



Global Edition

Chapter 19 Analysis of Convertible Bonds

Convertible Bond Provisions

- ❑ Has a call option to buy the common stock of the issuer.
- ❑ Exchangeable bonds grant the bondholder the right to exchange for other firm's stock
 - The number of shares of common stock received from converting is called the *conversion ratio*.
- ❑ Upon conversion, the bondholder typically receives from the issuer the underlying shares.
 - called *physical settle*.
- Issuer may have the choice to pay the cash value of the underlying shares.
 - called *cash settle*.

Convertible Bond Provisions (continued)

- ❑ The bondholder the right to purchase the common stock at the *conversion price* (P) equal to:

$$\frac{\text{par value of convertible bond}}{\text{conversion ratio}}$$
- ❑ Most convertible bonds are callable by the issuer at certain dates.
 - This standard type of call option in a convertible bond is called an *unprotected call*.
 - Another type of call feature: *protected call*
 - *The bond may only be called if the price of the underlying stock (or the average stock price over some number of days) exceeds a specified trigger price.*

Convertible Bond Provisions (continued)

- ❑ Some convertible bonds are *puttable*.
 - Classified as *hard* puts and *soft* puts.
 - *Hard put*: CB must be redeemed by cash.
 - *Soft put*, redeem CB by cash, common stock, subordinated notes, or a combination of the three.
- ❑ Another convertible that was at one time issued for its favorable tax treatment is one with a **contingent payment provision**, nicknamed "CoPa" bonds.
 - Traditional CB: coupon rate is fixed over the bond's life,
 - CoPa bond pays a higher coupon rate if the price of the underlying stock prices reaches a specified threshold (say, 125% of the conversion price).

Special Conversion Provisions

- Not all bonds allow a straightforward conversion privilege.
- Two types of convertible bonds issued prior to 2008 that **departed** from the traditional conversion privilege are
 - net share settlement convertible
 - contingent conversion convertible.
- 1) **net share settlement provision:**
When converting, the issuer pays the par value in cash to retire the bonds.
Also called **cash-par settlement provision**
Issuer motivation is from a financial accounting perspective: treated favorably in the calculation of the issuer's earnings per share.
- 2) **contingent convertible provision,**
the holder only has the right to convert when the price of the underlying stock exceeds a specified threshold price for a specified number of trading days.
nicknames "CoCo" bonds,
introduced in late 1999 and by 2003.

Categorization of Convertible Securities

- The U.S. convertible bond market is by far the largest convertible bond market.
 - Most U.S. convertible bonds are issued as **private placements** under Securities and Exchange Commission (SEC) Rule 144A.
 - Lehman Brothers publishes the Lehman U.S. Convertible Indices.
 - The main index is the Lehman Convertible Composite Index.
 - The different subindexes indicate the different subsectors or ways to categorize the convertible bond market.

The different subindexes of the four indices shown below indicate the different subsectors or ways to categorize the convertible bond market.

Type

- Cash-pay bonds
- Zero-coupon/original issue discount
- Preferreds
- Mandatories

Credit Quality

- Investment grade
- Intermediate grade
- Junk
- Nonrated

Underlying Market Capitalization

- Small cap
- Mid cap
- Large cap

Profile

- Typical
- Equity sensitive
- Busted
- Distressed

Categorization of Convertible Securities (Types)

- *Cash-pay bonds,*
 - referred to as traditional convertible bonds,
 - pay coupon interest.
- *Zero-coupon convertible bonds*
 - pay no coupon interest.
- A popular type of zero-coupon bond is a Merrill Lynch product called LYON → Liquid Yield Option Notes.
- An original issue discount (OID) CB
 - is issued at a discount from par
 - pay some coupon interest which is smaller than the market rate.
- A *convertible preferred* is a **preferred stock** that can be converted into **common stock**.
- *Mandatory convertible:*
 - converts **automatically** at maturity into shares of the issuer's common stock.
 - Differs from convertible bonds where conversion is **optional**.

Categorization of Convertible Securities (Continued)

- ❑ The market capitalization of a corporation=
 - ❑ outstanding shares X price per share of common stock.
- ❑ Credit quality is simply based on the rating of the convertible issue.
- ❑ According to Barclays Capital, as of mid 2009,
 - ❑ 31% investment-grade rating,
 - ❑ 32% an intermediate-grade rating,
 - ❑ 7% a junk bond rating
 - ❑ 29% were nonrated.
- ❑ The three largest sectors that issued convertible bonds were consumer noncyclicals(不受景氣循環) (23%), financial institutions (21%), and technology (19%).

