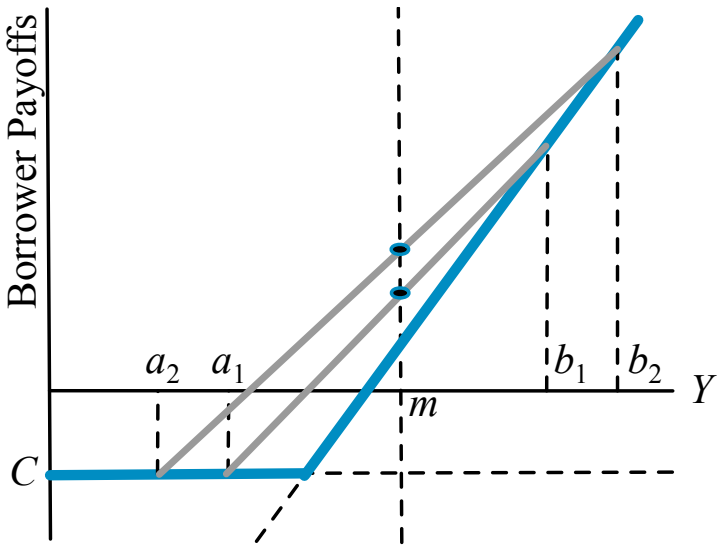
$$\pi(Y, r) \equiv \max\{Y - (1 + r)B, -C\},$$

- and lender's return is given by

$$\rho(Y, r) \equiv \min\{Y + C, B(1 + r)\}.$$

Adverse Selection Over Borrower Projects

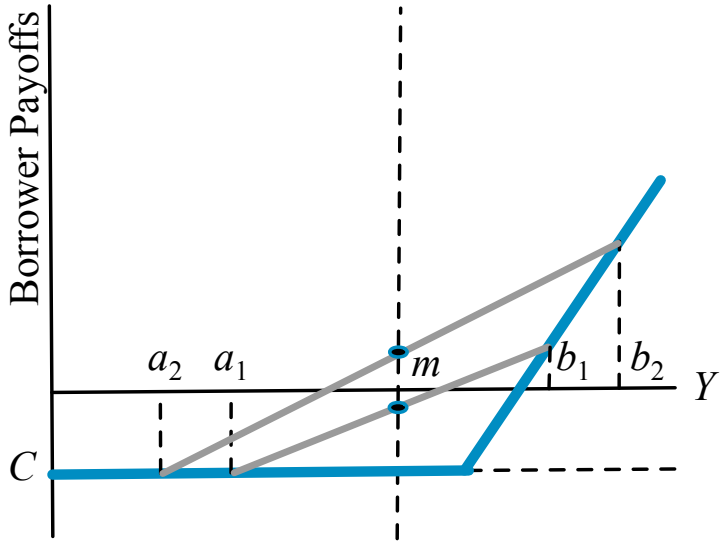
- **Expected payoff to borrower increases in riskiness, opposite for lender.**



- If riskiness not observed, borrower quality will degrade in r.

Adverse Selection Over Borrower Projects

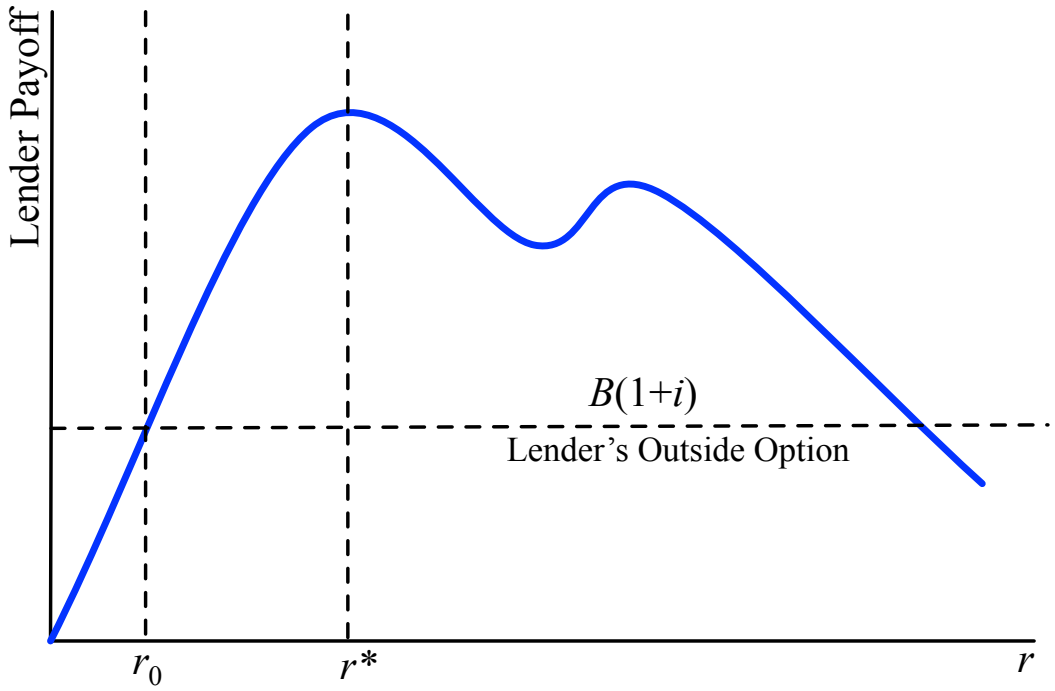
- **A higher interest rate can degrade the borrower pool**:



- **Two opposing effects** of the interest rate:
  - Increases repayment conditional on occurring
  - Worsens the risk composition

Adverse Selection Over Borrower Projects

- So lender's return typically non-monotonic in r.



