Convertible bonds as an asset class

Combination of bonds and equities – bond plus conversion option

• Bondholder has the right to convert the bond into common shares at some contractual price (conversion number may change over time).
• Issuer’s call and holder’s put
• Conversion premium and break-even calculations
• Decomposition of convertible value into different components
  - bond plus warrant plus default risk
  - put plus stock plus yield advantage
• Interest rate sensitivities – duration
• Lattice tree calculations: incorporation of default risk, call and conversion rights
**Holder’s perspective:** take advantage of the future potential growth of issuer’s company

**Issuer’s perspective:** raise capital at a lower cost by the provision of conversion privilege to bond holders
Equity perspective on convertibles

- To take advantage of the upside potential growth of the underlying stock (participation into equity).
- Swapping the variable stock dividends in return for fixed coupon payments until the earlier of the maturity date and the conversion date.

Fixed income perspective on convertibles

- Provides the “bond floor” value.
- Conversion option that allows the investor to exchange the straight bond for fixed number of shares.
Call terms

Issuer has the right to call back the bond at a pre-specified call price prior to final maturity, usually with a *notice period requirement*. Upon call, the holder can either convert the bond or redeem at the call price.

Issuer’s perspective on the call right

- To have the flexibility to call if they think they can refinance the debt more cheaply.

- To force bondholders to convert debt into equity, which can reduce debt levels and result a beneficial effect on the balance sheet. The issuer has the flexibility to shift debt into equity to reduce the leverage of the firm. In summary, it is used as a tool by issuer for possible future equity financing – managing the debt / equity balance.
Call protection

**Hard** (or absolute):
To protect the bond from being called for a certain period of time.

**Soft** (or provisional):
The issuer is allowed to call only when certain conditions are satisfied.

For example, the closing price of stock has been in excess of 150% of the conversion price on any 20 trading days within 30 consecutive days.

**Role of call protection**
To preserve the value of the equity option for the bondholders. While waiting for the stock price to increase, convertibles typically provide more income than the stock. Without the call protection, this income stream could be called away at any time. Hard call protection with longer time period is more desirable for the investors.
**Put feature**

Allows the holder to sell back the bond to the issuer in return for a fixed sum. Usually, the put right lasts for a much shorter time period than the maturity date of the bond.

- The holder is compensated for the lesser amount of coupons received in case the equity portion of the convertible has low value.

- It protects the holder against rising interest rates by effectively reducing the year to maturity. With smaller value of duration*, the convertible price becomes less sensitive to interest rate.

- Duration is the weighted average of times of cash flow stream, weighted according to the present value of the cash flow amount. Percentage change in bond price is proportional to negative yield change, where the proportional constant is the duration.
Put above par value or premium redemption at maturity

Renong Berhad (a Malaysian company) issued a 5-year bond with a 2.5 percent coupon with yield-to-put at 7.5 percent and a put price of 129.7. This is above the par of 100 used in the calculation of conversion into stock. Also, this results in increased downside protection in case the equity portion has low value.

Investors’ perspective
Even if the conversion turns out to be unprofitable, they are guaranteed a 7.5 percent return to the time of the put.
Convertible bond issued by the Bank of East Asia

US$250,000,000
2.00 percent Convertible Bonds due 2003

Issue date  July 19, 1996

Issue price  100 percent of the principal amount of the Bonds, plus accrued interest, if any, from July 19, 1996 (in denominations of US$1,000 each)

Conversion period  From and including September 19, 1996 up to and including July 7, 2003
Conversion feature

Conversion price  HK$31.40 per Share and with a fixed rate of exchange on conversion of HK$7.7405 = US$1.00.

Dilution protection clause  The Conversion Price will be subject to adjustment for, among other things, subdivision or consolidation of the Shares, bonus issues, right issues and other dilutive events.
Put feature

Redemption at the option of the bondholders

On July 19, 2001, the Bonds may be redeemed at the option of the Bondholders in US dollars at the redemption price equal to 127.25 percent of the principal amount of the Bonds, together with accrued interest.

The investors are protected to have 27.25% returns on the bond investment upon early redemption by the issuer.
Redemption at the option of the bondholders

On or after July 19, 1998, the Issuer may redeem the Bonds at any time in whole or in part at the principal amount of each Bond, together with accrued interest, if for each of 30 consecutive Trading Days, the last of which Trading Days is not less than five nor more than 30 days prior to the day upon which the notice of redemption is first published, the closing price of the Shares as quoted on the Hong Kong Stock Exchange shall have at least 130 percent of the Conversion Price in effect on such Trading Day.
Soft call protection

Parisian feature
The closing price has to be above 130 percent of the conversion price on consecutive 30 trading days.

• On the date of issuance of the notice of redemption (treated as day 0), the Issuer looks back 5 to 30 days (corresponds to [-30,-5] time interval) to check whether the history of the stock price path satisfies the Parisian constraint. That is, the last of the 30 trading days (with closing price above 130% of the conversion price) falls in [-30,-5] time interval.

• From Issuer’s perspective, when the Parisian constraint has been satisfied, the Issuer has 5 to 30 days to make the decision on redemption or not.
Reset feature in convertible bonds

In most cases, the reset on conversion price is downward and this makes the bond more valuable. For example, the conversion number is reset by dividing the par by the prevailing stock price.

Floor limit
The extent of downward reset cannot be below a certain multiplier of the first conversion price.
Hong Kong example - market manipulation on conversion

China Travel

China Travel (a red chip company in Hong Kong) issued a convertible bond with coupon rate 4.25% per annum in Nov., 1993, near the peak of 1993 bull market, with maturity date in Nov., 1998. The conversion price is HK$3.66.