Concepts for Convertible Bond Analysis : An Example

- ❑ **EXAMPLE.** Consider the following convertible bond with dividends *per share* = **\$1**; *current market price of XYZ common stock* = **\$17**; *current market price of XYZ bond* = **\$950**; *par value* = **\$1,000**; *conversion ratio* = **50**; *coupon rate* = **10%**; and, *maturity* = **10 years**. If this convertible bond is neither callable nor putable, then what is the conversion price for the XYZ bond?

$$\text{conversion price} = \frac{\text{par value}}{\text{conversion ratio}} = \frac{\$1,000}{50} = \$20$$

- If the market price is greater than \$20 there will be an incentive by the owner of the convertible bond to convert.
- This is especially true if the dividends received from converting would be large relative to the coupon payments.

Concepts for Convertible Bond Analysis: Min. Value of CB

- ❑ **Minimum Value of A Convertible Bond**
 - The *conversion value* of a convertible bond is the value of the bond if it is converted immediately.
 - It is expressed as:

$$\text{conversion value} = \text{market price of common stock} \times \text{conversion ratio}$$
 - The minimum price of a convertible bond is the greater of
 - i. its conversion value
 - ii. its value as a corporate bond **without** the conversion option—that is, based on the convertible bond's cash flows if not converted (i.e., a plain vanilla bond)
 - This latter value is called its **straight value**.

Concepts for Convertible Bond Analysis: Estimate Straight Value

- First determine the required yield on a nonconvertible bond with the same quality rating and similar investment characteristics.
- The straight value is conventionally computed as the PV of the bond's cash flows using this yield to discount the cash flows.
- If the straight value > conversion value, and the bond trades at its conversion value
 - Buying the convertible at the conversion value, the investor will realize a higher yield than a comparable straight bond.

Concepts for Convertible Bond Analysis (Calculate Conversion Value)

- Consider the convertible bond with dividends *per share* = \$1; current market price of XYZ common stock = \$17; current market price of XYZ bond = \$950; par value = \$1,000; conversion ratio = 50; coupon rate = 10%; and, maturity = 10 years.
- For the XYZ bond, what is its conversion value?
$$\text{conversion value} = \text{market price of common stock} \times \text{conversion ratio} = \$17 \times 50 = \mathbf{\$850}$$

Concepts for Convertible Bond Analysis (Calculate Straight Value)

- To determine the straight value, it is necessary to determine what comparable bonds are trading for in the market.
- Suppose that comparable bonds are trading to yield 14%.
- The straight value is then the price of our XYZ bond with a coupon rate of 10% and a maturity of 10 years selling to yield 14%.
- The price for such a bond would be \$788.

Concepts for Convertible Bond Analysis (Minimum Price to avoid Arbitrage)

- Conversion value of \$850
- straight value of \$788,
- the minimum price for the convertible bond is \$850.
- Arbitrage opportunity:
 - If the bond is selling at its straight value \$788 value,
 - Investor could buy the bond for \$788 and simultaneously sell 50 shares of XYZ stock at \$17 per share.
 - The short sale of the stock is covered when the bond conversion,
 - Produce an arbitrage profit of \$62
- The only way to eliminate this arbitrage profit is for the XYZ bond to sell for \$850, its conversion value.

Concepts for Convertible Bond Analysis (Minimum Price to avoid Arbitrage)

- Let comparable nonconvertible bonds are trading to yield 11.8%.
 - The straight value of XYZ bond would be \$896.
 - The conversion value is \$850
 - The minimum price for the XYZ bond is \$896.
- Suppose that the market price of the XYZ bond is \$850.
 - The yield would be about 12.7%, 90 basis points greater than comparable nonconvertible bonds.
 - As investors buy the bond, they will bid up its price to where the new yield is 11.8%.