- **The interest rate bounded by r^* even if borrowers willing to pay more.**

Moral Hazard and the Debt Overhang

- **Costly effort can influence success probabilities.**
- Startup cost B, output is either Y (good) or 0 (bad).
- Probability of good output is $p(e)$, where $e =$ agent effort.
- **If agent is self-financed**, choose e to maximize

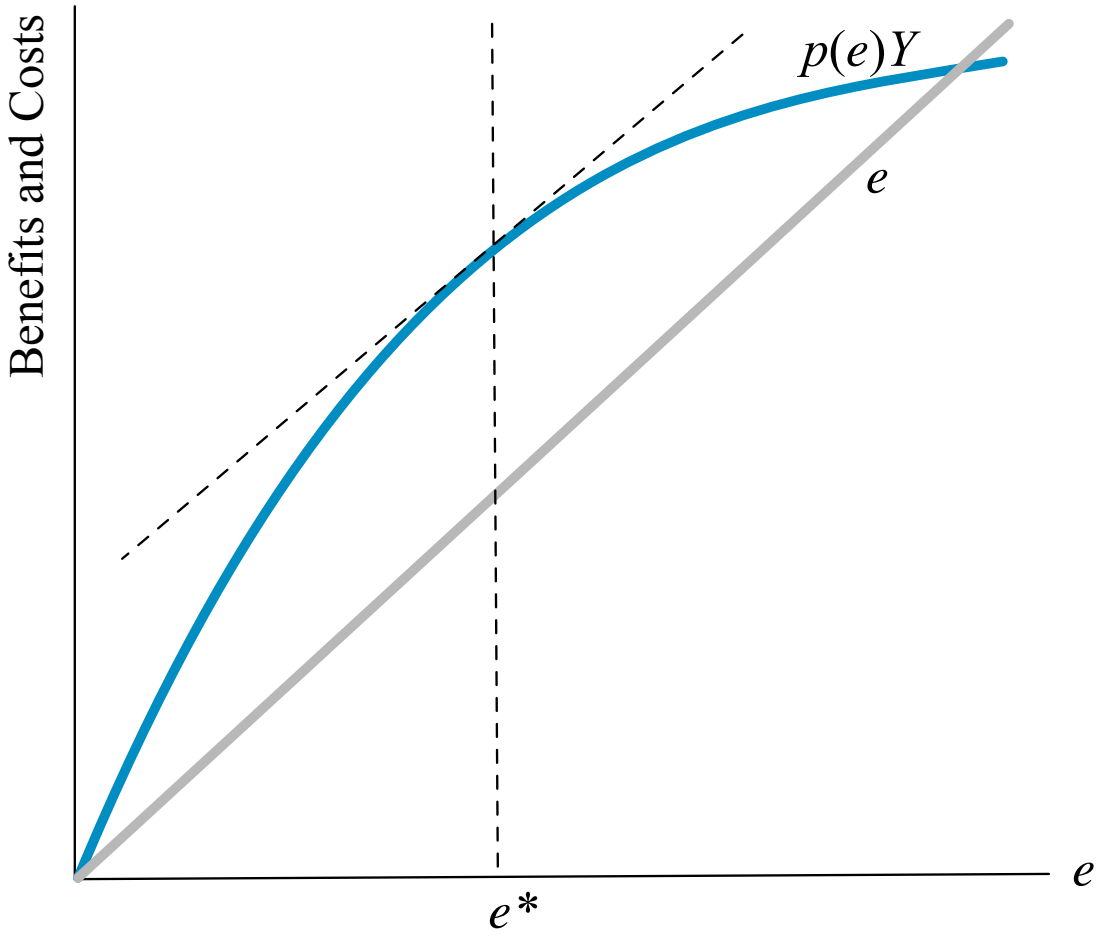
$$\text{Own Return = Social Surplus } = p(e)Y - e - B,$$

  where B is startup cost and i is the safe rate of return.
- Assume unique choice e^*; described by the first-order condition

$$p'(e^*)Y = 1$$

- This is the efficient, or **first-best** level of effort.

Moral Hazard and the Debt Overhang



Moral Hazard and the Debt Overhang

- **Debt financing**: $R = (1 + r)B$ is total debt, $C < B$ is collateral.
- Now the effort choice of a borrower facing a debt R given by

$$\max_{e} \quad p(e)(Y - R) - [1 - p(e)]C - e$$

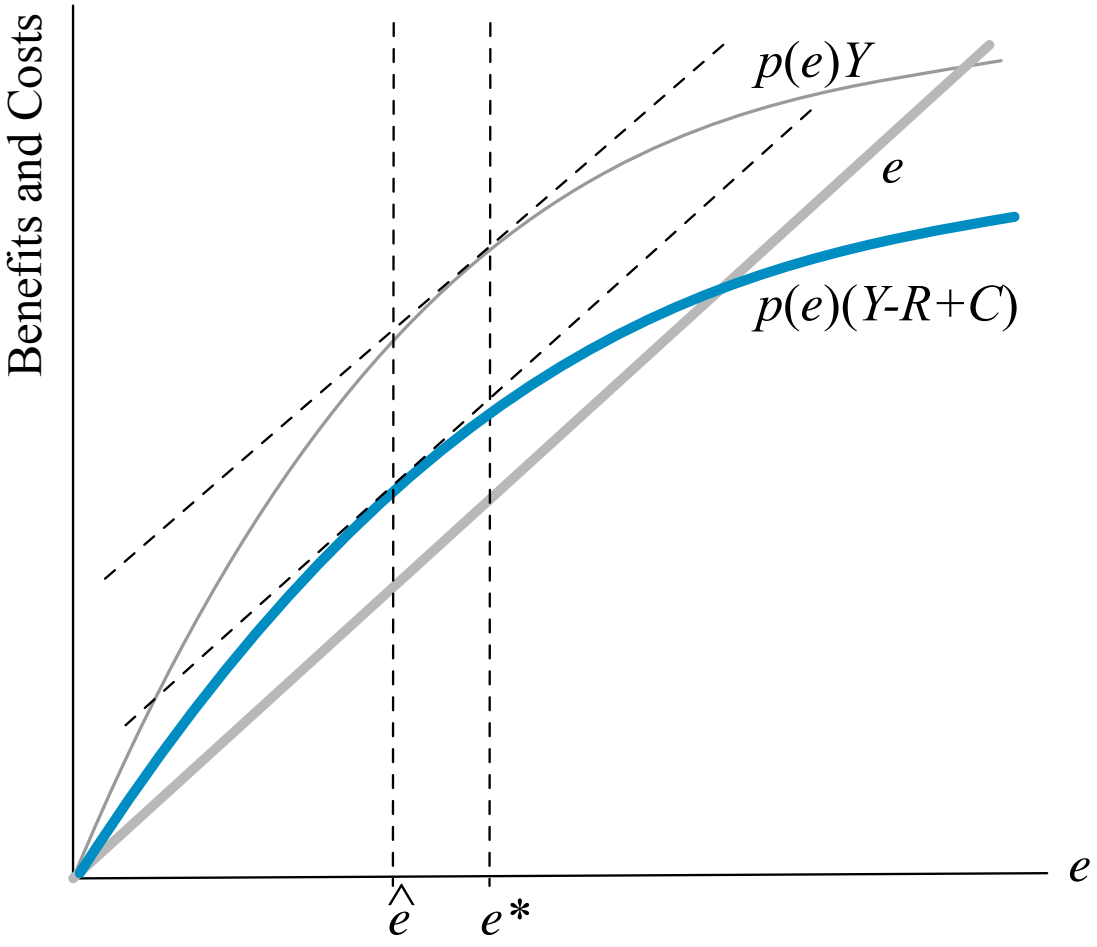
- Optimal choice $\hat{e}$ is defined by the first-order condition:

$$(Y + C - R)p'(\hat{e}) = 1.$$

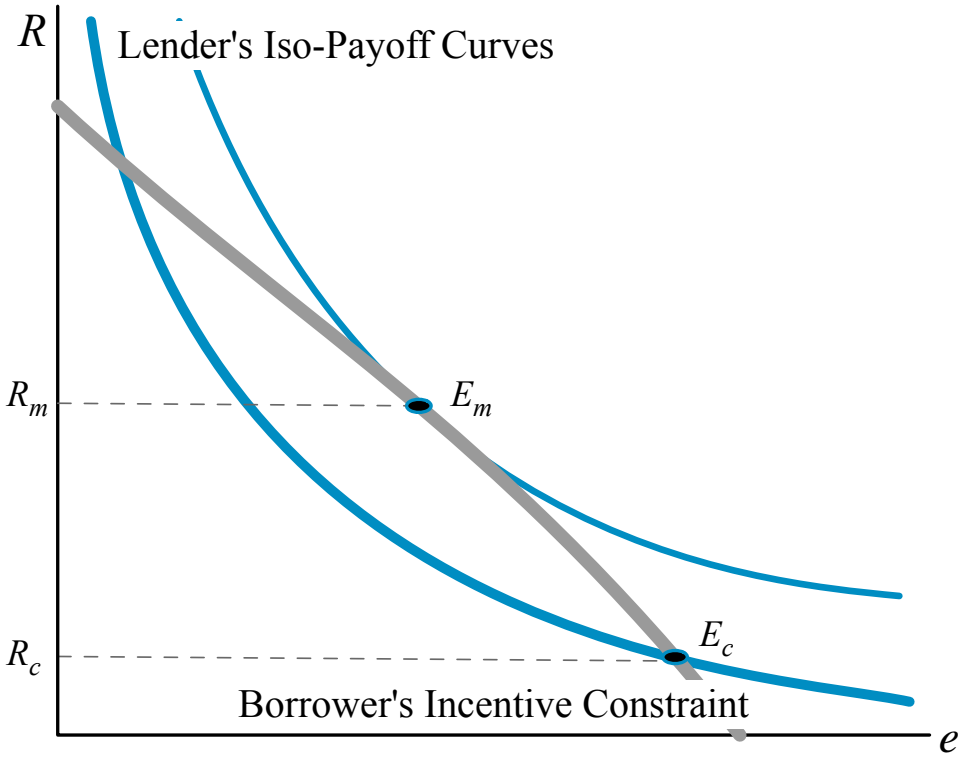
- $\hat{e} < e^*$.
- $\hat{e}$ is decreasing in R and increasing in C.
- This is the **debt overhang**.
- Lender return given by $\pi = p(e)R + [1 - p(e)]C$,

  where we've left out the (fixed) cost of giving the loan.

Moral Hazard and the Debt Overhang



Equilibrium Under the Debt Overhang



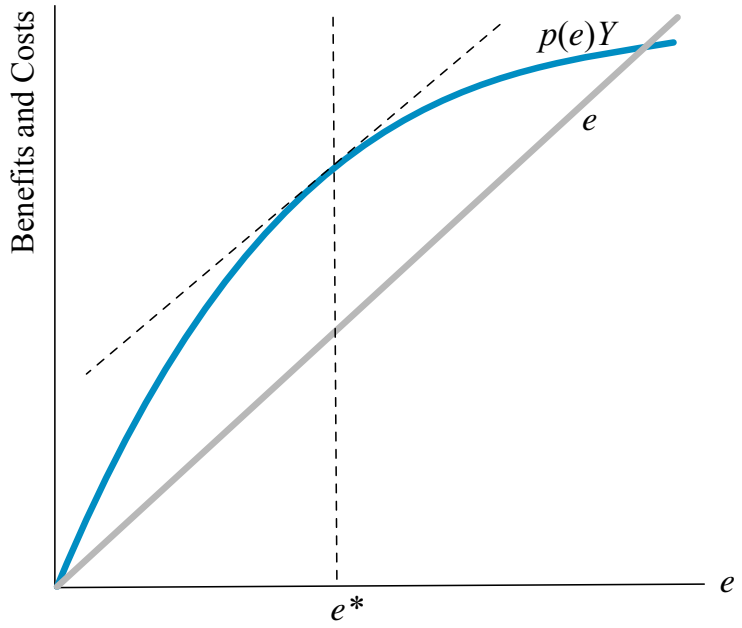
- Equilibrium is at E_c under competition, E_m under monopoly.