- Market background

Stock price jumped from HK$1.24 at the beginning of 1996 to HK$6.1 on 11 Aug., 1997 (historical high). The share price was seen to be overvalued. The management would like to convert the debt into equity.
• **Possible market manipulation**

China Travel owned more than 30% of its company’s total shares, and the red chip stocks were widely held by other red chip companies. Therefore, it was relatively easy to push up the share prices in bull market situation.

• **Constraint on calling**

The daily closing stock price had to stay over HK$5.49 (call price = 150% x conversion price) for more than 20 of the 30 consecutive trading days. This provision makes market manipulation more difficult and easily detectable.
Failed attempt of conversion

- On 6 Aug., 1997, the share price went above the call price for the first time and managed to stay above for 17 trading days.

- In Sept., 1997, the share price stayed above the call price for two more days (only one day short of the call requirement).

- Unfortunately, the share price went down under the general market’s big drop.

- Within two months after the failed attempt, the share price dropped below HK$3.66, and within one year, it fell below HK$1.0.

- The share price of China Travel fell much faster than the general stock market, suggesting a strongly inflated price before the market crash.
Premium for conversion right

• An investor who purchases a convertible bond rather than the underlying stock typically pays a premium over the current market price of the stock.

• Why would someone be willing to pay a premium to buy this stock? The market conversion premium per share is related to the price of a call option – limit the downside risk of the convertible bond.
Analytics of convertible bonds

stock price $30.00 per share
stock dividend $0.50 per share
convertible market price $1,000
coupon rate 7.00%
maturity 20 years
conversion price $36.37

Stock dividend yield = annual dividend rate / current stock price
= $0.50 / $30.00 = 1.67%
Conversion ratio
= number of shares for which one bond may be exchanged
= par / conversion price
= $1,000 / $36.37 = 27.50 shares

Conversion value
= equity value or stock value of the convertible
= stock price x conversion ratio
= $30.00 x 27.50 = $825.00
Conversion premium
= (convertible price – conversion value) / conversion value
= ($1,000 – $825) / $825.00 = 21.21%

Dollar premium
= convertible price – conversion value (expressed in points)
= ($1,000 – $825) / $1,000 x 100%
= 17.50 points
**Break even calculations**

Break even (years)
= conversion premium / (convertible yield – stock yield)
= 21.21 / (7.00 – 1.67) = 3.98 (years)

Number of years necessary for the stock investor to recover the conversion premium from the convertible’s higher income relative to an instrument of an equivalent amount in the stock.

- After 3.98 years, the convertible has made up, in income alone, the amount of the conversion premium.
Break-even calculations (cont’d)

Dollar maintenance

\[ \frac{\text{market price} - \text{conversion value}}{\text{coupon} - \frac{\text{market price}}{\text{stock price}} \text{ stock dividend}} \]

The time it takes for the convertible yield advantage to pay for its premium compared to an equivalent dollar amount purchased of the underlying stock.

- May use *conversion ratio* instead of market price/stock price.
Weaknesses of break-even analysis

- It ignores the main advantage of convertible: protection on downside risk on the underlying equity.
- It ignores the margin of safety offered by the convertible with the payment of principal at maturity.
Convertible = bond + warrant

Factors that affect the bond component

- Interest rates
- Credit rating/spreads
- Coupon
- Duration

Factors that affect the warrant component

- Stock performance
- Embedded strike price
- Common dividend yield and dividend growth rate
- Stock volatility
- Life of warrant / call protection
Put plus stock plus yield advantage

Applying the put-call parity:
\[ \text{call} + \text{bond} = \text{put} + \text{stock}. \]
Here, put is the right to sell the stock for bond

One may treat a convertible bond as yield-enhanced stock plus a put option.

- The put option represents the bond floor protection. The strike price is the bond investment value.
Casino operator brings ringgit convertible

- Malaysia's only casino operator, Resorts World, has raised M$1.1 billion ($300 million) from a convertible bond that was well received despite offering a **negative yield**.

- Issuing the zero-coupon bonds at par and setting the redemption price at 99%, which results in a yield to maturity of -0.5%. Desire to see bonds convert prompts Resorts World to use rare negative yield structure.

- The conversion price was fixed at launch at 10% over yesterday's (September 7, 2006) volume weighted average price of M$11.593, giving an initial conversion price of M$12.75.
• There is an **issuer call** after one year, subject to a 120% hurdle, to force conversion in case investors drag their feet.

• The reset mechanism has a **floor** at 90.9% of the original conversion price, which is high compared with the typical reset floor at 80-85%. The floor is equal to yesterday's volume weighted average price.

• The bonds were priced assuming a **credit spread** of 40 basis points over the Malaysian interest rate curve, a dividend yield of 2.2% = 120% of the previous year's, and a stock borrow cost of 5%. Note that the issuer is essentially **shorting stock**.
Issuer’s perspectives

• While common a few years back when interest rates were much lower, negative yields are rarely seen on CBs nowadays but highlights the issuer's desire to have the bonds convert in order to get equity on its balance sheet.

• The bonds have a short maturity of only two years, a conversion premium of only 10% and two conversion price resets - after the first year and 60 days before maturity - making it all but inevitable that the bonds will convert.

• The issuer is essentially saying that it is happy to sell equity at today's market price, but not lower. The expected appreciation of the ringgit makes the bonds a reasonable proposition.
Investor’s perspectives

• The bond floor was set at 90.7%, which one observer says is "reasonably attractive" given the strong focus on conversion and the implied volatility is 24%. This would mean if no conversion occurs at maturity, the loss in value is about 10%.