Market Conversion Price

- The price that an investor to obtain the common stock by converting the purchased convertible bond into the common stock is called the *market conversion price*.

$$\text{market conversion price} = \frac{\text{par value}}{\text{conversion ratio}}$$

- An investor who purchases a convertible bond rather than the underlying stock typically pays a **premium** over the current market price of the stock.
 - This premium per share is equal to the difference between the market conversion price and the current market price of the common stock.
 - That is,

$$\text{market conversion premium per share} = \text{market conversion price} - \text{current market price}$$

Market Conversion Price (continued)

- The market conversion premium per share is usually expressed as a percentage of the current market price as follows:

$$\text{market conversion premium ratio} =$$

$$\frac{\text{conversion premium per share}}{\text{market price of common stock}}$$

- The market conversion premium per share can be seen as the **price of a call option**.
- The difference between a call option and a convertible bond :
 - the former knows precisely the dollar amount of the downside risk,
 - the latter knows only that the most that can be lost is the difference between the convertible bond price and the straight value.

Market Conversion Price An Example:

- At a *market price* of **\$950** for convertible bond XYZ, a *stock price* of **\$17** and a *conversion ratio* of **50**, what is its **market conversion price**, **market conversion premium per share**, and **market conversion premium ratio**?

$$\text{market conversion price} = \frac{\text{par value}}{\text{conversion ratio}} = \frac{\$950}{50} = \$19$$

$$\text{market conversion premium per share} =$$

$$\text{market conversion price} - \text{current market price} = \$19 - \$17 = \$2$$

$$\text{market conversion premium ratio} =$$

$$\frac{\text{conversion premium per share}}{\text{market price of common stock}} = \frac{\$2}{\$17} = 0.117647 \text{ or about } 11.76\%$$

Current Income of Convertible Bond Versus Stock

- As an **offset** to the market conversion premium per share, investing in CB rather the stock:
 - investor realizes higher current income from the **coupon interest** paid on CB than would be received as dividends paid on the number of shares equal to the conversion ratio.
- Analysts evaluating a convertible bond typically compute the **time** it takes to **recover the premium per share** by computing the **premium payback period** (which is also known as the break-even time).

premium payback period (or break-even time)

$$\text{premium payback period} = \frac{\text{market conversion premium per share}}{\text{favorable income differential per share}}$$

where the *favorable income differential per share* is equal to

$$\frac{(\text{coupon rate} \times \text{par value}) - (\text{conversion ratio} \times \text{dividend per share})}{\text{conversion ratio}}$$

where the *coupon interest* = *coupon rate* x *par value* and the *premium payback period* does **not** take into account the time value of money.

An Example of Premium Payback Period

- For the XYZ convertible bond where the *coupon rate* is **10%**, the *conversion ratio* is **50**, the *dividend per share* is **\$1**, and the *market conversion premium per share* is **\$2**, how long would it take an investor to recover the *market conversion premium per share*?
- First computing the *coupon interest* from the bond.
 - *coupon interest from bond* = (*coupon rate*)(*par value*) = 0.10(\$1,000) = **\$100**.
 - The favorable income differential per share is:

$$\frac{(\text{coupon rate} \times \text{par value}) - (\text{conversion ratio} \times \text{dividend per share})}{\text{conversion ratio}}$$

$$= \frac{\$100 - (50 \times \$1)}{50} = \$1.00$$

An Example of Premium Payback Period (continued)

- The premium payback period can now be computed. We have:

$$\text{premium payback period} = \frac{\text{market conversion premium per share } \$2}{\text{favorable income differential per share } \$1} = 2 = 2 \text{ years}$$

- Thus, without considering the time value of money, the investor would recover the market conversion premium per share in two years.

Downside Risk With a Convertible Bond

- Use the straight value of the bond as a measure of the downside risk of a convertible bond,
 - The price of the convertible bond cannot fall below this value.
 - The straight value acts as the current floor for the price of the convertible bond.
 - The downside risk is measured as a percentage of the straight value and computed as follows:

$$\text{premium over straight value} = \left(\frac{\text{market price of the convertible bond}}{\text{straight value}} \right) - 1$$

- The higher the premium over straight value, all other factors constant, the **less attractive** the convertible bond.