Social Surplus and Lender Power

- **Social surplus:**

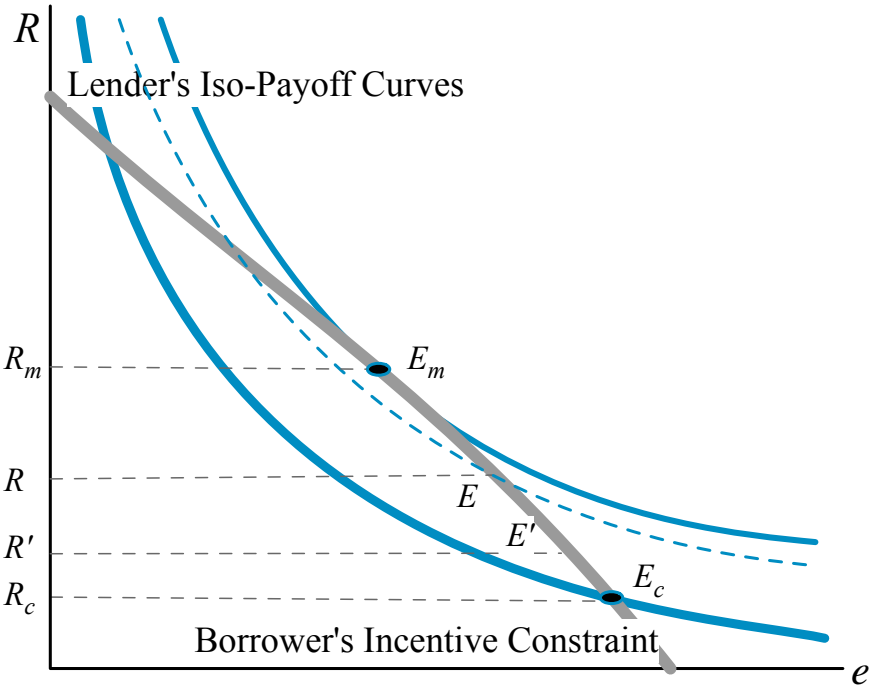
$$S \equiv \underbrace{p(e)(Y-R)-(1-p(e))C-e}_{\text{Borrower payoff}} + \underbrace{p(e)R+(1-p(e))C}_{\text{Lender payoff}} = p(e)Y-e,$$

- Note: social surplus rises as e rises to e^*, then falls again.



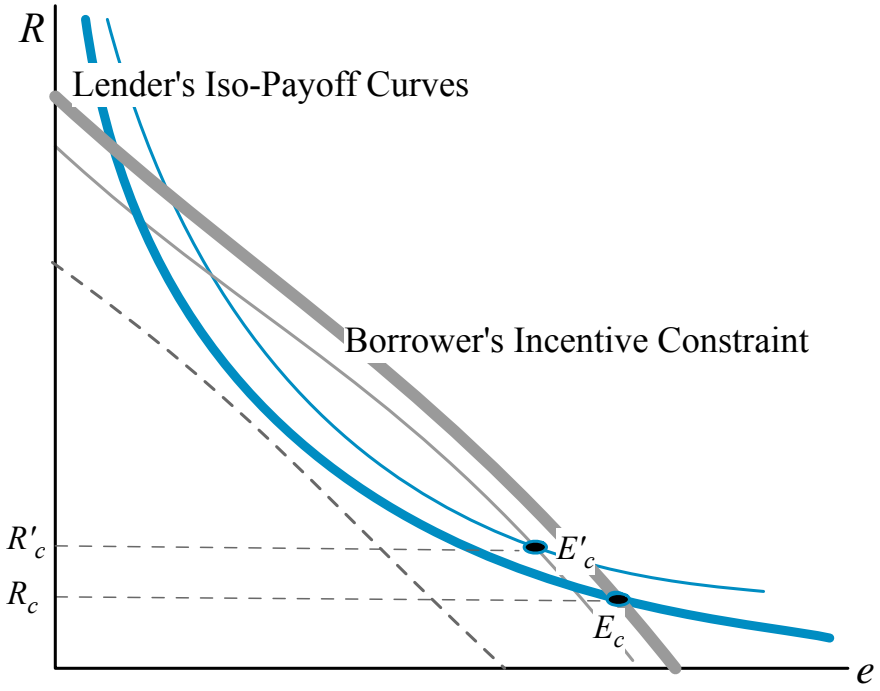
Social Surplus and Lender Power

- Equilibria with higher lender profits involve higher interest rates (though with a ceiling even at full monopoly) but lower levels of effort and social surplus, the latter given by $p(e)Y - e$.



The Effect of Borrower Collateral

- Reduced collateral / poorer borrower; same level of lender payoff



- Under competition: worse terms, lower effort.

Strategic Default in Credit Markets

- **Focus in this section: outside options, variable loan size**
- $Y = F(L)$
- Borrow L repeatedly (working capital)
- Stationary contract (L, R).
- **To repay or not to repay?**
- If repay, get $[F(L) - R]/(1 - \delta)$.
- If default, get $F(L)$ today and v per period starting tomorrow.

$$F(L) + \delta \frac{v}{1 - \delta}.$$

Strategic Default in Credit Markets

- The **no-default constraint** or **self-enforcement constraint**:

$$\frac{F(L) - R}{1 - \delta} \geq F(L) + \delta \frac{v}{1 - \delta};$$

  - which simplifies to

$$\delta[F(L) - v] \geq R.$$

- **Interpretations of v:**

  - Alternative lenders:

$$v = F(\hat{L}) - \hat{R} \text{ for other lenders } (\hat{L}, \hat{R}).$$

  - Solitary operations: $v = F(0)$.

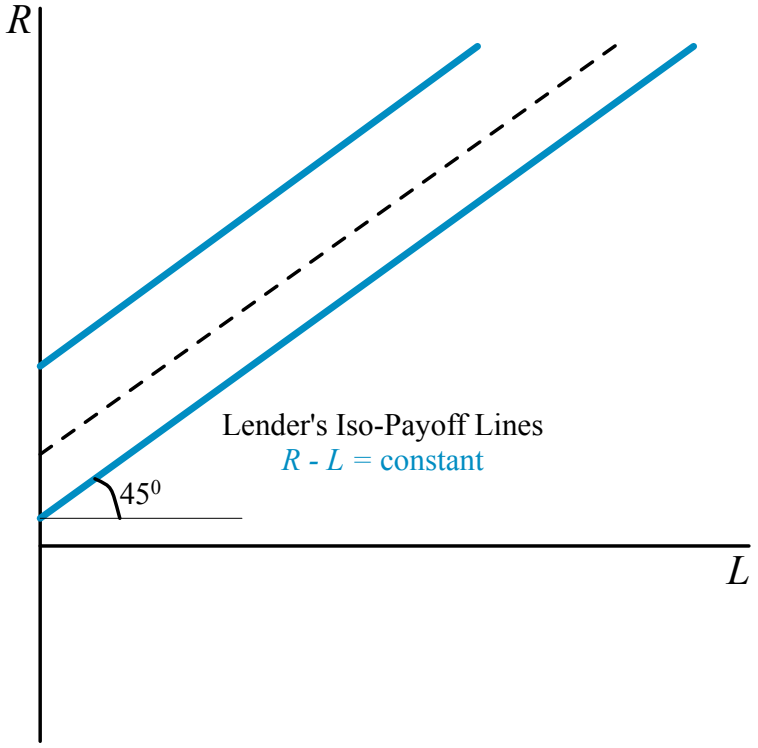
  - Occupation changes: $v =$ wages.

