Corporate Finance: Debt renegotiation

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Gertner and Scharfstein, JF 1991

A Theory of Workouts and the Effects of Reorganization Law

The model

- The timing:

Period 0	Period 1	Period 2
The firm has a cash flow $Y < B+D$ The firm can restructure its debt	The firm needs to pay B to a bank and qD to bondholders The firm can invest I in a project	The firm needs to pay (1-q)D to bondholders The project yields $X \sim [0,\infty)$

- The dist. of X is f(x) and the CDF is F(X)
- The mean of X is $\hat{X} = \int_0^\infty X dF(X)$

Bank debt restructuring

- Y < I+B+qD ⇒ without restructuring the firm cannot invest
- The firm must raise I+B+qD-Y in period 1 in order to cover I
- The Trust Indenture Act of 1939 requires debtholders unanimity to change the interest, principal, or maturity of pubic debt ⇒ renegotiation of public debt is very hard
- Bank debt restructuring:
  - the bank gives the firm cash worth I+B+qD-Y so the firm can meet all its obligations in period 1
  - the face value of the new bank's debt is higher to ensure that the bank makes a profit
- Simplifying assumption: bankruptcy occurs in period 2 iff

$$X < Z \equiv \underbrace{I + B + qD - Y}_{\text{Bank debt}} + \underbrace{(1-q)D}_{\text{public debt}}$$

- This is a simplifying assumption since the face value of the new bank debt is actually higher

Bank debt restructuring – period 2

- **Solvency: X > Z**

$$Z \equiv \underbrace{I + B + qD - Y}_{\text{New bank debt}} + \underbrace{(1-q)D}_{\text{Public debt}} = I + B + D - Y$$

$\Rightarrow$ The firm and the bank split X–(1-q)D

- **Bankruptcy: X < Z**

$\Rightarrow$ X

$\rightarrow \dfrac{I + B + qD - Y}{Z} X$ New bank debt

$\rightarrow \dfrac{(1-q)D}{Z} X$ Public debt

Condition for bank restructuring

$$\underbrace{\int_0^Z \frac{I+B+qD-Y}{Z} X dF(X)}_{\text{Period 2 payoff in bankruptcy}}$$

$$+\underbrace{\int_Z^\infty \left(X-(1-q)D\right)dF(X)}_{\text{Period 2 payoff in solvency}} - \underbrace{\left(I+qD-Y\right)}_{\substack{\text{Period 1 extra}\\ \text{cash outflow}}} \geq \underbrace{\frac{B}{B+D}Y \equiv L_B}_{\substack{\text{payoff in period 1 under}\\ \text{bankruptcy (absent}\\ \text{restructuring)}}}$$

$$\int_0^Z X + \underbrace{\frac{I+B+qD-Y-Z}{Z}}_{-(1-q)D/Z} X dF(X)$$

$$+\int_Z^\infty \left(X-(1-q)D\right)dF(X) - \left(I+qD\right) \geq \frac{B}{B+D}Y - Y = -\frac{D}{B+D}Y \equiv -L_D$$

The bank will agree to restrcture B:

$$\hat{X} - I \geq \underbrace{qD + \int_0^Z \frac{(1-q)D}{Z} X dF(X) + \int_Z^\infty (1-q) D dF(X)}_{V_D = \text{the value of public debt under restructuring}} - L_D$$