• Analysts are, however, optimistic that the company's casino operations will drive earnings growth, and of the 19 analysts that cover the company, according to Bloomberg data, 16 have a "buy" or "overweight" recommendation.
• The share price is up a modest 4.5% this year to Thursday's closing price of M$11.70, which compares with a 6.2% gain in the Kuala Lumpur Composite Index.

• There is no stock lending available at the moment, although Resorts World, which is a subsidiary of conglomerate Genting, is among a group of stocks that is qualified for short-selling once this becomes available.
Intrinsic value of convertibles

The intrinsic value of a convertible bond is the greater of:
1. Conversion value
2. Bond investment value – value as a corporate bond without the conversion option (based on the convertible bond’s cash flow if not converted).

- To estimate the bond investment value, one has to determine the required yield on a non-convertible bond with the same quality rating and similar investment characteristics.
- If the convertible bond does not sell for the greater of these two values, arbitrage profits could be realized.
# Bond investment value

- Present value of the interest and principal payments discounted at the straight (non-convertible) bond interest rate

$$\text{bond interest value} = \sum_{t=1}^{n} \frac{C}{(1 + r)^t} + \frac{P}{(1 + r)^n}$$

where $P = \text{par value}$, $r = \text{discount rate}$, $C = \text{coupon rate}$,

$n = \text{number of periods to maturity}$.

<table>
<thead>
<tr>
<th>Years</th>
<th>payment</th>
<th>present value factor</th>
<th>present value</th>
</tr>
</thead>
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<tr>
<td>1 - 20</td>
<td>$80</td>
<td>8.514</td>
<td>$681.12</td>
</tr>
<tr>
<td>20</td>
<td>$1,000</td>
<td>0.149</td>
<td>$149.00</td>
</tr>
</tbody>
</table>

$\text{take } r = 10\%$

$\text{Total } = \$830.12$
Estimation of the discount rate

Use the yield-to-maturity of a similar non-convertible bond as a proxy.

• The apparent deterioration of the creditworthiness of an issue will not be reflected in the convertible price because the common stock may be rising due to higher share price volatility.
Valuation of convertible debts

List of parameters

- Coupon rate
- Creditworthiness of the issuer
- Maturity date
- Conversion premium
- Ratio of conversion price to current stock price
- Volatility of the stock price
- Dividend yield of the stock price
- Presence of other embedded option features, like callability and puttability
- Prevailing risk free interest rate and volatility of interest rate
- Correlation of the stock price with the interest rate
Duration

Duration is the weighted average of the times that the principal and interest payments are made.

\[
\text{duration} = \frac{\sum_{t=1}^{n} tC_t / (1 + i)^t}{\sum_{t=1}^{n} C_t / (1 + i)^t}
\]

where \( t \) is the time of payment
\( C_t \) is the coupon and/or principal payment
\( i \) is the market yield.

Duration analysis provides a measure how bond values change with changing interest rates.
Duration analysis applied to convertibles

The approximation for the convertible bond’s interest rate sensitivity

\[ D^{cv} = D_{adj} \left( 1 - \frac{C/I}{2} \right) \]

where \( C = \) conversion value and \( I = \) investment value.

- The equity component of the convertible bond may dampen the convertible’s interest rate sensitivity, depending on the bond’s equity participation. Hence, convertibles trading high above their investment value will be less sensitive to interest rates.
Duration and coupon

- For non-convertible bonds, the duration decreases as their coupon increases. This is because higher coupon bonds deliver more cash flows near the start of bond’s life.

- With convertible feature, the higher coupon rate may lead to lower propensity to convert. The CB then has a longer life, so this leads to higher duration.

These two effects are counteracting.
Interest rate sensitivity

1. The exercise price is a function of the investment value. An increase in interest rates will lower the investment value.

2. However, the exercise price of the embedded call is reduced. A lower exercise price will increase the value of the warrant.
## Interest rate sensitivity (cont’d)

<table>
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<th>Basic price</th>
<th>Int rate + 1%</th>
<th>Change</th>
<th>Int rate -1%</th>
<th>Change</th>
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<tr>
<td>Investment value</td>
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<td>$812.75</td>
<td>-$35.09</td>
<td>884.74</td>
<td>$36.90</td>
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<td>Warrant value</td>
<td>$337.66</td>
<td>$362.58</td>
<td>+24.92</td>
<td>$312.72</td>
<td>-$24.94</td>
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<tr>
<td>Total</td>
<td>$1185.50</td>
<td>$1175.33</td>
<td>-$10.17</td>
<td>$1197.47</td>
<td>+$11.92</td>
</tr>
<tr>
<td>Percent change</td>
<td></td>
<td></td>
<td>-1.02%</td>
<td>1.19%</td>
<td></td>
</tr>
</tbody>
</table>
Correlation with interest rates

Consider the impact of an increase on interest rate
• The future share price is expected to be higher because of higher drift rate.
• Due to negative correlation between interest rate and share price (say, the S&P 500-stock index has a correlation of about minus 0.5), the share price drops first.

Negative correlations normally lower CB value; positive correlations make the CB worth more.

In some situation, CBs may have price differences in the range of 10-15% when correlation moves from 1.0 to –1.0.
Pricing of risky convertible bonds

One-factor binomial model

* stock price process follows binomial random walk
* interest rates to be deterministic

Two discount rates

1. If the convertible is certain to remain a bond, it is appropriate to use a discount rate corresponding to the creditworthiness of the issuer – risky rate.

2. Suppose the bond is certain to be converted, it is then appropriate to use the riskfree rate.

At maturity, the holder will choose the maximum between the par value and the value of stocks received upon conversion.
How to account for the creditworthiness of the issuer?