Lender's Payoff and the Self-Enforcement Constraint

- Lender's net payoff is

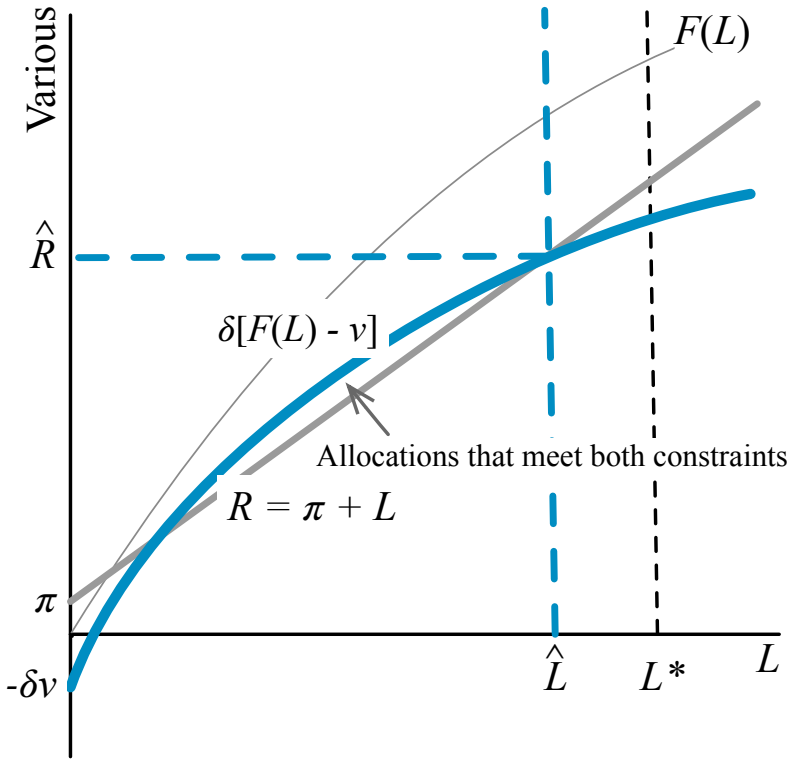
$$R - L.$$

(can factor in a safe rate of interest as well, but let's ignore that here).



Lender's Payoff and the Self-Enforcement Constraint

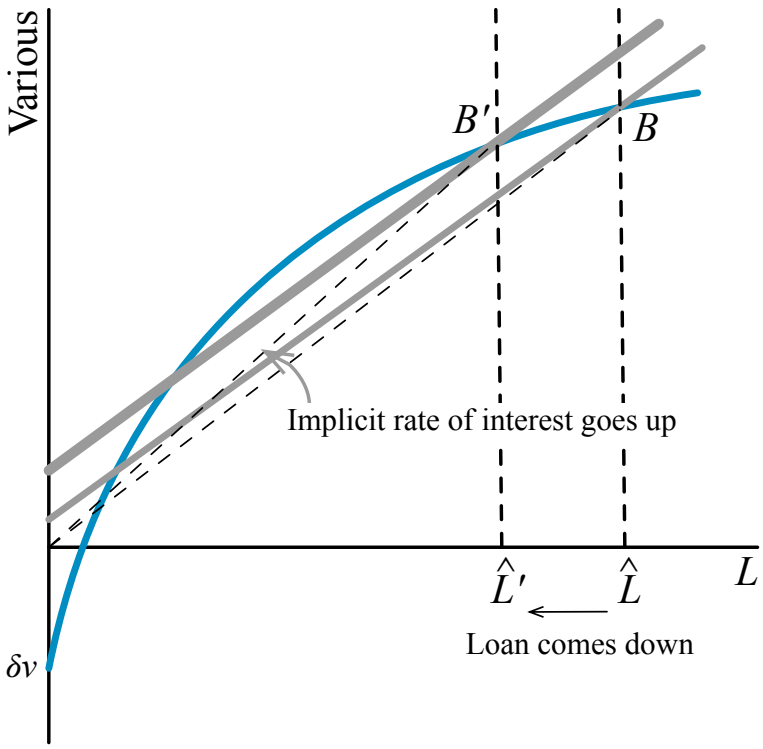
- Combine with δ times $F(L)$ to get no-default constraint $\delta[F(L) - v] \geq v$.



The Social Surplus

- Borrower's payoff is $F(L) - R$, lender's payoff is $R - L$,
- Therefore **total surplus** $= F(L) - L$.
- This is maximized when $L = L^*$, where $F'(L^*) = 1$.
- We presume that L^* is too big to be self-enforceable.
- Ideally, we'd like to get as close to L^* as we can.

