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Investment Banking

5. Bonds and Hybrid Instruments

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Bonds and Hybrids

Bonds
Warrant Bonds
Convertible Bonds

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Bonds

Bonds and Hybrids

- It is a negotiable debt security whereby the issuer receives money from the security buyer/investor in exchange for
  - Interest income (coupon)
  - Repayment (of the principal) at a later date (maturity)

  According to the conditions set out upon the bond issue
- Advantages
  - Normally has more favourable conditions in terms of interest than the bank loan, due to the fact that risk is borne by multiple investors
  - Special conditions can be added to the structure of the deal, such as equity conversion, anticipated payback, and so on.

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Bonds

Bonds and Hybrids

Characteristics

- Face Value
  - Debt amount, the value that is written in the security
  - Basis to calculate the interest
- Issue Price
  - Amount that the first buyer of the bond has to pay
    - if Price>VN: issue above-par
    - if Price <VN: issue below-par
    - if Price =VN: issue at par
- Interest (or Coupon) Rate
  - Applied to the face value to calculate the periodic interest
  - Can be fixed or variable (floating)
    - Caps and Floors
- Principal Repayment
  - Normally done once at the time of maturity (bullet payment)
  - Specific situations: Sinking funds and Serial bonds

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Bonds

Bonds and Hybrids

Characteristics

- Guarantees
  - Bondholders have priority, vis-a-vis equity holders, over the company's cash-flows (or, in case of bankruptcy, over the company assets)
  - However, not all the creditors / bondholders have the same priority
  - Different seniority/priority levels
- Maturity
  - Date for the last payment of principal
  - Time-to-Maturity is the time between today and the maturity date
- Covenants
  - Clauses designed to protect bondholders

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Bonds

Bonds and Hybrids

Market Price vs. Transaction Price

- Market Price (or clean price)
  - (Quoted) Price of a bond not including any accrued interest
  - Normally expressed as percentage of face value

- Transaction Price (or dirty price or full price)
  - The price of a bond which includes this accrued interest

$$\text{Clean Price} + \frac{\text{Number of days since last interest was paid}}{\text{Number of days bewteen two consecutive interest payments}} \text{ x Interest}$$

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Bonds

Bonds and Hybrids

Valuation of Bonds

$$B_0 = \sum_{i=1}^{n} \frac{I_i}{(1+k_d)^i} + \frac{F}{(1+k_d)^n}$$

- B_0 – value of a bond;
- F – face value of a bond (repayment amount of a standard bond);
- I_i – interest (coupon);
- n – number of periods to maturity;
- k_d – required rate of return (market rate or discount rate) for an investor as a function of the rating (credit risk of the firm)

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Bonds and Hybrids

Bondholder required rate of return (k_d)

- k_d = risk-free rate + default spread
  - Company cost of debt
  - Default spread (risk premium) is function of the firm credit risk
  - As credit risk increases, the probability of default increase and so the risk premium required by debtholders also increase which led to an increase in the cost of debt;
- How to estimate the default spread?
  - Rating