The discount rate to be used when we roll back is given by

$$pw_u + (1 - p)w_d.$$ 

Here, $p$ is the probability to a node where the discount rate is $w_u$ and $(1 - p)$ is probability to a node with $w_d$. The appropriate discount rate is the weighted average of the discounted rates at the nodes in the next time step.
conv = value of stocks received if conversion takes place

call  = call price

roll  = value given by the rollback
       (neither converted nor recalled)

At each node, the optimal strategy of the holder is exemplified by taking the maximum of min(roll, call) and conv.

• The maximum reflects the conversion right, which persists with or without recall by the issuer.

• min(roll, call) means the bond value can never shoot beyond the call price.

Dynamic programming procedure:

\[
\max(\min(\text{roll}, \text{call}), \text{conv})
\]
Alternative dynamic programming procedure:

\[
\min(\max(roll, conv), \max(call, conv))
\]

• The term \(\max(roll, conv)\) represents the optimal strategy of the holder.

• Upon recall, the holder chooses to accept the call price or convert into shares. This can be represented by \(\max(call, conv)\).

The issuer chooses to recall or to abstain from recalling in order to minimize the option value.
Third dynamic programming procedure:

\[ \min(\max(roll, conv), call) \]

- The term \( \max(roll, conv) \) represents the optimal strategy of the holder.

- Even under the optimal strategy adopted by the holder, the bond value is always bounded above by the call price.
Example

A 9-month discount bond issued XYZ company with a face value of $100. Assume that it can be exchanged for 2 shares of company’s stock at any time during the 9 months.

* It is callable for $115 at any time.
* Initial stock price = $50, \( \sigma = 30\% \) per annum and no dividend; risk-free yield curve to be flat at 10% per annum.
* Yield curve corresponding to bonds issued by the company to be flat at 15%.
* Tree parameters are: \( u = 1.1618, \ d = 0.8607, \ p = 0.5467, \ R = e^{0.1\Delta t} = 1.0253. \)
* At maturity, the convertible is worth \( \max(100, 2S_T) \).
Binomial tree for pricing a risky convertible bond

upper figure: stock price
middle figure: discount rate
lower figure: value of convertible
At node $D$
Roll back gives the bond value
\[(0.5467 \times 156.84 + 0.4533 \times 116.18)e^{-0.1 \times 0.25} = 134.98.\]
The bondholder is indifferent to conversion or hold, also the issuer is also indifferent as to whether the bond is called; the correct discount rate at node $D$ is 10%.

At node $F$
The correct discount rate is 15% since the convertible is contain not to be converted if node $E$ is reached.

At node $E$
The correct discount rate is
\[0.5467 \times 10\% + 0.4533 \times 15\% = 12.27\%.
\]The value of convertible at $E$
\[(0.5467 \times 116.18 + 0.4533 \times 100)e^{-0.1227 \times 0.25} = 105.56.\]
The bond should be neither converted nor called.
**At node B**
The discount rate is
\[ 0.5467 \times 10\% + 0.4533 \times 12.27\% = 11.03\% \]
and value of convertible is
\[ (0.5467 \times 134.99 + 0.4533 \times 105.56)e^{-0.1103 \times 0.25} = 118.34. \]
It is optimal to *call the bond at node B* so that it *causes immediate conversion* and leads to $116.18. The *discount rate* at node B should be *taken to be 10\%*, since *conversion* takes place at this node.

**At node A**
The discount rate is
\[ 0.5467 \times 10\% + 0.4533 \times 13.51\% = 11.59\%. \]
The convertible value at node A is
\[ (0.5467 \times 116.18 + 0.4533 \times 98.00)e^{-0.1159 \times 0.25} = 104.85. \]
If the bond has no conversion option, its value is
\[ e^{-0.75 \times 0.15} = 89.36. \]
The value of conversion option = 104.85 – 89.36 = 15.49.
Structured convertibles

- Mandatory convertibles
  (performance based conversion premium, parallel debts)
- LYON (Liquid Yield Option Note)
- Exchangeables
- convertible stock notes
- Debt exchangeable for common stock
Mandatory convertible securities

Product nature

• Mandatory convertible into common stock at maturity.

• They are effectively yield-enhanced common stock, and offer no downside protection to the investor apart from their higher yield.

• MCS have grown to constitute about 14% of the total US convertible market.
Payoff of an MCS at Maturity
Mandatory convertible securities (cont’d)

• Issue price – lower strike price: The same as the common stock price at the time of issue.

• Conversion price – upper strike price: This is the price at which the MCS are convertible into common stock at a premium to the issue price.

• The conversion ratio at maturity changes depending on the price of the stock.

• At issue, the MCS is priced with a so-called conversion premium, which determines the level of the strike price for the long call in the call spread (the upper strike).
MCS: The Mysterious Changing Conversion Ratio
An MCS consists of the following pieces

MCS = underlying common stock (stock price × lower conversion ratio) + (out-of-the-money call option on the underlying common stock struck at the upper strike price) × upper conversion ratio – at-the-money call option on the underlying common stock struck at the lower conversion ratio
The Anatomy of an MCS
Perspective of the investor

- MCS involves the forward sale of equity at a price higher than the current stock price, but without the traditional downside support of investment value of a normal convertible.
- In return, the investor receives a higher dividend.
- Less interest rate sensitive but more equity sensitive compared to convertibles.
Numerical example

Stock price at issue  $27.875
Upper strike  $30.750
Lower strike  $25.000

Valuation
Long stock value  $27.875
Long 0.8130 calls struck at $30.750  $5.411
Short 1 call struck at $25  -$9.228
Present value of net cash flow  +$4.391

Fair value  $28.450
Performance based conversion premium

1. If the stock goes up from the issue price, the participation is at first delayed until the point of the upper strike, and then rises at a reduced rate equal to the upper conversion number.
2. On the downside, participation is one-for-one with the stock.