Lender Power

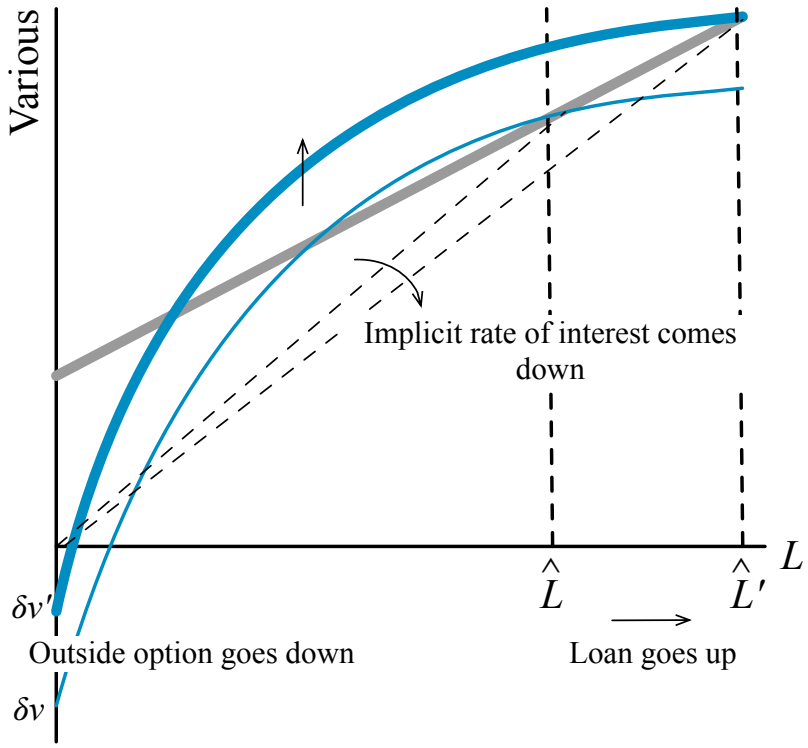


- Equilibria with higher lender profits involve higher interest rates, lower loans and lower social surplus.

Outside Options

Effect of a fall in outside option v.

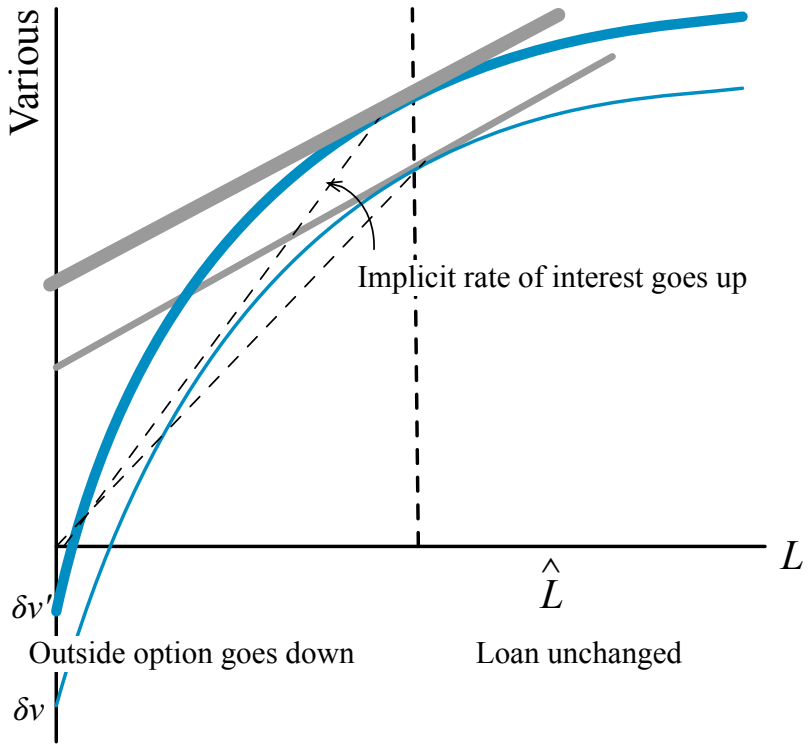
- **Competition**: $L \uparrow$, implicit interest rate $\downarrow$.



Outside Options

Effect of a fall in outside option v.

- **Monopoly**: interest rate ↑, L unchanged.



Two Credit Variants Special to Developing Countries

A. Microfinance

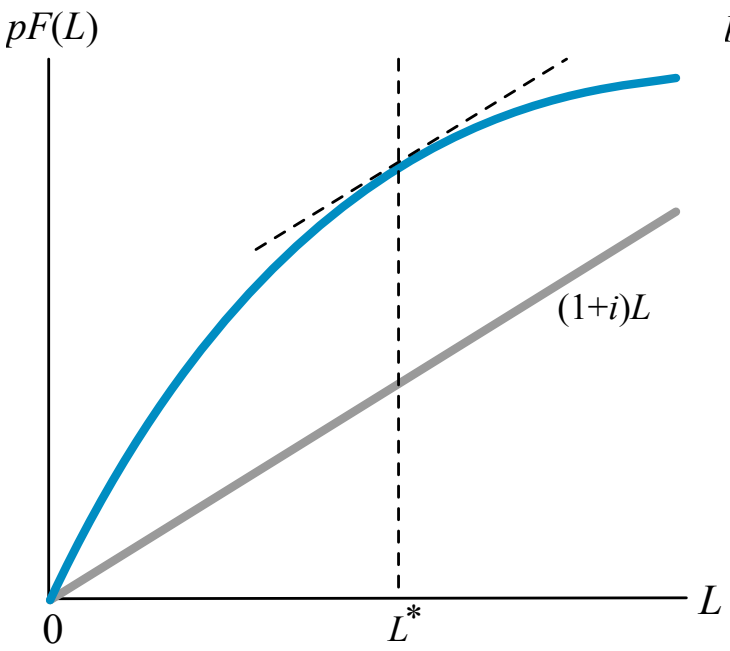
- All our ideas apply to microfinance:
- adverse selection, moral hazard, strategic default.
- MFOs use several devices to get around these problems:
- group lending to figure out whom to lend to
- frequent meetings and repayments
- restricting loans for working capital to avoid strategic default