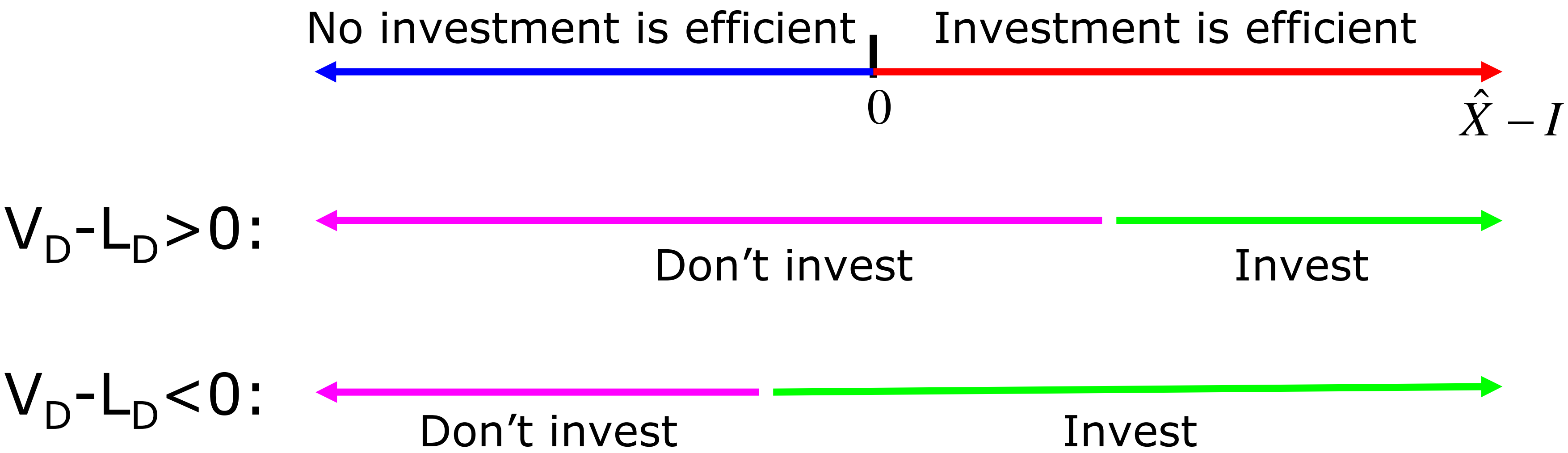
- The condition for restructuring:

$$\underbrace{\hat{X} - I}_{\text{Expected NPV}} \geq \underbrace{V_D - L_D}_{\text{Transfer to public debt}}$$

- V_D-L_D is positive or negative

Investment with bank debt

- Invest iff: $\hat{X} - I \geq V_D - L_D$



- We can have underinvestment (debt overhang) or overinvestment (asset substitution)

The effect of public debt maturity

- The value of debt under resructuring:

$$V_D = qD + \int_0^Z \frac{(1-q)D}{Z} X dF(X) + \int_Z^\infty (1-q) D dF(X)$$

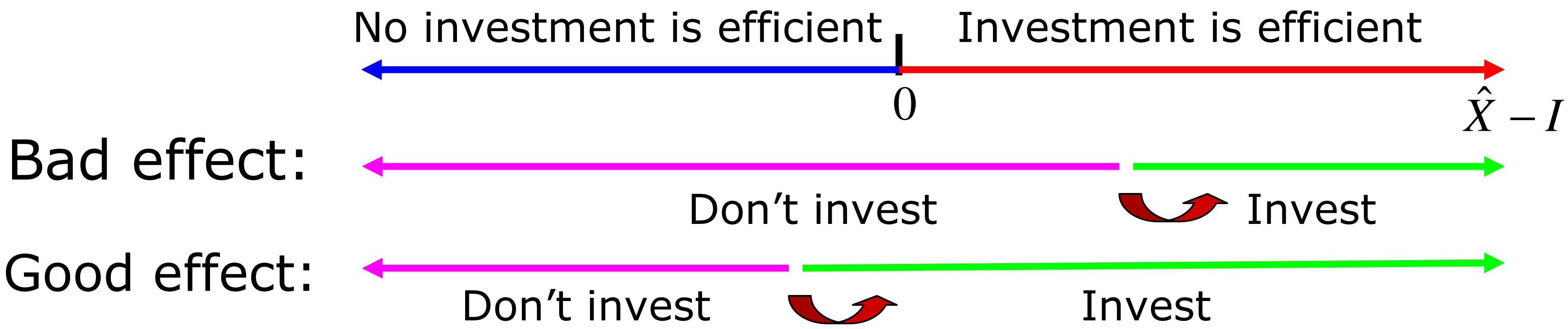
- V_D = D if q = 1
- How does q affect V_D?

$$\frac{\partial V_D}{\partial q} = D - \int_0^Z \frac{D}{Z} X dF(X) - \int_Z^\infty D dF(X)$$

