

**EC372 Bond and Derivatives Markets**  
**Topic #10: Financial Intermediation, II**

**R. E. Bailey**

**Department of Economics**  
**University of Essex**

**Outline**

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Reading: *Lecture notes* (available online in the CMR)

Other references (but not required reading for EC372:

**1 Financial Intermediation as Delegated Monitoring**

**Delegated Monitoring**

- Investors delegate responsibility for monitoring borrowers to intermediaries.

In the ‘delegated monitoring’ approach investors (but not necessarily *all* investors) delegate responsibility to an intermediary (e.g., a bank) to monitor the ultimate recipients (borrowers, e.g., firms) of investors’ funds.

Such delegation could result from several causes, including: (i) economies of scale (intermediaries gather funds from investors and lend to many borrowers); (ii) expertise (intermediaries have a comparative advantage in specialist monitoring skills); (iii) ‘lumpy’ (indivisible) investment projects (each firm’s investment project may require the funds of many investors).

- Aspects of delegated monitoring:

1. *Screening* – assess borrower’s creditworthiness

2. *Prevention* – check borrower’s behaviour
3. *Auditing* – penalise borrower’s misbehaviour

The classification is taken from Freixas and Rochet, *Microeconomics of Banking*.

## 1.1 Principal-Agent relationships

### Principal-Agent theory: a sketch

- The principal seeks to control the actions of an agent in the interests of the principal.
- Suppose principal has complete control over the agent:
  - treat as a single decision-making unit
- Suppose principal has *incomplete* control over the agent:
  - scope for genuine principal-agent relationship
- The principal designs rules to give *incentives* to the agent to act in the principal’s interests
- Why does the principal have incomplete control over the agent?
  1. Hidden actions  $\Rightarrow$  *Moral hazard*
  2. Hidden information  $\Rightarrow$  *Adverse selection*

### Principal-Agent: Financial Intermediation

- Financial intermediation: principal  $\Leftrightarrow$  bank; agent  $\Leftrightarrow$  borrower
- Principals (banks) elicit information from or influence the behaviour of agents (borrowers)
- Key assumptions in the ‘moral hazard’ approach:
  1. *Incomplete contracts*: lender cannot specify borrower’s action in every circumstance. Some discretion must be left to the borrower.
  2. *Divergent objectives*: lender cares only about cash payoff; borrower prefers to shirk. The borrower may prefer to sacrifice some profit for ‘private benefits’ (an easy time) but the lender captures none of the borrower’s private benefits.
- Alternative approach: depositors are principals that monitor banks (agents) (*not studied in EC372*)

## 2 The Holmstrom & Tirole (HT) Model

### The Holmstrom & Tirole (HT) Model

- HT model is based on *moral hazard*
- Three groups of decision-makers (all risk-neutral):
  1. *Firms* – issue bonds or borrow from banks

2. *Investors* – hold bonds issued by firms but cannot monitor them
  3. Financial *intermediaries* (banks) – lend to firms and monitor them
- Alternative asset has a fixed payoff equal to  $\gamma > 0$  Thus  $\gamma$  is the ‘opportunity cost of capital’ (essentially “one plus the interest rate”).
- NOTE: Competition among investors and risk neutrality implies that the *expected payoff on bonds equals  $\gamma$* .
- HT model has two varieties:
    1. *Fixed* investment: scale of each firm’s investment is exogenous
    2. *Variable* investment: firms choose scale of investment project

## Firms’ investment opportunities

### Firms’ investment payoffs

- Firms differ only in the amount of initial capital,  $A$ .
- Cost of project:  $I$  (from own funds, loans or bonds)
- Investment payoffs:  $R^*$  = success; 0 = failure.
- Each firm chooses effort,  $H$  (no shirking) or  $L$  (shirking), with probabilities of success  $p_H$  and  $p_L$ :  $\Delta p \equiv p_H - p_L > 0$ .
- Private benefits:  $H \Rightarrow \text{Nil}$ ;  
 $L \Rightarrow B^*$  if not monitored,  $b^*$  if monitored; with  $B^* > b^*$