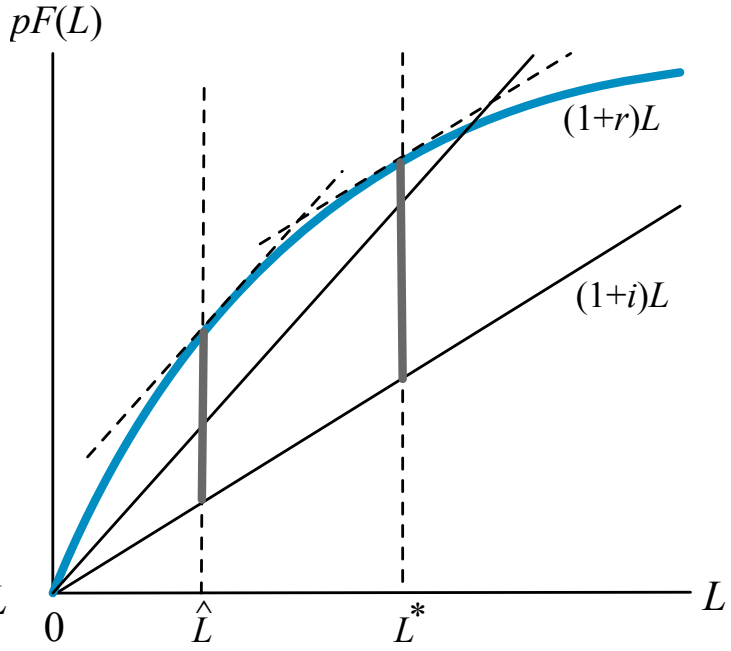
- **B. Interlinked Contracts.**
- Market segmentation:
  - Landlord lends to tenant, the trader to farmers, etc.
- **Reasons for interlinkage:**
  - Nonmarketable Collateral. Easier to accept if it matches occupation.
  - Enforcement. Double threats; e.g., remove tenancy + future loans.
  - Covering Fixed Costs. Promise of output sales cover fixed trading costs.
  - Removal of Distortions. Multi-dimensional pricing.

Trader Lending: An Example of Multidimensional Pricing

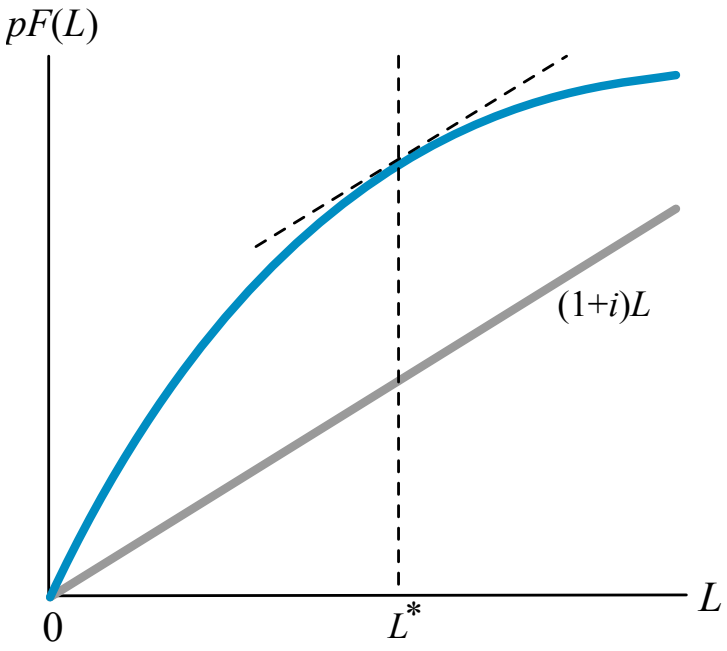
- Borrrower borrows L, produces rice $Q = F(L)$.
- Market price of rice is p.
- Lender charges interest rate r, i is his safe opportunity rate.
- The borrower *chooses* L (a different kind of moral hazard).
- Lender cannot “force” borrower to borrow more than he wants.

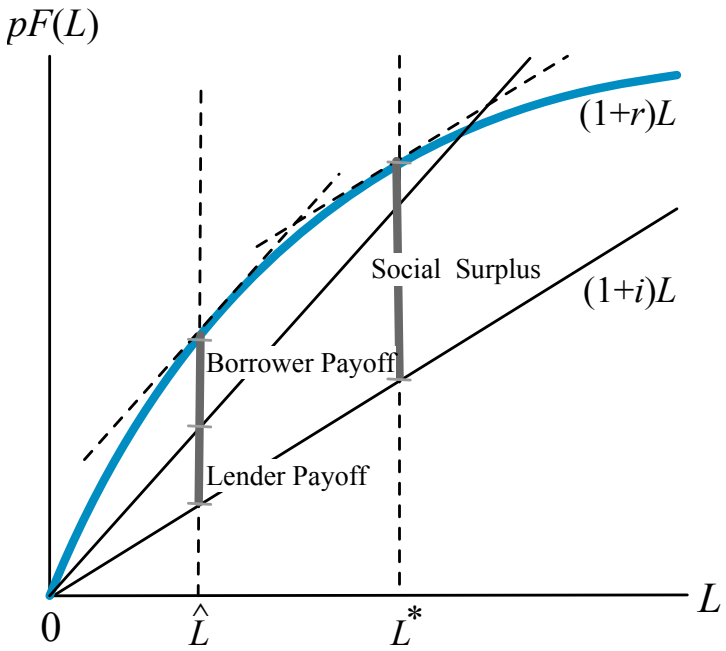
Why Pure Moneylending is Inefficient





Why Pure Moneylending is Inefficient





- Lender chooses r to max $(r-i)L$.
- Borrower chooses L to max $pF(L)-(1+r)L$.
- **underborrows relative to L^*.**

The Optimal Interlinked Contract

Trader-lender:

- Can buy crop at price q and charge rate r.
- Chooses (q, r) to maximize $(p - q)F(L) + (r - i)L$
- Knowing that borrower will choose L to maximize $qF(L) - (1 + r)L$.
- Must respect borrower outside option: $qF(L) - (1 + r)L \geq$ Bo.

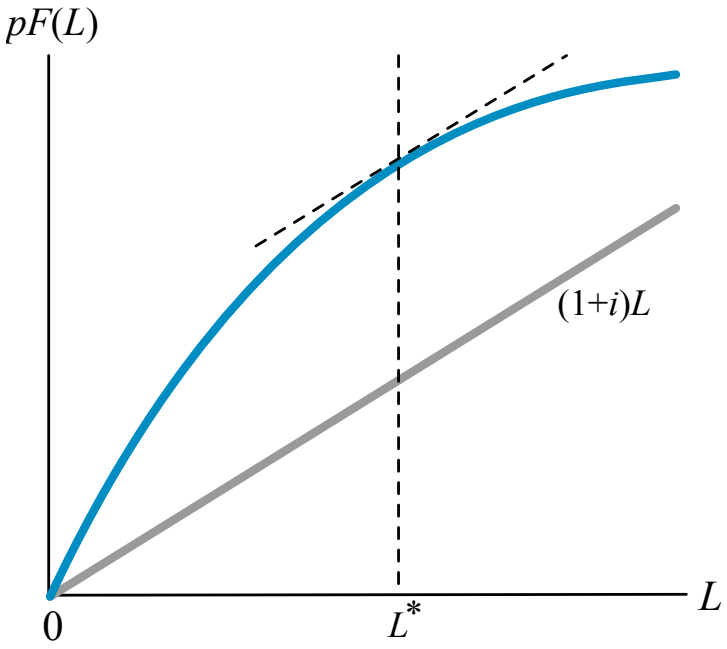
Solution: Imagine "profit tax" t with farmer accessing loans at rate i