$$> D - \int_0^Z \frac{D}{Z} Z dF(X) - \int_Z^\infty D dF(X) = 0$$

The effect of public debt maturity

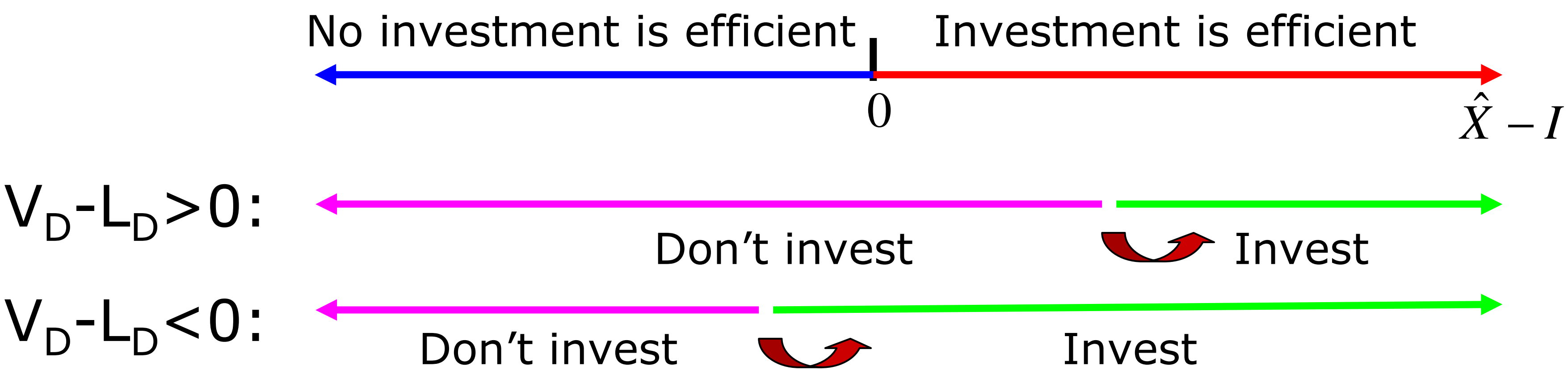
- $q\uparrow \Rightarrow V_D\uparrow \Rightarrow V_D - L_D\uparrow$
- Investment takes place iff: $\hat{X} - I \geq V_D - L_D$
- Since $q\uparrow \Rightarrow V_D\uparrow$, underinvestment is likely when $q \rightarrow 1$ (short maturity) and overinvestment is likely when $q \rightarrow 0$ (long maturity)



- $q\uparrow$ exacerbates underinvestment (debt overhang) but alleviate overinvestment (asset substitution)

New capital infusions from a new bank or by issuing equity

- Invest iff: $\hat{X} - I \geq V_D - L_D + \underbrace{B - L_B}_{(+)}$



- The new cash infusion exacerbates underinvestment (debt overhang) but alleviate overinvestment (asset substitution).
- V_D is even higher if the cash infusion is via equity (debt has priority over equity during bankruptcy in period 2)

⇒ The firm will issue debt, not equity (equity subsidizes public debt and is therefore wasteful)

New senior debt

- Suppose the firm can issue in period 1 senior debt with face value D′ which is due in period 2 (existing debt is not protected by seniority covenants)

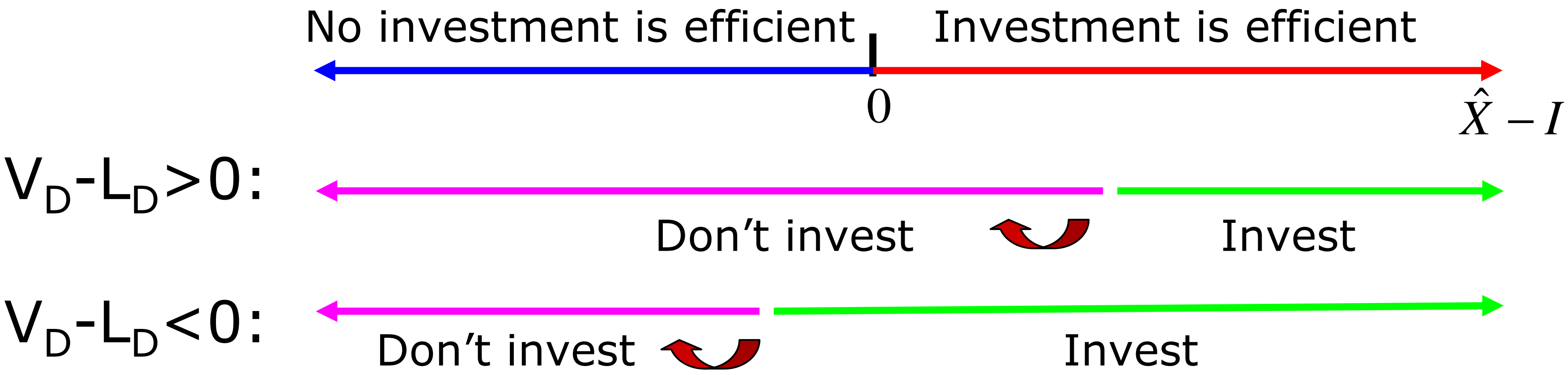
- If $D' \rightarrow \infty$, the firm always defaults in period 2 so the new senior debtholders will get the entire period 2 cash flow