Downside Risk With a Convertible Bond Evaluating Premium over Straight Value

- If comparable nonconvertible bonds are trading to yield 14%, the straight value of the XYZ bond would be \$788.
- What is the *premium over straight value* for bond XYZ if the convertible bond has a market price of \$950?

$$\text{premium over straight value} = \left(\frac{\text{market price of the convertible bond}}{\text{straight value}} \right) - 1 = \frac{\$950}{\$788} - 1 = 1.2055838 - 1 = 0.2055838 \text{ or about } 21\%$$

- If the yield on a comparable nonconvertible bond is 11.8% instead of 14%, the straight value would be \$896. What would the *premium over straight value* be?

$$\text{premium over straight value} = (\$950 / \$896) - 1 = 0.06 \text{ or } 6\%$$

Option Measures

- Because a CB embeds a call option on the underlying common stock, we can estimate the sensitivity of a CB' price from measures used in option theory.
 - like *delta*, *gamma*, *vega*, and *implied volatility*.
- The first three measures show the sensitivity of the option's price to changes in a particular factor that is known to affect the price.
- Several of these factors include: the price of the underlying stock; the expected volatility of the underlying stock's price; and, the amount of time remaining to the expiration of the option.
- The measures are calculated by using a theoretical model to value the price of an option (like Black–Scholes option pricing model) and determining how the theoretical value changes when a factor (holding all other factors constant) changes.

Option Measures (Delta)

- An option's delta measures the sensitivity of an option's price to a change in the price of the underlying.
- For an option on common stock, the underlying is common stock.
- In the case of a CB, the underlying is the common stock of the issuer.
- Hence, a CB's delta is the sensitivity of its value to a change in the underlying stock's price.
- Another name used for delta is *hedge ratio* or *neutral hedge ratio*.
- More specifically, delta is the ratio of the change in the convertible's value to the change in the price of the underlying shares.

Option Measures (Delta; continued)

- The delta is used to estimate the impact of a change in the underlying stock price on the CB's value as follows:
 - $\text{approximate change in a CB's value} = \text{change in stock price} \times \text{conversion ratio} \times \text{delta}$
- **Ex:** Consider convertible bond XYZ described earlier with a conversion ratio of 50. Suppose that the delta is 0.60. For a price change of \$0.125 for the stock price, what is the approximate change in the CB's value?

$$\text{approximate change in a CB's value} = \text{change in stock price} \times \text{conversion ratio} \times \text{delta} = \$0.125 \times 50 \times 0.60 = \$3.75$$

Option Measures (Delta Hedge)

- delta 0.5 X conversion ratio 50 = 30.
- Short 30 shares to obtain a market neutral position.
- Ex: Let stock price increases by \$0.125.
 - Short 30 shares of stock will lose $\$0.128 \times \$30 = \mathbf{\$3.75}$.
 - Compensated by the increment of CB price \$3.75.
- Two important points about delta.
 - i. Delta is only an approximation of the value change of a CB for a small stock price change.
 - ii. An option's delta changes over time.
 - Delta changes due to a change in the stock price and changes in the other factors that affect the option value, says time to maturity.
 - To maintain a hedged position (i.e., market neutral position) in the CB and short stock position, the short position would have to be changed as delta changes.

Option Measures (Gamma)

- Duration is the first order approximation of how the bond's price changes when interest rates change.
- The convexity measure shows for larger change in interest rates what the **additional change** in the bond's price will be.
- Basically, convexity relates to the benefit associated with larger interest rate movements or interest rate volatility.
- In option theory, *gamma* plays the same role as convexity.
- In the case of CB, gamma is the additional change in the CB's value for a larger change in stock price

Option Measures (Vega)

- The sensitivity of the option's price to a change in expected volatility for the underlying.
- For a CB, it estimate the sensitivity of the CB's price to a change in the expected volatility of the stock's price.

Option Measures (Implied Volatility)

- In an option pricing model, the only unknown input that must be estimated is expected volatility.
- We may "back out" the expected volatility given the observed option price and the option pricing model.
- The volatility so obtained is referred to as **implied volatility**.
- The difference between **implied** volatility and **historical** volatility

Profile of a Convertible Bond

- ❑ One way to categorize CB is by the [convertible's profile](#). (see previous slide)
- ❑ "By profile" means the factors that dominate the performance of the convertible such as the stock price of the issuer or the level of interest rates and spreads.
- ❑ The categories according to Lehman Brothers are
 - i. typical
 - ii. equity sensitive
 - iii. busted
 - iv. distressed-> relevant to the stock price

Profile of a Convertible Bond (continued)

- ❑ By a "typical" convertible, it can refer to a *balanced convertible* with hedge ratios. Their correlation with stock price changes, ranging from roughly 55% to 80%.
- ❑ An *equity sensitive convertible*, also referred to as an *equity substitute convertible* by practitioners, is one in which the underlying stock price **exceeds** the conversion price.
- ❑ When the price of the underlying stock is very far below the conversion price, the convertible is said to be a *busted convertible*.
- ❑ A *distressed convertible* can be viewed as a special type of busted convertible where the price of the underlying stock has fallen so far below the conversion price that it is likely that the issuer will be **forced into bankruptcy**.

