CORPORATE FINANCE, BANKING AND VENTURE CAPITAL

Lecture 1a: Leveraged Banks

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February 2021

Motivation

- **Simple** Banking model:
  - illustrate alternative form of financing constraint
  - direct application of linear investment model as in last lecture
  - incentive problem limits pledgeable income and deposit funding
  - endogenously explains leverage and capital structure of banks
  - prepares last lecture on role of banking in macroeconomy
  - reduced presentation, with problem solving
- **Manuscript**: provides details

Definitions

- **Balance sheet of banks**
  - Loans B, external equity E, deposits D

$$B = D + E$$

- **Stakeholders:** insiders and outsiders

$$\begin{aligned}
\text{banker} &: \pi^b = \left(1 + i^l\right) B - R^d - R^e, \\
\text{equity investor} &: \pi^e = R^e - (1 + r) E \geq 0, \\
\text{depositors} &: \pi^d = R^d - (1 + i) D \geq 0, \\
\text{joint surplus} &: \pi = \left(1 + i^l\right) B - (1 + r) E - (1 + i) D \\
&: \quad = \left(i^l - i\right) B - (r - i) E.
\end{aligned}$$

  – last equation uses balance sheet to replace $D = B - E$

- **Bankers:** have unique skills, but no own funds

Incentive Problem

- **Timing:** logical sequence of decisions
  1. in beginning, get external equity E
  2. conditional on E, get deposits D and invest B
  3. after that: manage diligently or divert funds
- **Problem:** only part ϕ of earnings $\left(1+i^l\right)B$ is verifyable
  - bankers might act opportunistically, divert a part $(1-\phi)\left(1+i^l\right)B$
  - costless diversion: if she diverts at all, she diverts the maximum
- **Incentive problem**: the rent of banker (insider) depends on
  - honest: get $\left(1+i^l\right)B - R^d$; OR get: keep $(1-\phi)\left(1+i^l\right)B$

$$\left(1+i^l\right)B - R^d \geq (1-\phi)\left(1+i^l\right)B \quad \Leftrightarrow \quad \phi\left(1+i^l\right)B \geq R^d$$

Incentive Problem

- **Financing constraint**:
  - need to prevent diversion limits pledgeable income to

$$IC : \phi \left(1 + i^l\right) B \geq R^d$$

  - if violated: banker diverts $(1 - \phi) \left(1 + i^l\right) B$,
    - declares bankruptcy, depositors would not get fully repaid
  - lack of pledgeable earnings limits deposit financing (debt capacity)
- **Banker's problem:** conditional on equity E, s.t. to IC and PC
  - PC: depositors must give funds $D = B - E$, and at least break even

$$\begin{aligned} \pi^b &= \max_{B, R^d} \left(1 + i^l\right) B - R^d - R^e \\ \text{IC} &: +\mu \cdot \left[\phi \left(1 + i^l\right) B - R^d\right] \\ \text{PC} &: +\lambda \cdot \left[R^d - (1 + i)(B - E)\right] \end{aligned}$$