Why it is called performance based premium

The investor does not actually pay the conversion premium up front. The declining ratio represents the conversion premium paid by the investor – paid only when the stock performs well.

Both issuer’s and investors’ interests are aligned.
MCS Price at Maturity

Issue Price

Conversion Price

Common Price at Maturity

Original Investment Recovered in Stock

No Premium Paid

Premium Paid

MCS: Performance Based Conversion Premium
Parallel debt MCS

The higher dividend paid by the issuer is not tax deductible. To get around the problem: pairing of the equity MCS with a debt security.

- All the proceeds from the sale of the MCS are invested in US Treasuries with maturities same as that of the MCS.
- The yield from the Treasuries is supplemented with an additional fee from the issuer to arrive at the stated yield on the MCS.

Parallel debt

- The issuer enters the public debt market to issue an interest bearing note with a maturity and face amount similar to the terms of MCS.
Parallel debt MCS (cont’d)

• At maturity, the investor delivers either cash (the settlement fee) or the maturing Treasury note to satisfy the terms of the purchase contract of the MCS.

• In return, at maturity, the issuer can use these proceeds to retire the corporate debt obligation.

• The Treasuries are owned by the investor – so the investor does not need to bear the default risk of the issuer.

• The investor also enjoys a tax benefit from this structure since that portion of the income received from the Treasury coupon payments is exempt from state and local taxes.
**MCS: Parallel Debt Structure**

*Source: Morgan Stanley*
Exchangeable convertible bonds

They are issued by one company and converted into the stock of another company.

*Example*
Pennzoil owned over 18,000,000 shares of Chevron common stock. Using this stock as collateral, Pennzoil issued over $902,000,000 worth of bonds convertible into Chevron shares.

*Advantages*
- Received the proceeds for selling the issues at a 21% premium over Chevron’s current stock price.
- Pennzoil received $33.4 million annually in dividends from the Chevron shares.

*Disadvantage*
Forfeit the potential upside growth of the stock price.
Liquid Yield Options Note (LYON)

- introduced by Merill Lynch in 1985

1. The bonds were created as zero coupon bonds offered at a deep discount to face value.

2. Investors were given a put option at a price equal to the original offering price of the LYONs plus the interest that accrues to the date of the put.

Since the put price is based on a yield-to-maturity consistent with the time frame of the put, companies can issue what is essentially longer-term debt at rates equivalent to those of short to intermediate maturities.
LYON example – Motorola Inc. 0% Due 2013

Risk/Reward Table

<table>
<thead>
<tr>
<th>Time</th>
<th>Stock price</th>
<th>Bond price</th>
<th>Convertible participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOWNSIDE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.00 year</td>
<td>-32.0</td>
<td>-1.4</td>
<td>4.3%</td>
</tr>
<tr>
<td>0.50 year</td>
<td>-23.9</td>
<td>-1.8</td>
<td>7.5%</td>
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<tr>
<td>0.50 year</td>
<td>31.5</td>
<td>15.2</td>
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<tr>
<td>UPSIDE</td>
<td></td>
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<tr>
<td>1.00 year</td>
<td>47.3</td>
<td>23.4</td>
<td>49.4%</td>
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</tbody>
</table>
Example of LYON – Waste Management, Inc.

- Issued on April 12, 1985.
- Face value of $1,000 maturing on Jan. 21, 2001.
- At any time prior to maturity, the investor may elect to convert the bond into 4.36 shares of Waste Management common stock.
- Though the issuer may call the LYON immediately after issuance, the investor does receive some call protection since the issuer may not call the bond prior to June 30, 1987 unless the price of the common stock rises above $86.01.
- On issue date, the stock price was $52.125.
<table>
<thead>
<tr>
<th>Date</th>
<th>Put Price</th>
<th>Date</th>
<th>Put Price</th>
</tr>
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<tbody>
<tr>
<td>June 30, 1988</td>
<td>$301.87</td>
<td>June 30, 1995</td>
<td>$613.04</td>
</tr>
<tr>
<td>June 30, 1989</td>
<td>$333.51</td>
<td>June 30, 1996</td>
<td>$669.45</td>
</tr>
<tr>
<td>June 30, 1990</td>
<td>$375.58</td>
<td>June 30, 1997</td>
<td>$731.06</td>
</tr>
<tr>
<td>June 30, 1991</td>
<td>$431.08</td>
<td>June 30, 1998</td>
<td>$798.34</td>
</tr>
<tr>
<td>June 30, 1991</td>
<td>$470.75</td>
<td>June 30, 1999</td>
<td>$871.80</td>
</tr>
<tr>
<td>June 30, 1993</td>
<td>$514.07</td>
<td>June 30, 2000</td>
<td>$952.03</td>
</tr>
<tr>
<td>June 30, 1994</td>
<td>$561.38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Call Price</td>
<td>Date</td>
<td>Call Price</td>
</tr>
<tr>
<td>--------------</td>
<td>------------</td>
<td>---------------</td>
<td>------------</td>
</tr>
<tr>
<td>At issuance</td>
<td>$272.50</td>
<td>June 30, 1994</td>
<td>$563.63</td>
</tr>
<tr>
<td>June 30, 1986</td>
<td>$297.83</td>
<td>June 30, 1995</td>
<td>$613.04</td>
</tr>
<tr>
<td>June 30, 1987</td>
<td>$321.13</td>
<td>June 30, 1996</td>
<td>$669.45</td>
</tr>
<tr>
<td>June 30, 1988</td>
<td>$346.77</td>
<td>June 30, 1997</td>
<td>$731.06</td>
</tr>
<tr>
<td>June 30, 1989</td>
<td>$374.99</td>
<td>June 30, 1998</td>
<td>$798.34</td>
</tr>
<tr>
<td>June 30, 1990</td>
<td>$406.00</td>
<td>June 30, 1999</td>
<td>$871.80</td>
</tr>
<tr>
<td>June 30, 1991</td>
<td>$444.08</td>
<td>June 30, 2000</td>
<td>$952.03</td>
</tr>
<tr>
<td>June 30, 1992</td>
<td>$477.50</td>
<td>At maturity</td>
<td>$1,000.00</td>
</tr>
<tr>
<td>June 30, 1993</td>
<td>$518.57</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The call prices are increases at a rate of 9% per year compounded semi-annually.
## Stock price for optimal conversion

