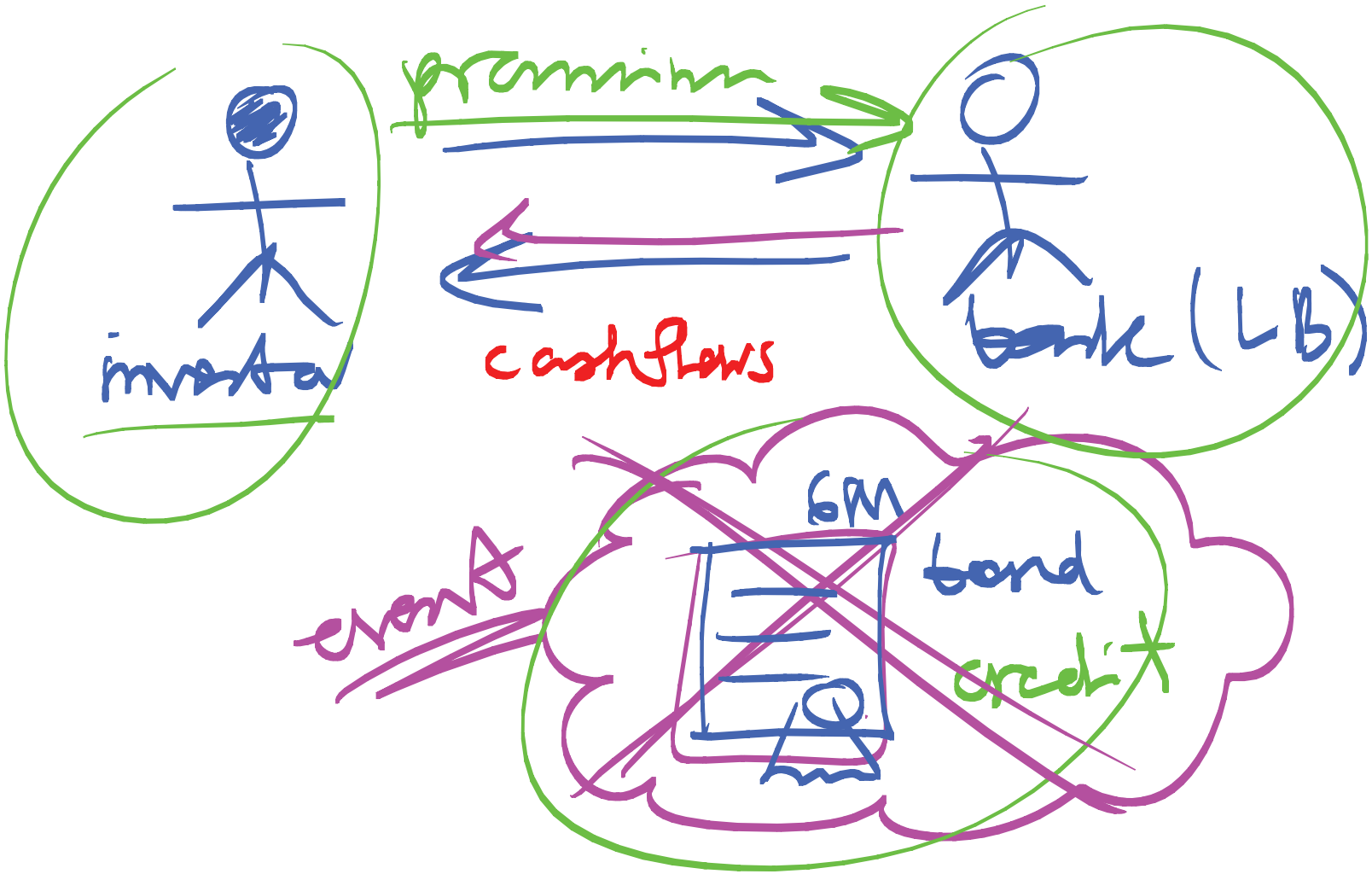
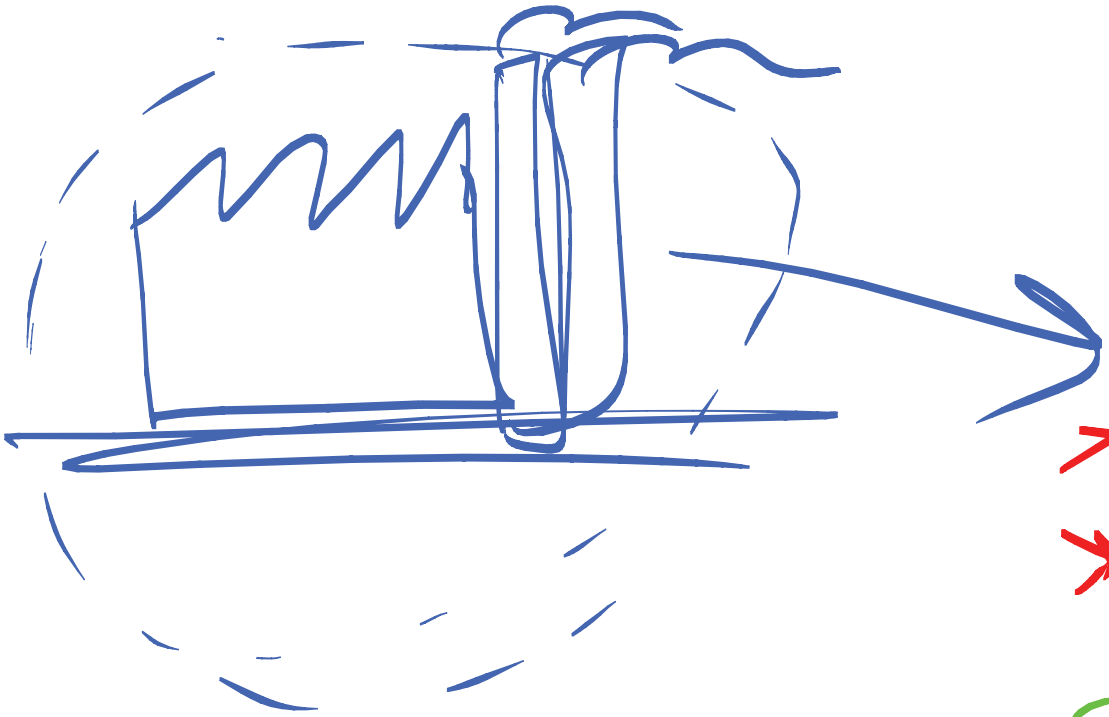
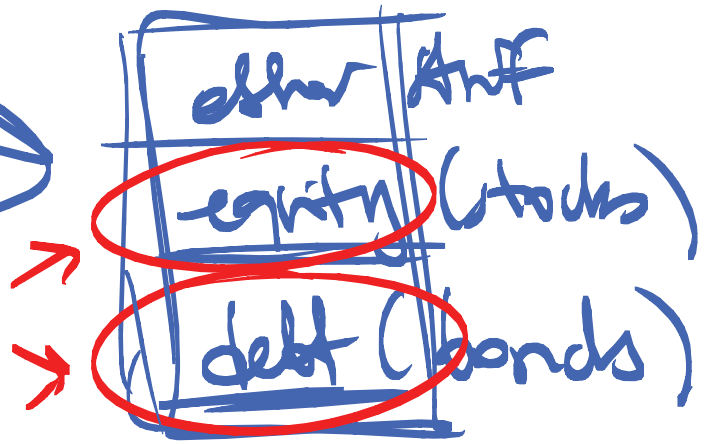
CDS = credit default swap





