Credit Risk

Lecture 16: Credit Risk
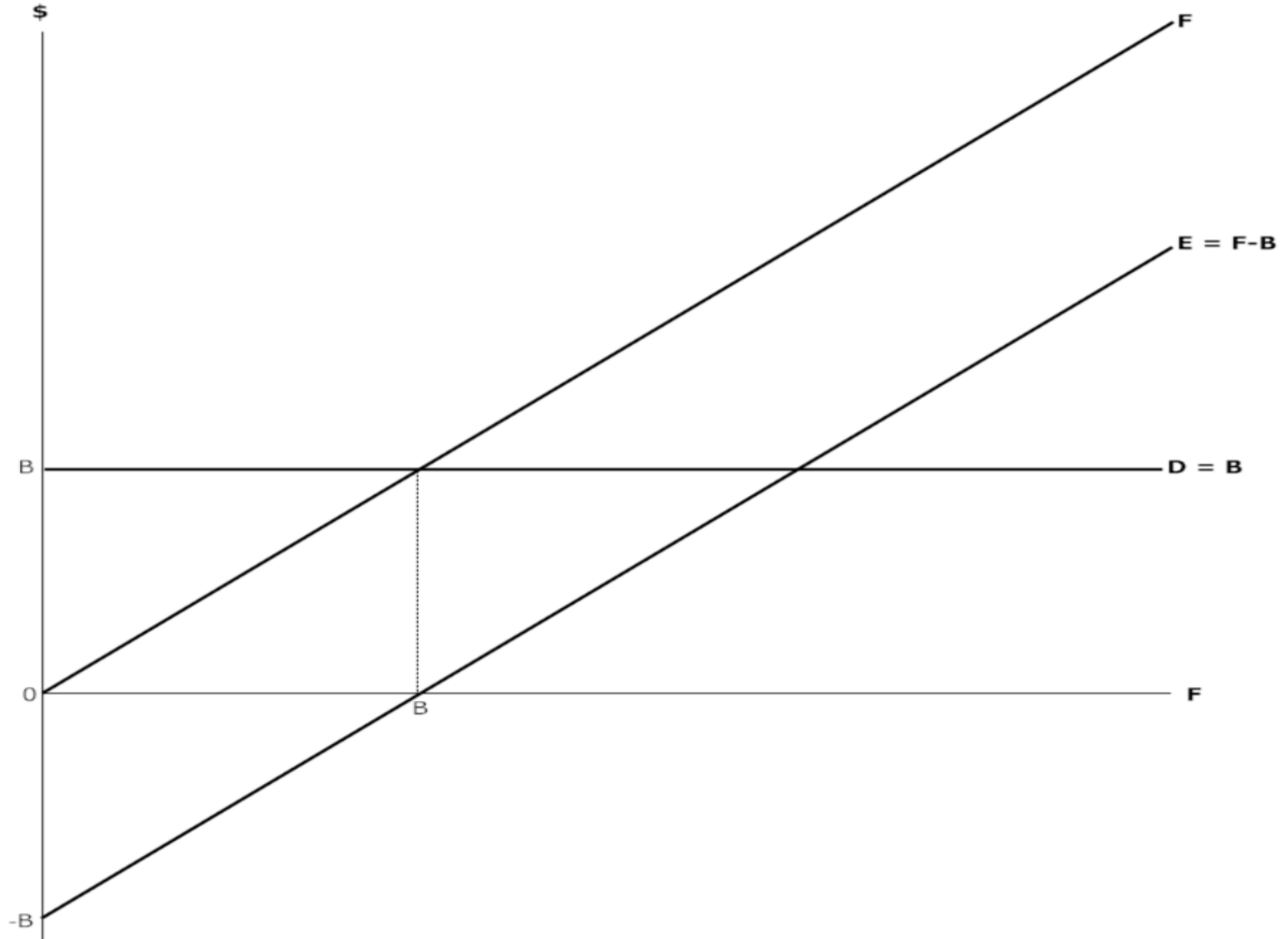
Unlimited Liability

- Assume a single period – the firm is formed at $t=0$, and cash flows are realized at $t=1$.

- Let F, D, and E represent the $t=1$ payoffs on the firm's assets, its debt, and equity. Assume the firm has promised to repay creditors $\$B$ at $t=1$. Under *unlimited liability*, these payoffs can be written:

$$F = D + E;$$

$$E = F - B; \text{ and}$$

$$D = B.$$

Unlimited Liability

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Pricing Credit Risk using the BSM model