<table>
<thead>
<tr>
<th>Date</th>
<th>Critical Price</th>
<th>Date</th>
<th>Critical Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>At issuance</td>
<td>$129.50</td>
<td>June 30, 1993</td>
<td>$273.00</td>
</tr>
<tr>
<td>June 30, 1985</td>
<td>$132.00</td>
<td>June 30, 1994</td>
<td>$287.00</td>
</tr>
<tr>
<td>June 30, 1986</td>
<td>$145.00</td>
<td>June 30, 1995</td>
<td>$301.50</td>
</tr>
<tr>
<td>June 30, 1987</td>
<td>$158.50</td>
<td>June 30, 1996</td>
<td>$316.00</td>
</tr>
<tr>
<td>June 30, 1988</td>
<td>$173.50</td>
<td>June 30, 1997</td>
<td>$329.50</td>
</tr>
<tr>
<td>June 30, 1989</td>
<td>$194.50</td>
<td>June 30, 1998</td>
<td>$339.00</td>
</tr>
<tr>
<td>June 30, 1990</td>
<td>$217.00</td>
<td>June 30, 1999</td>
<td>$340.00</td>
</tr>
<tr>
<td>June 30, 1991</td>
<td>$238.50</td>
<td>June 30, 2000</td>
<td>$317.50</td>
</tr>
<tr>
<td>June 30, 1992</td>
<td>$257.00</td>
<td>Jan. 21, 2001</td>
<td>$229.36</td>
</tr>
<tr>
<td>June 30, 1993</td>
<td>$518.57</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Some properties of zero-coupon convertibles

- It is most sensitive to interest rate changes since only par is paid at maturity.

- With conversion ratio fixed, as the bond value moves toward par, the conversion price rises. Hence, in order for it to be worthwhile for the investor to convert, the stock price must rise at least as fast as the bond price accrues.

- Since the call option is less valuable, the zero-coupon convertibles should be issued with a lower conversion premium.
**Rationale for issuing exchangeables**

The issuer wants to monetize the value of a non-strategic asset in a tax-efficient manner. This is an alternative form of capital raising. The shares in a third company may be held due to aborted takeover.

- The issuer receives the proceeds of the sale immediately (at a premium to the current share price and may gain advantage from higher volatility of share price prior to aborted takeover), but does not have to pay capital gains tax until the bonds are actually converted several years in the future.
Asset-linked convertibles

Combined the security of fixed income with convertibility into precious metal instead of common stock.

Example
Sunshine Mines issued a convertible bond with a 15-year maturity and an 8.5 percent coupon, convertible into silver at $20 an ounce.

- The issuer is willing to share the potential price appreciation of the underlying commodity in exchange for a lower coupon rate and better terms in bond indentures.

- Payouts can be in either the commodity or its cash equivalent.

Investors looked to metal to preserve their capital when inflation is pronounced. As inflation leveled its peak in the early 1980s, interest in asset-linked convertibles also faded.
CrEDITS structure
(Credit Enhanced Debt Indexed To Stock)

- **Characteristic**
  Principal and coupon payments are guaranteed by an irrevocable letter of credit from a highly rated financial institution.

- **Issuer’s perspective**
  Pay a lower coupon rate. Get the credit guarantee by paying amount less than the coupon rate differential.

  - Six percent coupon rate is reduced to four percent but with principal and income guaranteed by a high-rated third party. This works well if the protection requires less than the 2 percent coupon rate differential.
CrEDITS structure (cont’d)

Attraction to investors

1. Upside potential of an emerging market or growth stock;

2. A name with high stock volatility;

3. High-quality downside protection that is uncorrelated to the shares.

Example
Indian Petrochemicals Corporation and GVC (a Taiwanese technology company)
Convertible stock notes

• Instead of paying interest and principal in cash, these notes pay in common stock or cash, at the issuer’s option (designed to give issuers flexibility in managing cash flow).

• They are typically issued by troubled companies. Companies facing bankruptcy often ask creditors to exchange debt for convertible stock notes (allowing for increased equity participation but forfeiting coupon incomes).
Example

*Anacomp* - facing *bankruptcy* in the mid-1980s

• proposed to exchange the convertible 13\(\frac{7}{8}\) percent bonds for convertible stock notes with higher conversion ratio (increased to 250 shares per bond from 57.143).

As the stock price recovered to $8 (original conversion price was $17.50) in mid-1987, the new convertible stock notes had an intrinsic value of 200% of par.

*This illustrates the advantage of being a creditor rather than a shareholder when a company’s fortunes change.*
Convertibles as a means of cheap financing

Sweeten debt

- Allow firms to borrow cheaply relative to straight debts.
- Convertibles protect companies with high and indeterminate risk from a prohibitive cost of straight debt.