### Firms’ investment opportunities

- Assumptions about expected payoffs:
  - $p_H R^* - \gamma I > 0$  – high effort investment is economically viable, in the sense that the expected payoff is sufficient to pay bond-holders  $\gamma$  and also leaves something for the firm.
  - $p_L R^* - \gamma I + B^* < 0$  – low effort is not economically viable in the sense that with  $L$ , investors would expect the payoff on bonds to be less than  $\gamma$ ; hence they would not hold firms’ bonds
- Note:  $p_L R^* - \gamma I + b^* < 0$  because  $b^* < B^*$   
 Also it can be shown that intermediated loans cost more than  $\gamma$ , reinforcing the unviability of  $L$ .
- Expected payoffs are split between firms, bond holders and banks
- ‘*Direct*’ finance obtained from issuing bonds;  
 ‘*Indirect*’ finance’ obtained from bank loans
- Firms borrow from banks only if bond finance is not available because banks will monitor them.

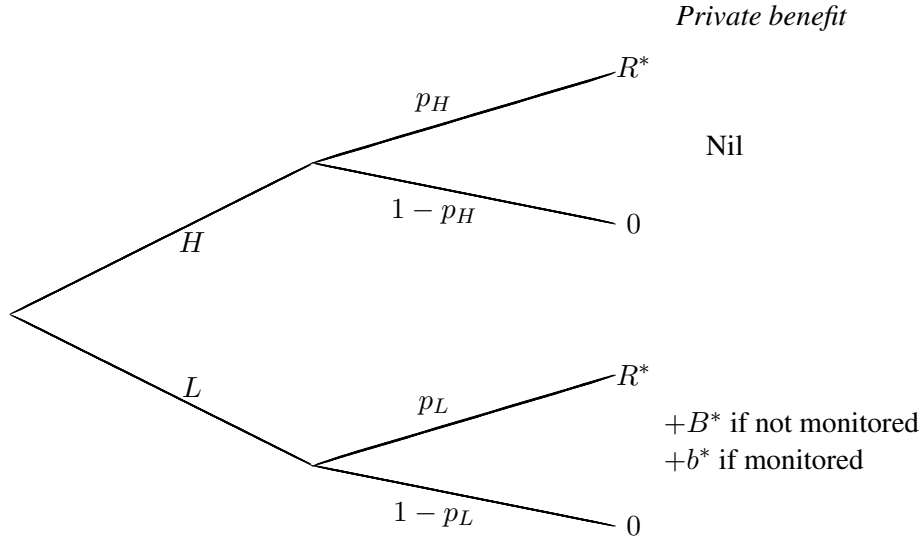


Figure 1: Firms' investment opportunities

Interpretation: Each firm chooses  $H$  or  $L$  (and  $B^*$  or  $b^*$ , if  $L$  is chosen); then 'Nature' chooses success or failure with the stated probabilities. Everyone is assumed to know the probabilities  $p_H$  and  $p_L$  that Nature will act in a particular way.

### 3 Fixed Investment

#### 3.1 Direct finance

##### Direct finance

- $R^* = R_f + R_u$ : firm's payoff =  $R_f$ ; investors' payoff =  $R_u$
- Non-shirking ( $H$ ) requires:

$$p_H R_f \geq p_L R_f + B^* \quad \text{or} \quad R_f \geq B^* / \Delta p$$

- Payoff to investors from an investment of  $I_u$ :

$$\gamma I_u = \gamma [I - A] \leq p_H \left[ R^* - \frac{B^*}{\Delta p} \right]$$

- Minimum capital required to obtain bond finance:

$$\bar{A}(\gamma) = I - \frac{p_H}{\gamma} \left[ R^* - \frac{B^*}{\Delta p} \right]$$

Only firms for which  $A \geq \bar{A}(\gamma)$  will be able to borrow from the bond market. Suppose that a firm has just enough initial capital to access the bond market, i.e.,  $A = \bar{A}(\gamma)$ . Then it follows that  $R_f = B^* / \Delta p$ ; in words, a firm with no 'excess' initial wealth, obtains a payoff on its investment project (if it is successful) exactly equal to the minimum required to induce the firm to behave.

