

Masters in FINANCE

RISKY DEBT - II Anderson and Sundaresan (1996)

Corporate Investment Appraisal

Fall 2015



100 ANOS A PENSAR NO FUTURO



0. General View

Integrates literature of:

corporate finance;
pricing (options).

Strategic Concerns in a valuation model.

How?

Game in extensive form, determined by:

Covenants/clauses of the debt contract;
Bankruptcy law (and enforcement).

Determine “sub-game perfect” *Equilibrium*, with endogenous:
cash-flow allocation;
“boundaries of reorganization” of the firm (i.e., for which values of the parameters is control transferred from shareholders to creditors).

Shareholders (owner-manager) and creditors play *non-cooperatively*.

Complete Information about the structure of the game and cash flows.

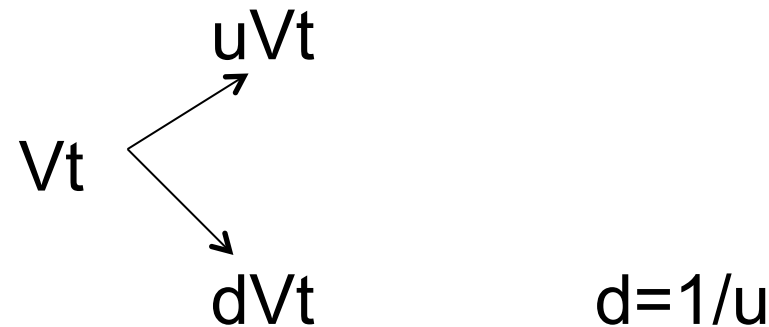
Objectives: How to design an optimal debt contract? (e.g., cash-payout ratio, level of leverage, tax effects).

Results:

Possibility of Strategic Debt Service;
Higher Default Premium than in previous studies;
And many others...

1. Model

Technology:



V_t is the present value of all cash flows (future and current).

Cash Flows: $f_t = \beta V_t$

β is the payout ratio;

a high β corresponds to a “cash cow” project;

a low β corresponds to growth opportunities.

Risk neutral Probability “up”:

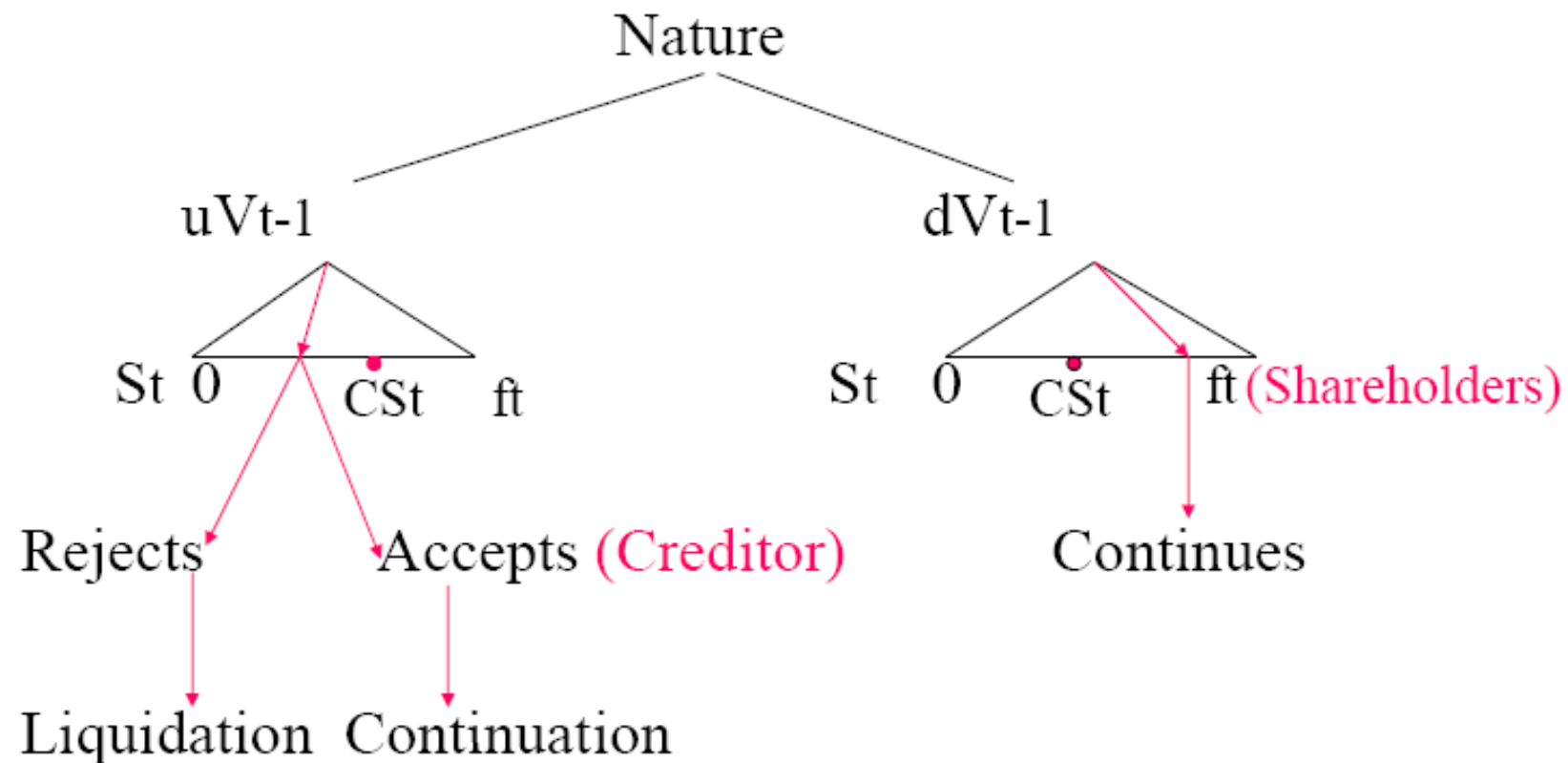
$$p = \frac{R(1 - \beta) - d}{u - d}$$

Liquidation Cost: K (fixed)