Remark

Should not ignore the liabilities associated with the convertibility feature.
Considerations for corporate treasurers

• What are the costs associated with issuing equity, debt, or convertibles. Quantify them using a weighted cost of capital for debt and equity.

• What is the probability of financial distress or embarrassment caused by a given capital structure?

• Consider the design of the corporate structure as a marketing problem. What types of investors will be attracted to the various pieces of the corporate pie?
Financing strategies

Advantage of equity as a source of financing – excellent insurance properties against financial distress.

- Equity will be issued by the more pessimistic firms.
- Straight debt will be issued by the more optimistic firms.
- Convertible debt will be issued by medium-quality firms.
Small, fast growing companies

Such companies have comparative advantage in the convertible market versus the fixed income market.

- They lack a long-term track record and have volatile capital structures – high coupon must be offered.

- They can transform the high volatility into a benefit since the warrant is more expensive.

- When the company grows, they may call the bonds. This in turn will strengthen the company’s equity base at the moment when it is most needed.
Convertibles as backdoor equity financing

Delayed equity

- Convertibles provide a way of selling common stock at a price above the existing market.
- They are employed as deferred common stock financing.

The call feature is important since it gives the company the means to shift debt to equity.

Convertibles offer a means to control the debt/equity ratio.
## Findings from questionnaires


<table>
<thead>
<tr>
<th>Category</th>
<th>Pilcher</th>
<th>Brigham</th>
<th>Hoffmeister</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delayed equity</td>
<td>82%</td>
<td>68%</td>
<td>40%</td>
</tr>
<tr>
<td>Sweeten debt</td>
<td>9%</td>
<td>27%</td>
<td>37%</td>
</tr>
<tr>
<td>Others</td>
<td>9%</td>
<td>5%</td>
<td>23%</td>
</tr>
</tbody>
</table>
### Reason(s) for Offering

My firm chose convertible as its financing source …

<table>
<thead>
<tr>
<th>Reason</th>
<th>Strongly Agree</th>
<th>Strongly Disagree</th>
<th>Neither Agree Nor Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. because of the lower coupon rate versus straight debt.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. because management felt that the stock was undervalued at the time.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. because management felt that the stock was overvalued at the time.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. as &quot;delayed equity&quot; financing, expecting that the debt would be converted.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. because the conversion feature provides bondholders with protection against unfavorable actions by stockholders or management.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. because our investment banker recommended it over other forms of financing.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. because other firms had recently made successful convertible offerings.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Percentage distribution:

- **Strongly Agree**: 1.7% 4.7% 4.7% 50.6% 35.5%
- **Strongly Disagree**: 16.9% 14.5% 24.1% 25.3% 19.3%
- **Neither Agree Nor Disagree**: 42.7% 19.5% 31.7% 3.7% 2.4%
- **Neither Agree Nor Disagree**: 7.0% 3.5% 5.8% 46.5% 37.2%
- **Neither Agree Nor Disagree**: 45.1% 20.7% 28.0% 6.1% 0.0%
- **Neither Agree Nor Disagree**: 10.7% 8.3% 45.2% 29.8% 6.0%
- **Neither Agree Nor Disagree**: 10.8% 10.8% 33.7% 42.2% 2.4%
By order of importance, please rank the following factors on a scale of 1 to 6 on the extent to which it influenced your firm’s decision to issue convertible; 1 = most influential, 2 = next most influential, etc.)

<table>
<thead>
<tr>
<th>Reason</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower coupon versus straight debt</td>
<td>48.3%</td>
<td>25.0%</td>
<td>13.3%</td>
<td>5.6%</td>
<td>5.6%</td>
<td>1.2%</td>
</tr>
<tr>
<td>stock was undervalued, so we couldn't issue equity</td>
<td>15.7%</td>
<td>22.6%</td>
<td>7.8%</td>
<td>11.3%</td>
<td>7.0%</td>
<td>28.0%</td>
</tr>
<tr>
<td>Stock was overvalued, so we took the opportunity to lock in a favorable conversion premium</td>
<td>3.4%</td>
<td>4.8%</td>
<td>2.2%</td>
<td>7.0%</td>
<td>26.8%</td>
<td>52.4%</td>
</tr>
<tr>
<td>Firm wished to issue &quot;delayed equity&quot;</td>
<td>22.5%</td>
<td>31.0%</td>
<td>20.0%</td>
<td>12.7%</td>
<td>14.1%</td>
<td>2.4%</td>
</tr>
<tr>
<td>Investment banker recommended it</td>
<td>7.9%</td>
<td>4.8%</td>
<td>27.8%</td>
<td>38.0%</td>
<td>18.3%</td>
<td>7.3%</td>
</tr>
<tr>
<td>Other firms had recently issued convertible debt successfully</td>
<td>2.20%</td>
<td>11.90%</td>
<td>28.90%</td>
<td>25.40%</td>
<td>28.20%</td>
<td>8.50%</td>
</tr>
</tbody>
</table>
1. In retrospect, my firm’s stock was _____ valued around the time of the convertible debt offering.

<table>
<thead>
<tr>
<th>under</th>
<th>correctly</th>
<th>over</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>46.4%</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>12.0%</td>
<td>Mean</td>
</tr>
<tr>
<td>Median</td>
<td>2.00</td>
<td></td>
</tr>
</tbody>
</table>

2. Around the time of the convertible debt offering, my firm’s management expected future earning to be _____ the market was expecting.