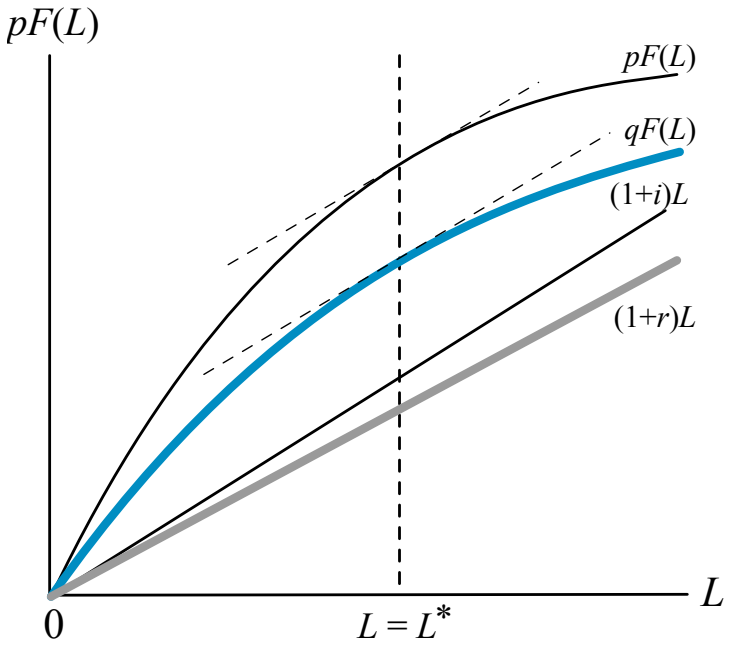
- $t[pF(L^*) - (1 + i)L^*]$ = lender's payoff, with
- $(1 - t)[pF(L^*) - (1 + i)L^*]$ = borrower's payoff = Bo.

Must be optimal if implementable:

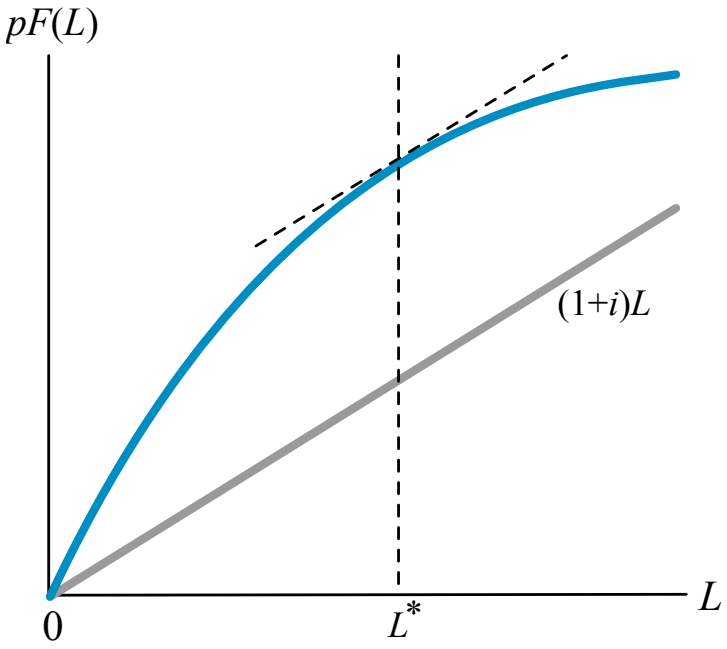
- But it is implementable by setting $q = tp$ and $(1 + r) = t(1 + i)$!

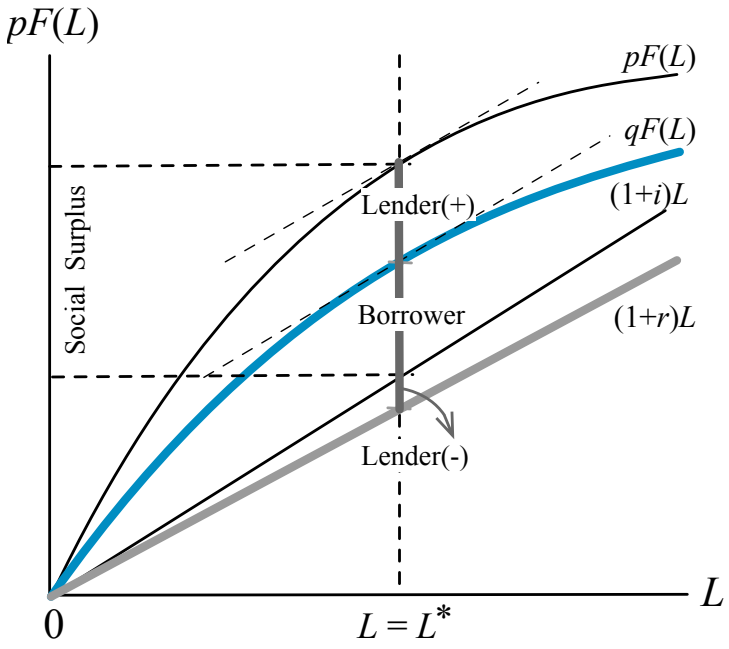
The Optimal Interlinked Contract





The Optimal Interlinked Contract





Credit Markets: A Summary

- **Fundamental features of credit markets:**
  - Rarely full collateral
  - Limited liability
- These two aspects **generate imperfections** of the market:
  - Via adverse selection: project mix becomes excessively risky
  - Via moral hazard: borrowers put in too little effort to repay
  - Via strategic default: borrowers take outside options
- **Outcomes typically inefficient**, with credit rationing
  - Inefficiencies exacerbated when lender has more monopoly power.