- Existing debt gets 0 in period 2

$\Rightarrow$ The value of the existing debt is only equal to the period 1 payment $qD < V_D$

New senior debt

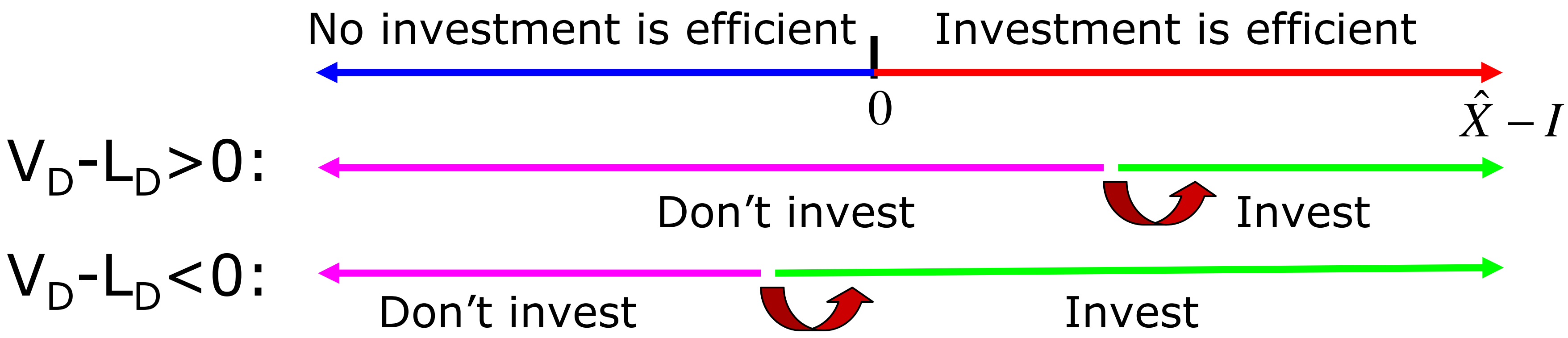
- Invest iff: $\hat{X} - I \geq qD - L_D$



- The new senior debt alleviates underinvestment (debt overhang) but exacerbates overinvestment (asset substitution).
- Seniority covenants (which prevent the firm from issuing senior debt) are worthwhile if overinvestment is likely ($q \to 0$) but are a bad idea if underinvestment is likely ($q \to 1$)

Existing public debt is junior to bank debt

- If the firm goes bankrupt in period 1, junior debtholders get $[Y-B]^+ < L_D$
- Invest iff: $\hat{X} - I \geq V_D - [Y-B]^+ > V_D - L_D$



- When existing debt is junior, underinvestment (debt overhang) is exacerbated (likely when $q \rightarrow 1$) but overinvestment (asset substitution) is alleviated (likely when $q \rightarrow 0$).

Public Debt Exchange

Public debt exchange

- Suppose the firm can restructure its public debt (despite the difficulties) through an exchange (tender your old debt and get a new debt or cash)

- The firm faces a cash shortage:

$$\underbrace{I+B}_{\substack{\text{Money to}\\ \text{pay bank}\\ \text{and invest}}} < Y < \underbrace{I+B+qD}_{\substack{\text{Money needed to}\\ \text{stay solvent in}\\ \text{period 1 and invest}}}$$

- Timing:
  - Stage 1: the firm makes TIOLI offer to the bank
  - Stage 2: the firm offers an exchange of existing public debt with new public debt due in period 2 whose face value is pD (investors who refuse keep their old securities)

Public debt exchange – stage 2

- Suppose the bank rejects the TIOLI
- The firm offers an exchange of existing public debt with new <u>senior</u> public debt due in period 2 and with face value pD
- The firm can set p s.t. old debtholders get nothing in period 2
- Suppose that

$$\underbrace{\hat{X} + Y - I - B}_{\substack{\text{Max. period 2 payoff of} \\ \text{new public debtholds} \\ \text{(they get everything} \\ \text{since p is set high)}}} \geq \underbrace{qD}_{\substack{\text{Period 1 payoff of} \\ \text{debtholders who reject} \\ \text{the exchange (their period 2} \\ \text{payoff is 0 since p is high)}}} \quad \Rightarrow \quad \hat{X} - I \geq qD - Y + B$$