Pros and Cons of Investing in a Convertible Bond

- ❑ Disadvantage of buying CB:
 - ❑ the conversion price is higher than the stock price at the CB purchased time. The return will be lower unless the interest payments for owning the CB are great enough to cover
 - i. the higher price paid per share
 - ii. any dividends that are forgone for the length of time
- ❑ Advantage of buying CB:
 - ❑ Its value will likely fall **less** than that of stock if a firm runs into financial distress difficulties.

Pros and Cons of Investing in a Convertible Bond (continued)

- ❑ **Call Risk**
 - Callable by the issuer.
 - A valuable feature for issuers, who deem the current stock price undervalued enough
 - selling stock directly would dilute the equity of current stockholders.
 - Raise equity funds over incurring debt, so it issues a convertible, setting the conversion ratio on the basis of a stock price it regards as acceptable.
- ❑ **Takeover Risk**
 - As the stock of the acquired company may no longer trade after a takeover, the investor can be left with a bond that pays a lower coupon rate than comparable-risk corporate bonds.

Convertible Bond Arbitrage

- ❑ Their payoff characteristics allow the creation of different positions that can benefit from the **mispricing** of a CB
- ❑ Seeking to capitalize on the perceived mispricing of a convertible bond issue is referred to as **convertible bond arbitrage**.
 - First: identify CB trading at a price that substantially deviates from the theoretical value indicated by a CB valuation model.
 - The process is heavily dependent on this valuation model.
 - For a substantially mispriced CB, a position is taken in CB, the stock, and derivative instrument needed to hedge market risks that could otherwise adversely impact the objective of the CB arbitrage strategies.

Attributes of Issues for Use in a Convertible Bond Arbitrage Strategy

- For CB, the following attributes are desirable in a convertible bond arbitrage:
 - (1) good liquidity, (2) low conversion premium, (3) high convexity, and (4) low implied volatility.
- With respect to the underlying stock, the following attributes are desirable: (1) high expected price volatility, (2) can be easily borrowed, (3) pay little or no dividends.

Types of Arbitrage Strategy

Cash flow arbitrage strategy:

- Create equivalent positions in CB and underlying stock so that any additional cash flow available from the CB can be captured while eliminating any risks.
- Typically a long position is established in CB, and a short position is established in the underlying stock.

Volatility trading strategy

- Regardless of how the stock price changes, the mispriced CB 's value will outperform the value of the short position in the underlying stock's value.
- Like higher convexity

Types of Strategy (continued)

gamma trading strategy

- In most option trading strategies, the position of a strategy must be changed as the price of the underlying changes.
- There are option strategies that involve capitalizing on the expected change in the delta .
- Instead of adjusting the short position in the underlying stock as specified by the delta, the manager takes a position based on the expected change in the delta.
- The expectation is to generate additional income when the stock price changes.

Options Approach to Valuation

- ❑ An investor who purchases a noncallable/nonputable convertible bond would be entering into two separate transactions:
 - i. buying a noncallable/nonputable straight bond
 - ii. buying a call option on the stock, where the number of shares that can be purchased with the call option is equal to the conversion ratio
 - ❑ The fair value for the call option depends on the factors that affect the price of a call option.
 - One key factor is the expected price volatility of the stock: the higher the volatility, the greater the value of the call option.
 - As a first approximation to the value of a convertible bond, the formula would be
- convertible bond value = straight value + price of the call option on the stock***
- The price of the call option is added to the straight value because the investor has purchased a call option on the stock.

Options Approach to Valuation (continued)

- ❑ Consider a common feature of a convertible bond: the issuer's right to call the bond.
 - If called, the investor can lose any premium over the conversion value that is reflected in the market price.
 - Therefore, the analysis of convertible bonds must take into account the value of the issuer's right to call the bond.
 - This depends on future interest rate volatility, and economic factors that determine whether it is optimal for the issuer to call the bond.
- ❑ The Black-Scholes option pricing model cannot handle this situation.
 - The binomial option pricing model can be used simultaneously to value the bondholder's call option on the stock and the issuer's right to call the bonds.
 - The bondholder's put option can also be accommodated.
 - To link interest rates and stock prices together, statistical analysis of historical movements of these two variables must be estimated and incorporated into the model.