## 3.2 Indirect finance

### Indirect finance

- Even if  $A < \bar{A}(\gamma)$ , a firm may still be able obtain a bank loan
- But, because monitoring is costly, loan finance is costly:  $\beta > \gamma$ , where  $\beta$  is the required return on bank loans. (Hence, firms will never borrow any more than is absolutely necessary from banks.)
- Now:  $R^* = R_f + R_u + R_m$ , where  $R_m$  is the bank's payoff.
- As banks monitor loans, shirking is lower:  $b^* < B^*$ . Hence:

$$R_f \geq b^*/\Delta p$$

- Assume monitoring costs  $c^*$  per firm (project). Then:

$$p_H R_m - c^* \geq p_L R_m \quad \text{or} \quad R_m \geq c^*/\Delta p$$

### Indirect finance, continued

- Competition drives banks' payoff to:  $R_m = c^*/\Delta p$
- If  $I_m$  is the bank's investment,  $\beta I_m = p_H R_m$ . Hence:

$$I_m(\beta) = \frac{p_H c^*}{\beta \Delta p}$$

- Only firms with capital,  $A \geq \underline{A}(\gamma, \beta)$  will be able to obtain a loan. (See notes for the definition of  $\underline{A}(\gamma, \beta)$ .)
- Indirect finance is possible only if  $c^*$  is low enough that:

$$c^* \Delta p < p_H [B^* - b^*] \quad \implies \quad \underline{A}(\gamma, \beta) < \bar{A}(\gamma)$$

In words: if monitoring costs are low enough, there will be a range of initial capital levels that enable a firm to obtain loans from an intermediary.

## 3.3 Interpretation

### Interpretation

- HT model shows how initial capital allows access to credit markets.
- Firms with enough capital can borrow without monitoring (but will still not shirk)
- Firms with too little capital will not be able to borrow at all.
- Firms with  $\underline{A}(\gamma, \beta) \leq A < \bar{A}(\gamma)$  can obtain bank loans (and will be monitored)

### 3.4 Credit Market Equilibrium

#### Credit Market Equilibrium

- HT assume that the aggregate supply of capital is given by:
  - Investors' capital:  $K_u = S(\gamma)$ , where  $S'(\gamma) > 0$
  - Banks' capital:  $K_m$  is exogenously fixed
  - Firms' initial capital:  $K_f$  is exogenously fixed
- Beware: some ambiguities remain (see notes).
- Firms' aggregate demand for funds:

$$\text{Firms' demand for uninformed capital: } D_u(\underset{-}{\gamma}, \underset{-}{\beta}; \underset{+}{K_f})$$

$$\text{Firms' demand for monitored loans: } D_m(\underset{-}{\gamma}, \underset{-}{\beta}; \underset{+}{K_f})$$

#### Credit Market Equilibrium, continued

- Market equilibrium conditions:

$$\text{Bond market (direct finance): } D_u(\gamma, \beta; K_f) = S(\gamma)$$

$$\text{Intermediary loans (indirect finance): } D_m(\gamma, \beta; K_f) = K_m$$

- Various 'shocks':
  1. *Credit crunch*:  $K_m$  falls
  2. *Collateral squeeze*:  $K_f$  falls
  3. *Savings squeeze*:  $S(\gamma)$  shifts left, lowering  $S$  for each  $\gamma$ .
- Results:
  1. *Credit crunch*  $\implies \beta \uparrow; \gamma \downarrow$ .
  2. *Collateral squeeze*  $\implies \beta \downarrow; \gamma \downarrow$ .
  3. *Savings squeeze*  $\implies \gamma \uparrow; \beta \downarrow$ .

(Check notes for details.)

## 4 Variable Investment

#### Variable Investment

- Allows firms to choose the size,  $I$ , of their investment projects
- Now all firms invest in a project proportional to initial capital.
- Hence, the model is no use in analysing access to different credit markets.
- Main use of the model: clarify aggregate credit market equilibrium theory
- Details are optional for EC372.