- If the condition holds, then there exists an equil. in which all public debtholders accept

⇒ If the condition holds, the bank gets B if it rejects the TIOLI ⇒ to induce the bank to accept the TIOLI, the firm must offer the bank at least B

Bank debt restructuring in stage 1

- The restructured bank debt, B', is senior to public debt
- The firm makes a TIOLI to the bank s.t.:

$$\underbrace{\int_0^{B'} X dF(X)}_{\text{The bank gets the first dollars up to B'}} + \underbrace{\int_{B'}^{\infty} B' dF(X)}_{\text{The bank is paid in full in period 2}} + \underbrace{Y - I - qD}_{\substack{\text{New cash infusion if (-)} \\ \text{Cash payment if (+)}}} = \underbrace{B}_{\substack{\text{The banks'} \\ \text{alternative}}}$$

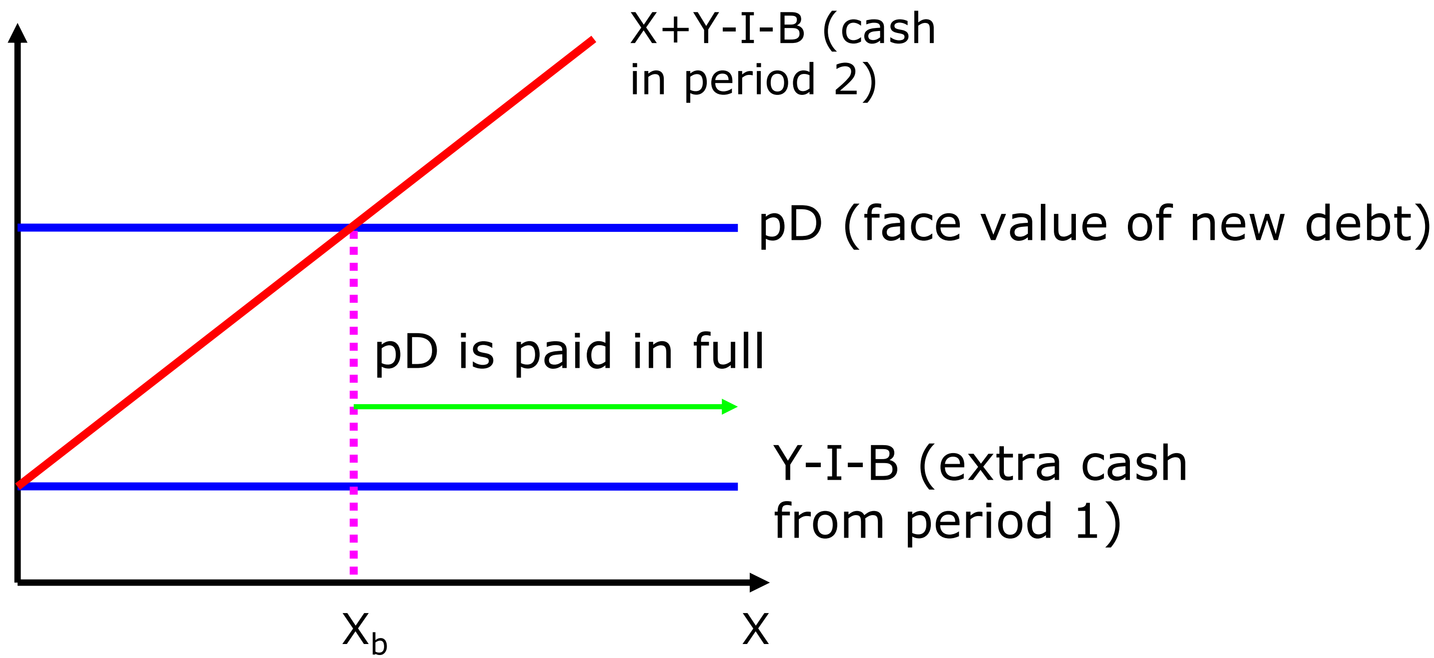
- Rewriting:

$$\int_0^{B'} \left(X + \left(Y - I - qD\right) - B\right) dF(X) = \int_{B'}^{\infty} \left(B - B' - \left(Y - I - qD\right)\right) dF(X)$$

- The bank accepts the TIOLI only if B' satisfies the above equation

Back to public debt exchange (the bank's debt remains B)

- Suppose that $\hat{X} - I \geq qD - Y + B$ so the firm can exchange its public debt
- Suppose the firm offers new debt with face value pD (p need not be so high that bankruptcy occurs for sure) - solvency in period 2:



Back to public debt exchange (the bank's debt remains B)

- Solvency in period 2 (the face value of new debt is pD):

$$X + \underbrace{Y - I - B}_{\text{Extra cash left from period 1}} \geq pD \quad \Rightarrow \quad X \geq I + B + pD - Y \equiv X_b$$

- The value of old public debt:

$$OD = \underbrace{qD}_{\text{Period 1 payoff}} + \underbrace{\int_{X_b}^{\infty} (1-q) D\, dF(X)}_{\text{Period 2 payoff in solvency}}$$

- The value of new public debt (paid only in period 2):

$$ND = \underbrace{\int_{0}^{X_b} (X + Y - I - B)\, dF(X)}_{\text{Public debt is not paid in full}} + \underbrace{\int_{X_b}^{\infty} pD\, dF(X)}_{\text{Public debt is paid in full}}$$

Public debt exchange

- The minimal p needed to ensure acceptance is defined implicitly by ND = OD:

$$\int_0^{X_b} (X + Y - I - B)\, dF(X) + \int_{X_b}^{\infty} pD\, dF(X) = qD + \int_{X_b}^{\infty} (1 - q) D\, dF(X)$$

- Reorganizing, p which ensures that public debt can be exchanged, is defined by:

$$\int_0^{X_b} (X + Y - I - qD - B)\, dF(X) = \int_{X_b}^{\infty} (1 - p) D\, dF(X)$$

Summary

- The bank accepts the TIOLI only if B′ satisfies:

$$\int_0^{B'} \left(X + \left(Y - I - qD\right) - B\right) dF(X) = \int_{B'}^{\infty} \left(B - B' - \left(Y - I - qD\right)\right) dF(X)$$

- Public debtholders accept the public debt exchange only if p satisfies:

$$\int_0^{X_b} \left(X + Y - I - qD - B\right) dF(X) = \int_{X_b}^{\infty} \left(1 - p\right) D\, dF(X)$$

Exchange or restructure B?

- Equityholders' payoff:
  - In a public debt exchange: $[X-X_b]^+$, where $X_b \equiv I+B+pD-Y$
  - In bank debt restructuring: $[X-B'-(1-q)D]^+$

- Exchange is more profitable iff

$$X_b < B'+(1-q)D \quad \Rightarrow \quad B' > \underbrace{X_b}_{I+B+pD-Y} -(1-q)D$$

- We'll show that this inequality holds by writing $B' = X_b-(1-q)D+\varepsilon$ and showing that $\varepsilon > 0$

Exchange or restructuring of B?

- The condition for bank debt restructuring:

$$\int_0^{B'} \big(X + (Y - I - qD) - B\big) dF(X) = \int_{B'}^{\infty} \big(B - B' - (Y - I - qD)\big) dF(X)$$

- Recall that $B' \equiv X_b - (1-q)D + \varepsilon$ and $X_b \equiv I + B + pD - Y$. Then the RHS becomes:

$$\int_{B'}^{\infty} \big(B - B' - (Y - I - qD)\big) dF(X)$$

$$= \int_{B'}^{\infty} \left(B - \left[\underbrace{\overbrace{(I + B + pD - Y)}^{X_b} - (1-q)D + \varepsilon}_{B' = x_b - (1-q)D + \varepsilon} \right] - (Y - I - qD) \right) dF(X)$$

$$= \int_{B'}^{\infty} \left(\overbrace{I + B - Y}^{X_b - pD} - X_b + D - \varepsilon \right) dF(X) = \int_{B'}^{\infty} \big((1-p)D - \varepsilon\big) dF(X)$$

Exchange is more profitable

- The TIOLI to the bank:

$$\int_0^{B'}\left(X+\left(Y-I-qD\right)-B\right)dF(X)=\int_{B'}^{\infty}\left(\left(1-p\right)D-\varepsilon\right)dF(X)$$

- The condition for public debt exchange:

$$\int_0^{X_b}\left(X+\left(Y-I-qD\right)-B\right)dF(X)=\int_{X_b}^{\infty}\left(1-p\right)DdF(X)$$

- Suppose that $\varepsilon < 0$. Then, $B' \equiv X_b-(1-q)D+\varepsilon < X_b$

⇒ The LHS of the 2nd equation is larger but the RHS of the 1st equation is larger ⇒ Contradiction!

⇒ $\varepsilon > 0 \Rightarrow B' > X_b-(1-q)D \Rightarrow$ exchange is more profitable