  - See exercise and manuscript: **both constraints binding**

Endogenous Leverage

- **Solution:** see exercise/ manuscript
  - **both constraints are binding**

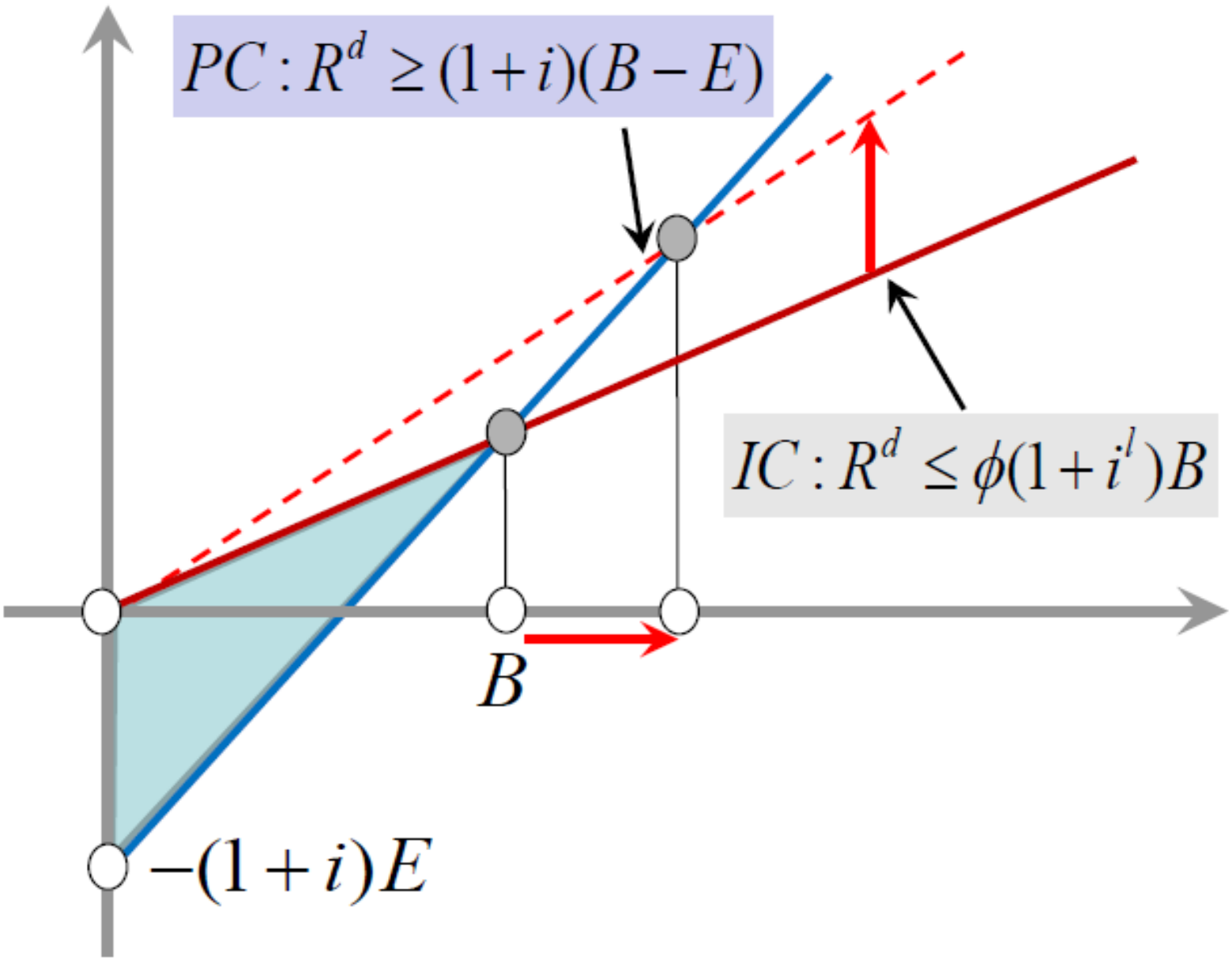
$$\text{IC}: \quad \phi\left(1+i^{l}\right)B = R^{d} = (1+i)(B-E) \quad : \text{PC}$$

  - solve for B and get maximum leverage:
- **CLASS ROOM EXERCISE**
  - find the formula for the leverage factor $\ell > 1$

$$B = \ell \cdot E$$

  - show that the equity ratio κ is the inverse of the leverage factor!
  - illustrate capital structure
  - typical equity ratio is 15% ($\kappa = 0.15$), what is the leverage factor ℓ?
- **Figure 1:** graphic illustration (remember linear investment model)

Figure 1: Bank Leverage



Equilibrium

- **Banker:** gets joint surplus $\pi = \pi^b + \pi^d\,(=0) + \pi^e\,(=0)$
  - never leave rents to competitive outsiders,
  - slide 3: using $B = \ell E$, banker gets

$$\pi^b = \left[\left(i^l - i\right)\ell - (r - i)\right] \cdot E$$

- **Scaling up bank**: if $\pi^b > 0$
  - attract more outside equity E, scale up surplus π^b
  - more lending B: loan rate i^l declines, surplus π^b falls
- **Competitive equilibrium**: i^l falls until $\pi^b = 0$
- **CLASS ROOM EXERCISE:**
  - note equity ratio κ, show that break-even loan rate i^l is

$$i^l = \kappa \cdot r + (1 - \kappa) \cdot i$$

  - loan rate is weighted average of funding costs r and i
  - **END**