Bonds with Options & Convertibles

Topics

- Bonds with options: Callable-Puttable
- Convertible bonds
- INCOMPLETE

Bonds with Embedded Options

A bond with no embedded option is referred to as a plain-vanilla or straight bond.

Many bond issues however attach some kind of option feature. The most common ones are:

(a) The issuer's option to call (buy back) the bond (a callable bond)

(b) The buyer's option to put (sell back) the bond (a putable bond)

Main characteristics

- There is usually a lockout period, during which the option feature is disabled.
- If the option is exercised, both callable and putable bonds are retired based on a predetermined schedule of exercise prices (call or put price schedules).
- The embedded options are neither European nor American in style; they are essentially Bermudan options, usually allowed to exercise at the bond's anniversary.

Main characteristics

- Callable bonds should be called by the issuer when interest rates fall and bond prices rise. The issuer can then issue another bond at a lower yield

- Putable bonds should be returned by the investor when interest rates rise and bond prices fall. The investor can then reinvest the proceeds at more attractive rates.

Main characteristics

- Both call and put provisions exist because of bond indenture covenants. These place restrictions on what issuing firms can and cannot do with the capital raised by the issue.
- When the company anticipates that bond indentures can prove too restrictive, it usually requires a call provision.
- Because investors might anticipate such behaviour by the issuing firm, they usually require a put provision.
- Bonds can be both callable and putable!

Pricing a callable bond

Consider the following on-the-run issues by a company

Maturity	Yield to maturity
1 year	3.5%
2 years	4.2%
3 years	4.7%
4 years	5.2%

Assume all issues trade at $100. If the short rate has a volatility of 10% p.a., price (a) a 4-year bond with a 6.5% coupon rate, and (b) a 4-year bond with a 6.5% coupon rate that can be called for $102 in year 1, $101 in year 2 and $100 in year 3.

Pricing

- A callable bond is worth less than a straight bond with the same characteristics

  Value of callable bond = Value of bond – Value of call option

- A putable bond is worth more than a straight bond with the same characteristics

  Value of putable bond = Value of bond + Value of put option

- A key input to the valuation of bonds with option features is the volatility of the interest rates. This depends on the interest rate model that is employed.

Pricing

The same principles can be applied to other securities with callable/putable features:

(a) Step-up callable notes: Callable instruments whose coupon rate is increased (i.e. “stepped up”) at designated times

(b) Capped floaters: Floating interest rate notes with a cap on the high end of interest rates. The cap acts as a put option on the interest rate.

Convertible bonds

A convertible bond is a hybrid security. It can be converted into common stock at the option of the investor. It is thus a bond with an embedded option that is granted to the investor.

Since a convertible bond may be callable and putable, it is a complex security because the value of the bond will depend on both how interest rates change (which affects the value of the call and put provisions) and how changes in the market price of the stock affects the value of the option to convert to common stock.

Convertible bonds

- The conversion provision grants the securityholder the right to convert the security into a predetermined number of shares of common stock of the issuer.

- Bonds that are convertible into shares other than the issuer's are called exchangeable bonds.

Characteristics

- The number of shares of common stock that the securityholder will receive from exercising the call option of a convertible security is called the conversion ratio.
- The conversion priviledge may extend for all or only some portion of the security's life, and the stated conversion ratio may change over time.
- It is always adjusted proportinately for stock splits and stock dividends.

Characteristics

- The (stated) conversion price is determined by dividing the bond issue price by the conversion ratio,

  Conversion Price (CP) = Par Value/Conversion Ratio

- The conversion (or parity) value is the value of the security if it is converted immediately,

  Conversion Value (CV) = Market price of common stock X Conversion Ratio

Characteristics

- The minimum price of a convertible security is

$$\max\left(CV, IV\right)$$

the maximum of the conversion value (CV) and the investment value (IV). The latter is the value of the straight bond, that is based on the on the convertible security's cash flows if not converted.

Characteristics

- The price that an investor effectively pays for the common stock if the convertible bond is purchased and then converted into common stock is called the market conversion price or conversion parity price:

  Market Conversion Price (MCP) = Security Market Price/Conversion Ratio

- It is a useful benchmark because once the actual market price of the stock rises above MCP, any further stock price increase is certain to increase the market value of the convertible bond by at least the same percentage

Characteristics

- An investor who purchases a convertible bond rather than the underlying stock, effectively pays a premium over the current market price of the stock

Market Conversion Premium Per Share (MCPPS) = MCP-Current Market Price of Stock

- This is usually expressed as a percentage of the current market price

Market Conversion Premium Ratio (MCPR) = MCPPS/Current Market Price of Stock

Characteristics

- Why would someone be willing to pay a premium to buy the stock?

Recall that the minimum price of a convertible security is the greater of CV and IV. Thus, as the stock price declines, the price of the convertible bond will not fall below its IV. The IV therefore acts as a floor for the convertible security's price. Viewed in this context, the MCPPS can be seen as the price of a call option on the common stock.

Characteristics

- Investing in the convertible bond rather than buying the stock directly, generally means that the investor realises higher current income from the coupon interest from a convertible bond than would be received from common stock dividends based on the number of shares equal to the conversion ratio.