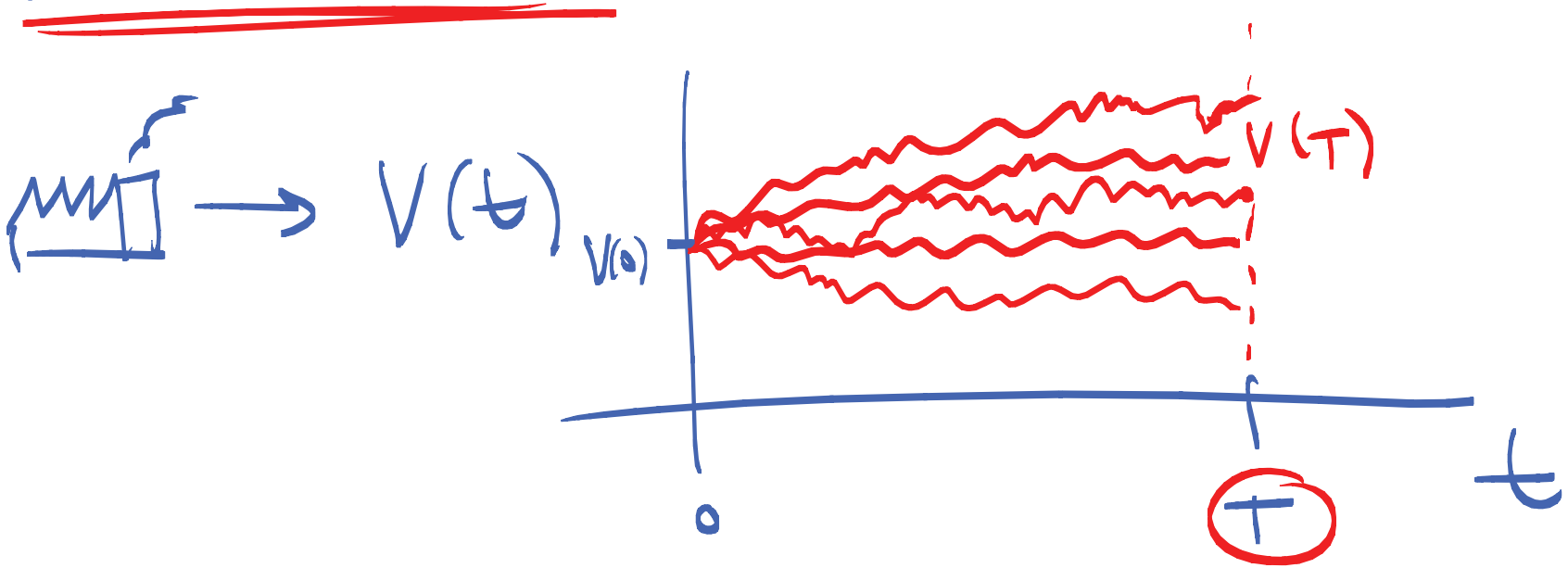
value of the firm



CAPITAL STRUCTURE

$$A = E + D$$

Merton (1974)



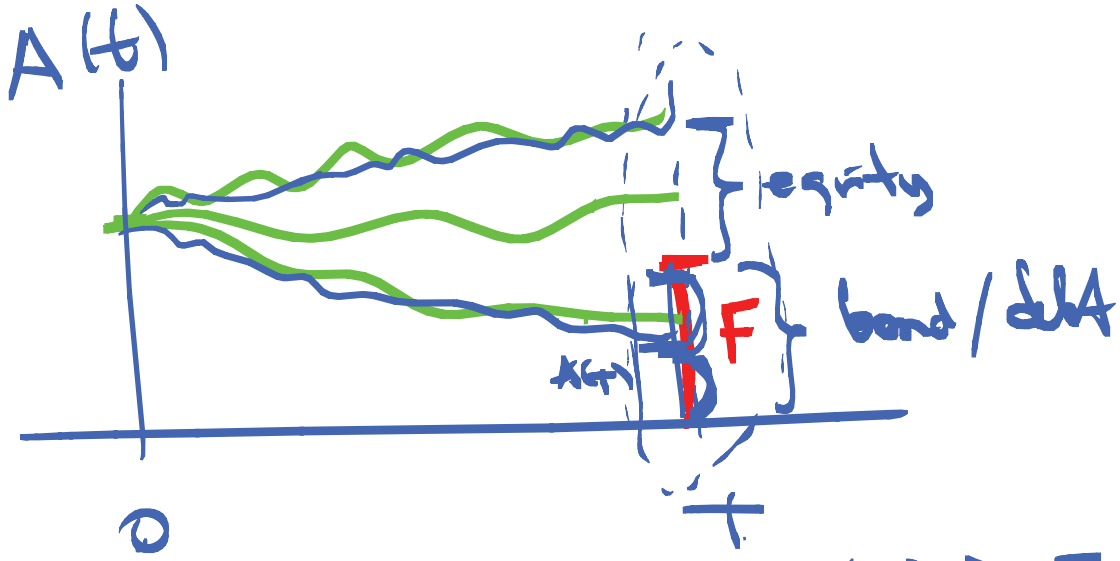
$$dV = rV\,dt + \underline{\sigma}\,V\,dW$$