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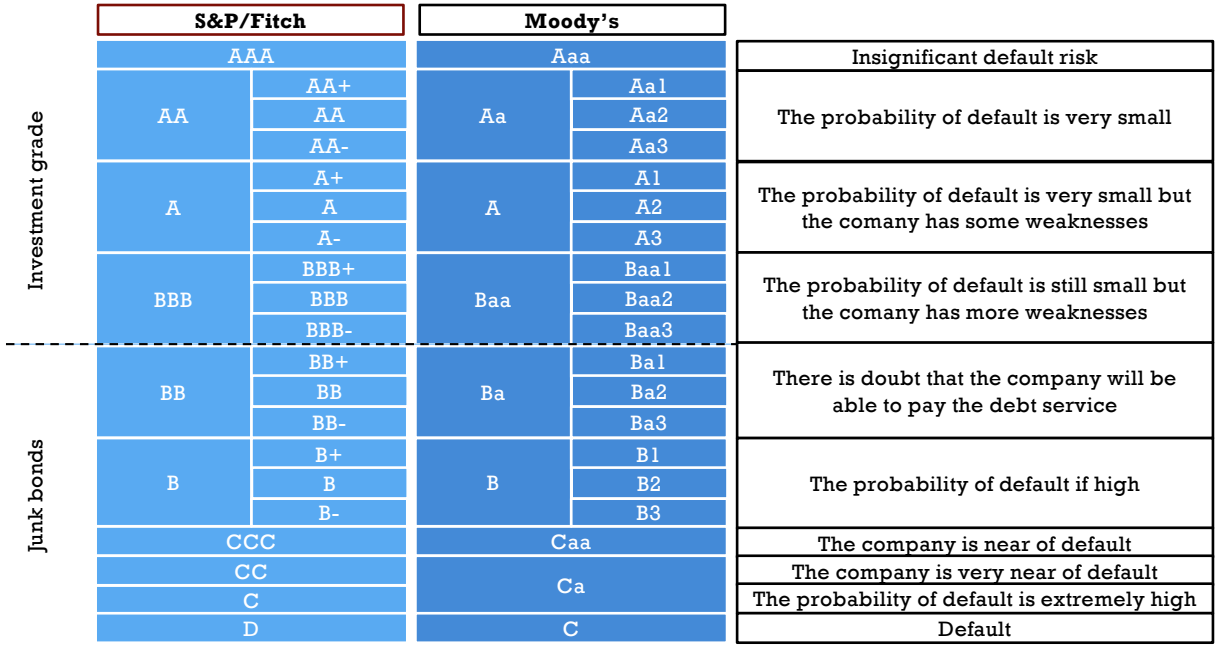
Rating



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Rating

- Main indicators of default risk (median values for each rating class)

	AAA	AA	A	BBB	BB	B	CCC
EBIT interest coverage (EBIT/Interest)	17.5	10.8	6.8	3.9	2.3	1.0	0.2
EBITDA interest coverage (EBITDA/Interest)	21.8	14.6	9.6	6.1	3.8	2.0	1.4
Operating Cash-flow / Debt (%)	105.8	55.8	46.1	30.5	19.2	9.4	5.8
(Op. Cash-flow – Investments)/Debt (%)	55.4	24.6	15.6	6.6	1.9	-4.5	-14.0
Net Profit/(Equity + Debt) (%)	28.2	22.9	19.9	14.0	1.7	7.2	0.5
Operating Income / Turnover (%)	29.2	21.3	18.3	15.3	15.4	11.2	13.6
Long Term Debt /(Sh. Equity + Debt) (%)	15.2	26.4	32.5	41.0	55.8	70.7	80.3
Debt/(Sh. Equity + Debt) (%)	26.9	35.6	40.1	47.4	61.3	74.6	89.4

Source: Aswath Damodaran, Applied Corporate Finance (3rd edition)

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Rating

- Is rating really a true measure of credit risk?

Rating (S&P at issuance date)	Percentage of default after		
	1 year after issuance	5 years after issuance	10 years after issuance
AAA	0.0	0.1	0.5
AA	0.0	0.3	0.9
A	0.1	0.7	2.0
BBB	0.4	3.4	6.9
BB	1.4	12.4	21.0
B	6.1	26.8	35.4
CCC	30.9	53.0	58.4

Source: Brealey, Myers and Allen, Principles of Corporate Finance (9rth Edition)

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Rating

- How to get a rating?
  - Rating companies
  - Synthetic rating
    - We can include several ratios and simulate a rating, or
    - We can use a main debt indicator (e.g., EBIT/Interests) and relate it to a rating

(pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/ratings.htm)

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Bonds and Hybrids

Rating

- Assuming that the rating is a good measure / predictor of the credit risk of a company, the demanded rate of return should be established according to the rating

Rating	*Default Spreads*		
	March 1999	January 2009	January 2020
AAA	0.20%	1.25%	0.63%
AA	0.50%	1.75%	0.78%
A+	0.80%	2.25%	0.98%
A	1.00%	2.50%	1.08%
A-	1.25%	3.00%	1.22%
BBB	1.50%	3.50%	1.56%
BB+	1.75%	4.00%	2.00%
BB	2.00%	4.25%	2.40%
B+	2.50%	5.00%	3.51%
B	3.25%	6.00%	4.21%
B-	4.25%	7.25%	5.15%
CCC	5.00%	8.50%	8.20%
CC	6.00%	10.00%	8.64%
C	7.50%	12.00%	11.34%
D	10.00%	15.00%	15.12%