- Under *limited liability*, corporate payoffs are: $F = D + E$, where
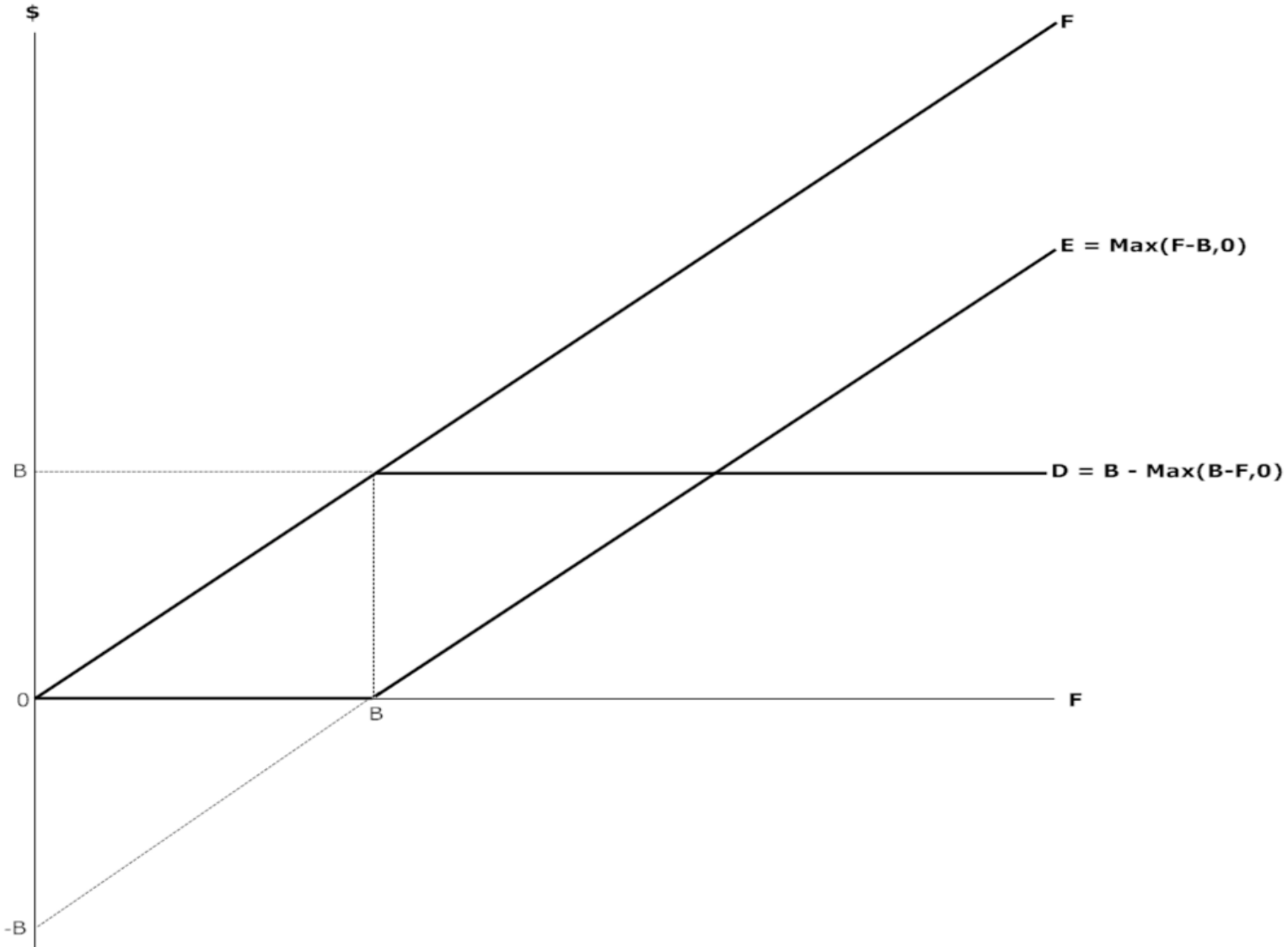
$$E = \begin{cases} F-B & \text{if } F \geq B \\ 0 & \text{if } F < B \end{cases}$$

$$= MAX\big[F - B, 0\big] = F - B + MAX\big[B - F, 0\big]$$

$$D = \begin{cases} B & \text{if } F \geq B \\ F & \text{if } F < B \end{cases}$$

$$= F - MAX\big[F - B, 0\big] = B - MAX\big[B - F, 0\big]$$

Limited Liability

Numerical Example: Pricing Credit Risk

Problem Setup:

- Suppose two banks exist which are identical in all respects except for degree of financial leverage.

- At date $t = 0$, Bank 1 issues zero coupon deposits with a face value of $500,000, whereas bank 2 has issued zero coupon deposits with a face value of $800,000.

- Current $(t = 0)$ asset value for both banks is $1,000,000, and 1 year from today (at date $t = 1$), depositors expect these banks to pay back the face value of deposits with profits earned from their investments.

- However, since both banks are limited liability corporations, and hold risky assets $(\sigma = .4)$, depositors face the risk of default.

- The annual riskless rate of interest is 3%.

1. Suppose there is no deposit insurance. What are the fair market values for the deposits held by Bank 1 and Bank 2 if there is no deposit insurance?

2. What are the values of Bank 1 and Bank 2 limited liability put options?

3. What are the (risk neutral) probabilities of default for Bank 1 and Bank 2?

4. Calculate yields to maturity and credit risk premiums for Bank 1 and Bank 2.

5. Suppose the government institutes a risk-based deposit insurance scheme in which bank deposits are fully insured against the risk of default. What are the fair premiums for deposit insurance paid by Bank 1 and Bank 2?

6. What effect will deposit insurance have on the yields to maturity and credit risk premiums that depositors expect from Bank 1 and Bank 2?

7. Now suppose the government charges premiums based on the average of the fair premiums that Bank 1 and Bank 2 should pay. Analyze the behavioral effects of such a pricing scheme. Specifically, who wins and who loses, and what incentives are conveyed by such a scheme?