Characteristics

- Analysts typically compute the time it takes to recover the premium (known as break-even time) via

Premium payback period = MCPPS/favourable income differential per share

where the denominator is equal to

(coupon interest - (conversion ratio x common stock dividend per share))/conversion ratio

- Notice that this metric does not take into account the time value of money

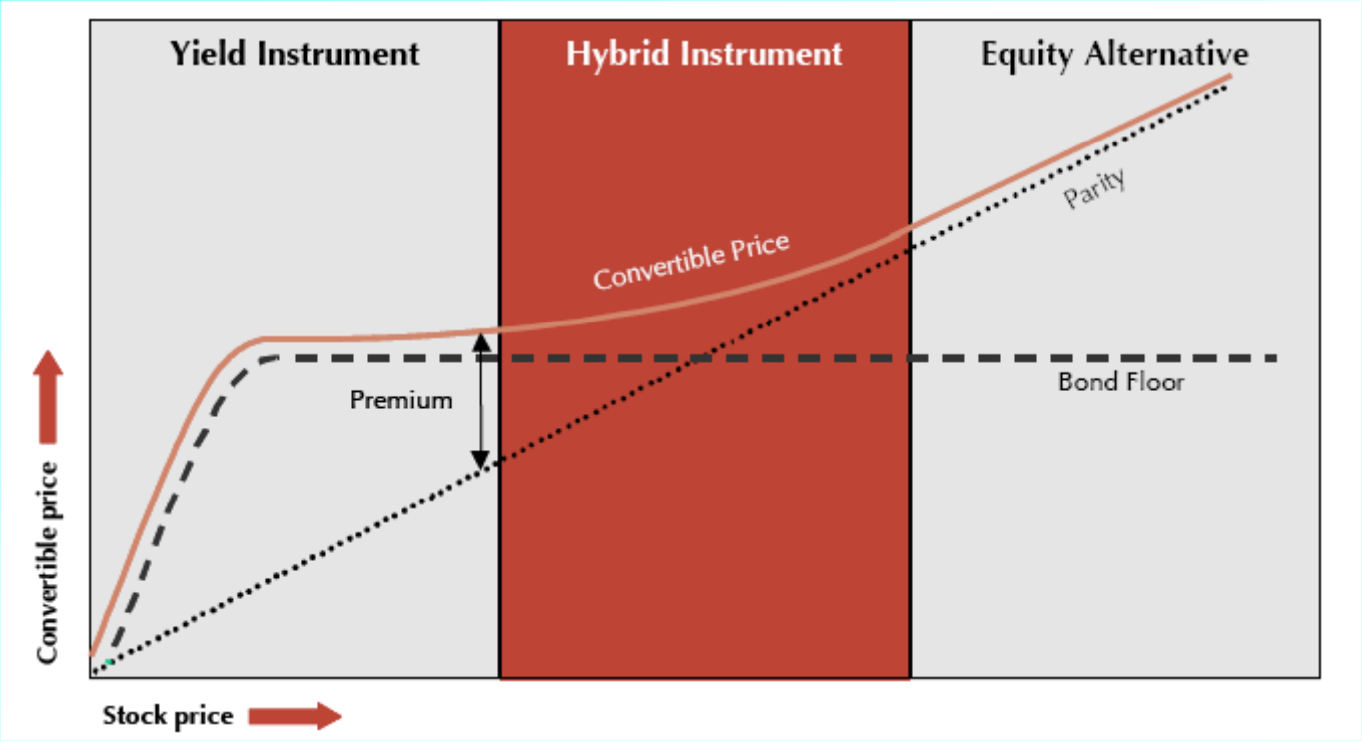
Downside risk

- The price of the convertible bond cannot fall below the IV. The downside risk is measured as a percentage of the IV as follows:

Premium over IV = -1+Market Price of Convertible bond/IV

- The higher the premium, the less attractive the convertible bond
- You should note that IV changes as interest rates change

Pricing


Yield Instrument
Hybrid Instrument
Equity Alternative
Parity
Convertible Price
Premium
Bond Floor
Convertible price
Stock price

Example

- Consider the following example of a callable convertible as of 10/7/93

Convertible bond
Market price (as of 10/7/93): $106.50 Issue date: 6/1/92
Issue proceeds: $100 million Maturity date: 6/1/02
Non-call until 6/1/95

Call price schedule	
6/1/95	103.59
6/1/96	102.88
6/1/97	102.16
6/1/98	101.44
6/1/99	100.72
6/1/00	100.00
6/1/01	100.00

Coupon rate: 5¾%
Conversion ratio: 25.320 shares of GSX shares per $1,000 par value
Rating: A3/A–

GSX common stock

Expected volatility: 17% Dividend yield (as of 10/7/93): 2.727%
Dividend per share: $0.90 per year Stock price: $33

Pricing

- The value of a convertible security is given by

  Convertible bond value = IV + value of call option on the stock – value of call option on the bond + value of put option on the bond

- The pricing will depend on the future evolution of interest rates and of the stock price.

Competing models

- Bhattacharya & Zhu (2005)
- Brennan & Schwartz (1977,1980)
- Constantinides (1984)
- Ingersoll (1977)
- Tsiveriotis & Fernandes (1998)

References

Brennan, M and Schwartz, E., 1977, Convertible Bonds: Valuation and Optimal Strategies for Call and Conversion, Journal of Finance, vol. 32, pp.1699-1715.

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Constantinides, G., 1984, Warrant Exercise and Bond Conversion in Competitive Markets, Journal of Financial Economics, pp.371-398.

References

Ingersoll, J., 1977, A Contingent-Claims Valuation of Convertible Securities, Journal of Financial Economics, pp.289-322.

Bhattacharya, M. and Zhu, Y., (2005), Valuation and Analysis of Convertible Securities, Chapter 42 in F. J. Fabozzi (ed.), The Handbook of Fixed Income Securities, Irwin Professional Publishing, Chicago.

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