<table>
<thead>
<tr>
<th>about the same as</th>
<th>much higher than</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3.6%</td>
<td>49.4%</td>
</tr>
<tr>
<td>4</td>
<td>35.1%</td>
</tr>
<tr>
<td>5</td>
<td>11.9%</td>
</tr>
<tr>
<td>Mean</td>
<td>3.55</td>
</tr>
<tr>
<td>Median</td>
<td>3.00</td>
</tr>
</tbody>
</table>

3. At the time of the convertible debt offering, prospects for my firm’s short-term (1-2 years) performance relative to its industry were:

<table>
<thead>
<tr>
<th>poor</th>
<th>fair</th>
<th>good</th>
<th>very good</th>
<th>excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2.4%</td>
<td>5.9%</td>
<td>34.1%</td>
<td>47.1%</td>
<td>10.6%</td>
</tr>
<tr>
<td>Mean</td>
<td>3.58</td>
<td>4.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Equity-like returns with less risk

Convertible securities are an appropriate investment vehicle for long-term investors seeking a high rate of total return but with less risk than common stock.

- Convertible investors hope to earn two-thirds of the upside return with only one-third of the downside risk.
  - In bull markets, convertibles have trailed global equity markets by only a few percentage point.
  - In bear markets convertibles offer considerably more downside support.
**Convexity ratio**

• Classic “two-thirds upside, one-third downside”

• Convexity ratio is the ratio of upside and downside participation.

For example, suppose the convertible provides 64% of the upside participation with only 34% of the downside movement, then the convexity ratio is 1.85. That is, the convertible provides 85% more upside participation than downside risk.
## Risk-reward relationship

Performance of various asset classes, 1973-1995

<table>
<thead>
<tr>
<th></th>
<th>Compound annual return</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convertible bonds</td>
<td>11.70 %</td>
<td>12.47%</td>
</tr>
<tr>
<td>S&amp;P 500</td>
<td>11.84%</td>
<td>17.27%</td>
</tr>
<tr>
<td>Long-term corporate bonds</td>
<td>9.66%</td>
<td>12.44%</td>
</tr>
<tr>
<td>Intermediate-term</td>
<td>9.91%</td>
<td>8.93%</td>
</tr>
<tr>
<td>corporate bonds</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Goldman Sachs Global Convertible Research (1996) “Convertibles as an Asset Class.”
Insulation from volatility

The price movements of convertibles are generally far less volatile.

<table>
<thead>
<tr>
<th>Company</th>
<th>Common Stock</th>
<th>Convertible</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Closing Price</td>
<td>Closing Price</td>
</tr>
<tr>
<td>Avon Products</td>
<td>45.89</td>
<td>44.04</td>
</tr>
<tr>
<td>Bell Atlantic/New Zealand Tel</td>
<td>17.85</td>
<td>14.15</td>
</tr>
<tr>
<td>Diamond Offshore</td>
<td>27.90</td>
<td>26.35</td>
</tr>
<tr>
<td>INCO</td>
<td>17.55</td>
<td>12.45</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>-14.15</td>
</tr>
<tr>
<td>DJIA</td>
<td>10423.20</td>
<td>8235.81</td>
</tr>
<tr>
<td>S&amp;P 500</td>
<td>1184.90</td>
<td>965.80</td>
</tr>
<tr>
<td>NASDAQ</td>
<td>1916.80</td>
<td>1423.19</td>
</tr>
</tbody>
</table>
• Adding convertibles to either bonds or stocks moves the efficient frontier lower in terms of risk and higher in terms of reward.
Long term convertible performance

• Over the period for which reliable long-run data are available (since early 1970s), the total return performance of US convertibles has virtually replicated that of the S & P 500, but with significantly lower risk.

• Over the same period, convertibles have significantly outperformed long-term corporate bonds while demonstrating comparable risk.

• Total return for convertible bonds has demonstrated a much higher correlation with the S & P 500 than with the corporate bond market.

• Convertibles can help maximize performance in both equity and fixed-income portfolios.
Possible reasons for the better performance

Inefficient company timing in calling convertible issues
If a deep-in-the-money convertible enjoys a significant yield advantage over the common stock but it is not called, it is likely to outperform the underlying stock. Companies may delay conversion for a number of reasons including balance sheet and rating agency considerations.

Attractive convertible pricing at issue
Typically, convertible securities are initially priced several percentage points cheap to their theoretical value in order to insure a successful launch. These securities trade higher in the immediate after-market. Apparently, companies are prepared to offer attractive terms in order to assure entry to the capital markets and to enjoy the tax benefits offered by convertibles.
What is a busted convertible?

The underlying stock is far out-of-the-money – the convertible trades on its fixed income characteristics.

Busted convertibles are characterized by low equity price sensitivity (low delta), large conversion premium and high yield to maturity.

• delta < 4%

• conversion premium > 75%

• yield more than 10%

Average credit quality of the busted convertibles is BB- versus BB+ for the entire domestic universe.
Secondary Market Behavior: Busted Convertibles
Advantages

• In contrast to junk bonds, the upside potential is not capped – may enjoy unlimited upside potential if the stock price recovers.

• With busted convertibles, the equity warrant (deep out-of-the-money) is often mispriced. Investors are effectively buying high yield debt with a free equity kicker.

• Busted convertibles are more attractive investment than high-yield debts in a modern economy that has shifted from slow growth, cyclical companies to more volatile growth companies.
Disadvantages

- Busted convertibles are often more illiquid. Traditional convertible investors become sellers as equity sensitivity diminishes.

- Convertible securities are generally subordinate to other creditors in the event of a liquidation or bankruptcy.

- The biggest risk is continued credit deterioration.

Analyzing busted convertibles is a research intensive process involving both equity and credit analysis.