Contracted Debt Service, date t : CSt

Actual Debt Service, date t : $S_t \in [0, f_t]$

- Game from date (t-1) to date (t): an example



Equilibrium:

At terminal date T:

V_T is observed;

Shareholder decides S_T ;

If $S_T \geq CS_T$, game ends with payoffs: $(V_T - S_T; S_T)$ for shareholder and creditor, respectively;

If $S_T < CS_T$, the creditor may accept or reject;

If the creditor accepts, the payoffs are: $(V_T - S_T; S_T)$;

If the creditor rejects, the payoffs are: $(0, \max(V_T - K, 0))$;

In equilibrium the Value of Equity is:

$$E(V_T) = V_T - B(V_T)$$

And the Value of Debt is:

$$B(V_T) = \min(CS_T, \max(V_T - K, 0))$$

Argument for equilibrium:

- If the shareholders decide $S_T \geq C_T$, payoffs are: $(V_T - S_T; S_T)$. In this case they would choose $S_T = C_T$.
- If the shareholders decide $S_T < C_T$, then:
Creditor accepts if: $S_T \geq \max(V_T - K, 0)$.
In this case, the shareholders would choose:
$$S_T = \max(V_T - K, 0)$$
- Hence, shareholders choose to pay whichever minimizes the Value of Debt.

Moving backwards in time... until date t:

- Realization of V_t (and of f_t);
- Shareholders choose S_t ;
 - If $S_t \geq C_{St}$, the game continues to date $(t+1)$;
 - If $S_t < C_{St}$, creditors decide to:

Reject, obtaining: $\max(V_t - K, 0)$; or

Accept, getting:

$$S_t + \frac{pB(uV_t) + (1-p)B(dV_t)}{R}$$

They choose the largest of the two.

Shareholders anticipate this decision when choosing S_t .

For relatively high values of V_t , there will be no default;

For relatively low values of V , they choose “strategic default”, paying an amount that leaves creditors just indifferent.

If no liquidation takes place, in state V_t , the Debt Service is:

$$S(V_t) = \min \left(CS_t, \max \left(0, \max(V_t - K, 0) - \frac{pB(uV_t) + (1-p)B(dV_t)}{R} \right) \right)$$

The Value of Debt is:

$$B(V_t) = S(V_t) + \frac{pB(uV_t) + (1-p)B(dV_t)}{R}$$

And the Value of Equity:

$$E(V_t) = f_t - S(V_t) + \frac{pE(uV_t) + (1-p)E(dV_t)}{R}$$

In some cases, *forced liquidation* will occur: $S(V_t) > f_t$; the Debt Value being:

$$B(V_t) = \max(0, \min(V_t - K, CS_t + P_t))$$

And Equity Value: $E(V_t) = V_t - K - B(V_t)$

2. Valuation

- For “straight debt”, with fixed coupon and 100% reimbursement at maturity T ($CSt=cP$ and $t<T$; $CSt=(c+1)P$ if $t=T$).
- With $c=0$ and $K=0$, this is the case of Merton (1974). Useful to compare for “calibration”. Denominate a ratio “ d ” of *quasi*-debt:
 - Obtain the same results as Merton in terms of risk premium.
 - When we consider $K\neq 0$: the spread in this model changes significantly!! Much more so than in Merton. (Check the tables).

The analysis is extended in order to include non-zero coupon debt.

The paper also makes adjustments with taxes so as to consider the Tax Shield of Debt in the valuation, with tax-deductible coupons:

$$E(V_t) = (f_t - S(V_t))(1 - \tau) + \frac{pE(uV_t) + (1 - p)E(dV_t)}{R}; t < T$$

$$E(V_T) = (1 - \beta)V_T + (f_T - s_T cP)(1 - \tau) - s_T P; s_T = \frac{S(V_T)}{(1 + c)P}$$

In case of forced liquidation, the taxes are deducted before computing the liquidation value – this is the only difference in the way in which the value of Debt is computed.

As $T \cdot \beta \cdot V_t$ is small relative to V_t , taxes don't have too large an effect in the strategies for "St".

But Taxes do affect to a large extent the value of "E". They constitute an important factor for the "design".

Security Design Problem:

$$\max_{c, T, P, g} E(V_0; \sigma^2, \beta, R, K, \tau)$$

s.t.

$$D \leq B(V_0; \sigma^2, \beta, R, K, \tau)$$

c = coupon

T = maturity

P = face value

g = number of "grace periods" (no reimbursement of principal)

A_t = amortization at date t

$$A_t = \begin{cases} 0 & \text{if } t \leq g \\ \frac{P}{T - g} & \text{if } t > g \end{cases}$$

Some Results:

High growth (Low Beta) use low coupons;

Low growth use high coupons;

When the Tax Rate rises, tendency to choose higher coupons;

Highly levered firms use low coupons;

etc...