Sources: Aswath Damodaran, Corporate Finance, Theory and Practice (2nd Edition) – March 1999 | Aswath Damodaran, Applied Corporate Finance (3rd Edition) – January 2009 | Aswath Damodaran website – January 2020

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Bonds and Hybrids

Yield-to-maturity (k_{YTM})

- Expected rate of return
  - implicit rate of return for which the present value of cash-flows of the bond equals its actual price (P_0)

$$P_0 = \sum_{i=1}^{n} \frac{I_i}{(1 + k_{YTM})^i} + \frac{F}{(1 + k_{YTM})^n}$$

  - Assumptions:
    - The bond is kept until its maturity;
    - Periodic cash-flows are reinvested and generate a return equal to ytm.

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Warrant Bonds

Bonds and Hybrids

- Bond with one or more warrants embedded
  - Warrant – is a right to buy shares of a company at a pre-determined price that can be exercised in a predetermined date or period of time
- The bond and warrant are autonomous rights
  - The exercise of the warrant does not imply the loss of the bond
  - After the issue, they can be independently traded
- Value of a bond with warrants = (Straight) Value of the bond + Value of the warrant(s)
  - Warrant – similar to a call option on the shares of the company;
  - Fixed exercise price;
  - Exercise price is paid in cash;

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Warrant

Bonds and Hybrids

Valuation

- Just like a call the investor will exercise the warrant if S>X
  - S – Share price
  - X – Exercise price
- However, at maturity, the profit of the warrant holder is not the same as in the call (S-X)
  - Since the company has to issue new shares when the warrant is exercised, there is a dilution effect to the existing shares
  - This dilution is similar to a seasoned equity offer (SEO) as in practice the exercise of a warrant is a form of raising equity for the company
    - After a SEO, the equilibrium price (P_E) is equal to

$$P_E = (N_0 * P_0 + n * S) / N_1$$

Where N_0 = Number of shares before the issue

P_0 = Share price before the issue

n = Number of new shares

S = Subscription price of new shares

N_1 = Number of shares after the issue

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Warrant

Bonds and Hybrids

Valuation

- After the exercise of the warrants, the new value for the shares will be equal to:
  - $S' = (nS+mqX) / (n+mq)$, where
    - n – number of existing shares
    - m – number of issued warrants
    - q – number of shares to be issued per warrant
- So, the value of the warrant at maturity is equal to $S' – X$,
- Defining $\lambda = mq / (mq+n)$ (dilution factor)*
  - We can demonstrate that the value of the warrant is equal to $[1-\lambda] \times C$
    - In which C is the value of the call without the dilution effect

*Number of new shares/Total number of shares after warrant exercise

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Warrant

Bonds and Hybrids

Black and Scholes Model

- Value of call (C) can be calculated using the Black-Scholes Model (B&S)

$$C_0 = S_0 e^{-\delta T} N(d1) - X e^{-rT} N(d2)$$

$$d_1 = \frac{\ln(S_0/X) + (r - \delta + \sigma^2/2)T}{\sigma\sqrt{T}}$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

- S_0 – Share price;
- σ – Share risk, measure by the standard deviation of annual returns on the share;
- X – Exercise (striking) price;
- r – Risk-free rate of return (on anual basis)
- δ – dividend-yield (on anual basis)
- T – Time to exercise/maturity (as an year fraction);
- N(d) – cumulative probability of d, based on the reduce normal probability distribution;
- ln – natural logaritmic function.