$$dS = rS\,dt + \sigma S\,dW$$

MERTON (1974)

$$A(t) = D(t) + E(t)$$

assets — debt — equity



equity:

- solvency: $A(T) \geq F$: $E \leftarrow A(T) - F$, $D \leftarrow F$
- insolvency: $A(T) < F$: $E \leftarrow$ nothing, $B \leftarrow A(T)$

firm

equity:

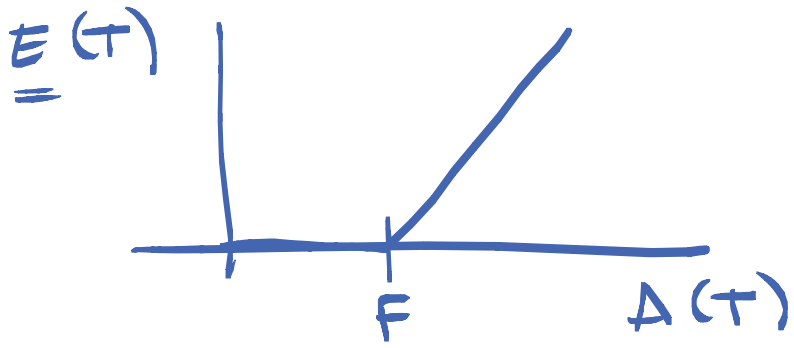
$S \rightarrow E$: $A(T) - F$

$I \rightarrow E$: nothing

$$\boxed{E(T) = \max\left[A(T) - F, 0\right]}$$

$S(T)$ K

European Call:



"equity is call option on the assets of the firm"

Riskfree $\rightarrow$ $\underline{ZCB}(t) = (1)\exp\left[-(r)(T-t)\right]$

pond T

Risky bonds $\rightarrow$ $\underbrace{\overline{ZCB}(t)}_{D(t)} = \underbrace{(1)}_{F}\exp\left[-(r+s)(T-t)\right]$

$$D(t) = F\exp\left[-(r+s)(T-t)\right]$$

$$\log(D/F) = -(r+s)(T-t)$$

$$\frac{1}{(T-t)}\log(D/F) = -r-s$$

$$\rightarrow \boxed{s = \frac{-1}{(T-t)}\log\left(\frac{D}{F}\right) - r}$$

$$dr = r\,dt + \sigma r\,dw + J$$

$$dV = rV\,dt + \sigma V\,dW \quad \text{(GBM)}$$

Euler discretization:

$$V_{i+1} - V_i = r V_i \Delta t + \sigma V_i \underbrace{(dW)}_{\sqrt{\Delta t}\, N(0,1)}$$

$$V_{i+1} = V_i + r V_i \Delta t + \sigma V_i \sqrt{\Delta t}\, N(0,1)$$

$$V_{i+1} = V_i \left(1 + r\Delta t + \sigma \sqrt{\Delta t}\, N(0,1)\right)$$

$$\sim \left(\sum_{i=1}^{12} U_i - 6\right)$$