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Warrant

Bonds and Hybrids

Valuation example

- Actual number of shares (n) 1,000,000
- Price per share (S_0) €12
- Number of warrants (m) 100.000
- Number of shares per warrant (q) 1
- Exercise Price (X) €10/share
- Maturity (T) 2 years
- Share Volatility (σ) 25%
- Risk-free rate (r) 10%

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Warrant

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Valuation example

- Value of the call (C)
  - S =12
  - X = 10
  - T = 2
  - r = 10%
  - σ = 25%
  - d_1 = 1.2581; $N(d_1)$ = 0.8958
  - d_2 = 0.9046; $N(d_2)$ = 0.8172
  - e^{-rT}= 0.8187
  - C = 4.0596
- Dilution factor (λ)
  - λ = 100,000/(1,000,000+100,000) = 0.090909
- Value of the warrant (W) = (1-0.090909) x 4.0596 = 3.69

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Convertible Bond

Bonds and Hybrids

- At the time of issue it is necessary to define
  - Principal repayment and interest payment dates;
  - Conversion period;
  - Conversion ratio
    - Number of shares into which the bonds are converted
    - Or, conversion price: Face value of the bonds / conversion ratio

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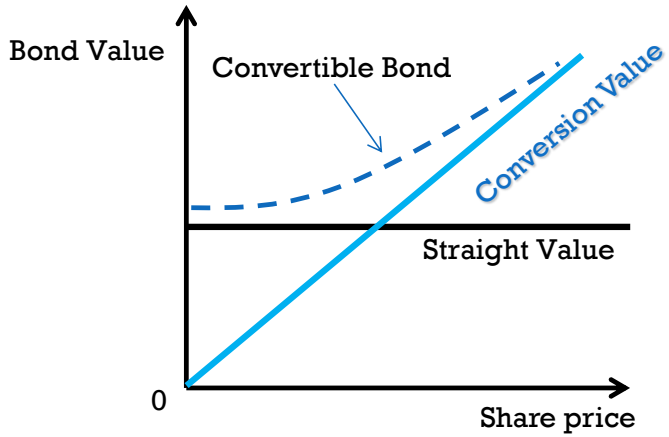
Convertible Bond

Bonds and Hybrids

Valuation

- Value of a standard bond (Straight Value) vs Conversion value
  - Conversion Value
    - Value of the bond if converted at that moment
    - Share price x conversion ratio
  - Since none of components can be negative, they both work as a minimum value for the bond



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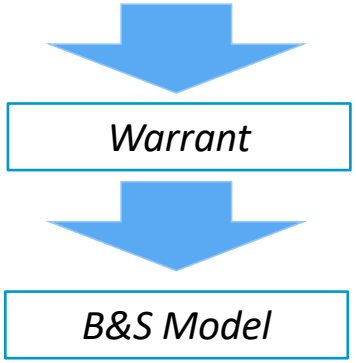
Convertible Bond

Bonds and Hybrids

Valuation

Straight Value + Value of the option to convert



- Exercise price
  - Is not paid in cash like in the warrant bond
  - Equal to the conversion price

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Convertible Bond

Bonds and Hybrids

Valuation example

- Face value (reimbursement) € 1,000
- Number of bonds (m) 130,500
- Coupon interest 4.5% (annual)
- YTM of a similar standard bond 7% (annual)
- Maturity (T) 5 years
- Conversion ratio 26.225
- Company Shares
  - Number of shares (n) 45,207,580
  - Share price (S_0) € 31
  - Volatility (σ) 20%
  - Risk-free rate 6.5%

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Convertible Bond

Bonds and Hybrids

Valuation example

- Conversion Price (X)
  - Face Value/Conversion ratio = 1,000 / 26.225 = 38.131
- Call option value (C)
  - S = € 31
  - X = € 38.131
  - $d_1 = 0.4874$; $N(d_1) = 0.687$
  - $d_2 = 0.0402$; $N(d_2) = 0.516$
  - $e^{-rT} = 0.7225$
  - C = 7.08
- Dilution factor (λ)
  - $\lambda = (130{,}500 \times 26.225)/(45{,}207{,}580 + 130{,}500 \times 26.225) = 0.0704$
- Value of the option to convert
  - (1-0.0704) x 7.08 x 26.225 = 172.62

Number of shares into each bond can be converted

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Convertible Bond

Bonds and Hybrids

Valuation example

- **Straight value**

$$\sum_{i=1}^{5} \frac{45}{(1+7\%)^i} + \frac{1{,}000}{(1+7\%)^5} = 897.5$$

Straight value + Value of the call = € 897.50 + € 172.62 = € 1,070.12