Introduction to Convertible Bond

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- Three Questions
    1. What is a convertible bond?
    2. Where is mathematics?
    3. How to make money?

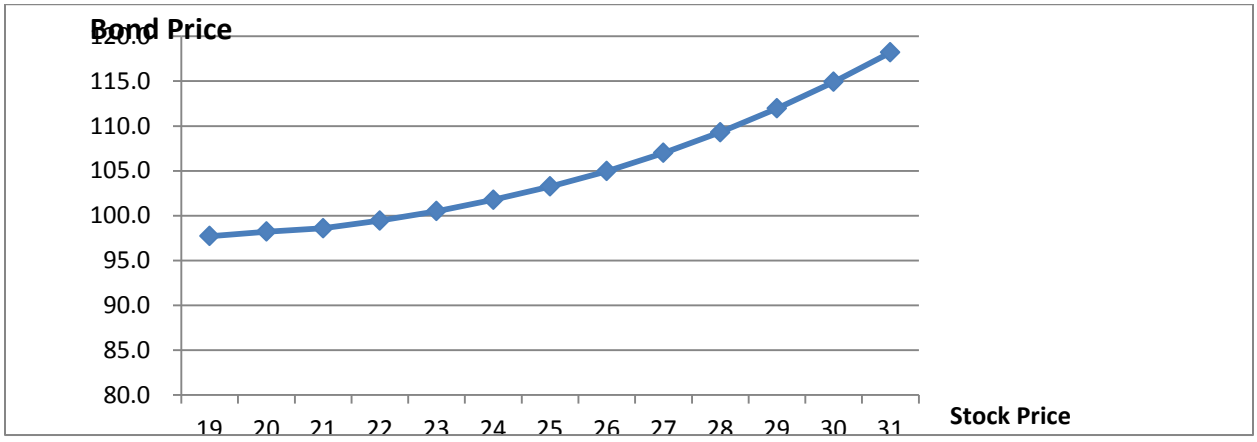
- **What is a convertible bond?**
    - Common Stock and Stock Option
        - A common stock is a security that represents ownership in a corporation
        - Stock option is the right, but not the obligation, to buy (call) or sell (put) a stock at an agreed-upon price within a certain period or on a specific date.
    - A corporate Bond is a debt security issued by a corporate which is obliged to pay coupon periodically and to repay the principal at its maturity.
        - Example of a Corporate Bond
            - Pay 100
            - Coupon: 6% per year
            - At maturity, get 100 back
    - A convertible bond is a corporate bond that can be converted to shares of the issuing company's common stock at the bondholder's discretion. A convertible has the features of both common stock and corporate bond.
    - Example of a convertible bond
        - Pay 100
        - Conversion Ratio: the bond can be converted into 8 shares during the life of the bond
        - Coupon: 3% per year
        - At maturity, get 100 back or get 8 shares of the stock.
    - Convertible Bond Features
        - Conversion Price = Par/Conversion Ratio = 100/8=12.5
        - Parity: value of the bond if converted at today's share price = conversion ratio * current stock price. (Optionality of Convertible Bond)
        - Premium: excess of bond price above parity = (CB Price – Parity)/Parity, e.g. if stock price=10, then premium=25%.

- Bond Floor: the present value of the bond's cash flows as straight debt.
- Bond Yield

- Where is mathematics?
  - Stock Price S: dS/S = u*dt + (vol) * dz where dz is a normal distribution with mean 0 and standard deviation sqrt(dt).
  - ITO's Lemma: f(S, t), then df = [(df/dS)*u*S+(df/dt) + 0.5*vol*vol*S*S*(d(df/dS)/dS)]*dt + (df/dS)*(vol)*S*dz
  - PDE for a convertible bond: dP/dt + 0.5*vol*vol*S*S*d(dP/dS)/dS – P*(r+spread) + c = 0 where r is risk free rate, c is the annual coupon rate, spread is the credit spread of the convertible bond, P is the convertible bond price, and we assume there is no dividend payment of the stock.
  - Delta of a convertible bond: first order approximation dP/dS

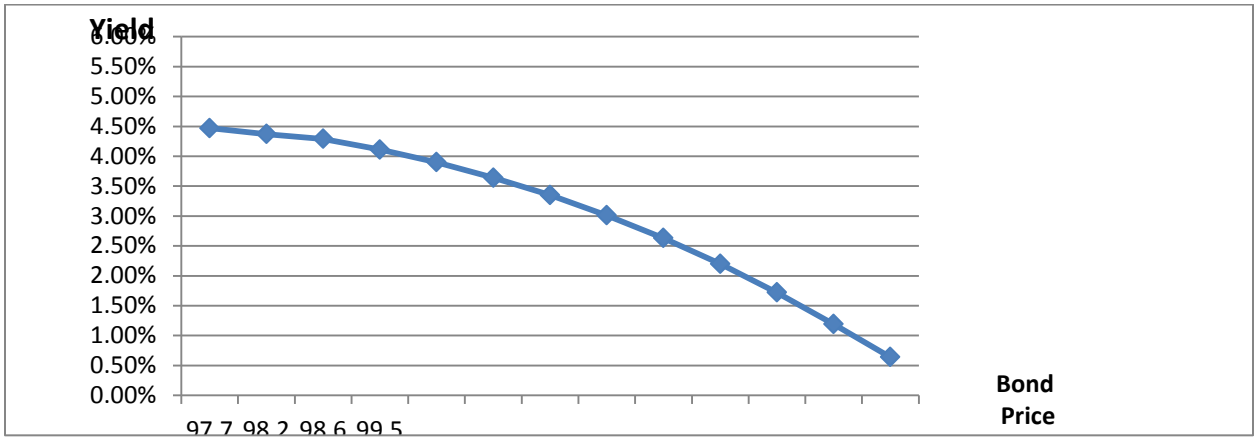
- How to make money?
  - Example: CPN 4%; Maturity Jan 15, 2019; Conversion Ratio 3.8; Face: 100
  - Participation as stock going up

BondPrice	97.7	98.2	98.6	99.5	100.5	101.8	103.2	105.0	107.0	109.3	**111.9**	114.9	118.2
stockPrice	19	20	21	22	23	24	25	26	27	28	29	30	31



- Yield/Spread as a bond

BondPrice	97.7	98.2	98.6	99.5	100.5	101.8	103.2	105.0	107.0	109.3	**111.9**	114.9	118.2
Yield	4.47%	4.37%	4.29%	4.11%	3.90%	3.64%	3.35%	3.01%	2.63%	2.20%	1.72%	1.19%	0.64%



- Convertible Arbitrage: e.g. CB Price = 100, and stock price=26 so that parity=98.8.
- Gamma trading to realize volatility

Delta	11.14%	14.59%	20.43%	25.09%	30.30%	36.06%	42.35%	49.24%	56.89%	65.26%	74.07%	82.47%	89.40%
Stock Price	19	20	21	22	23	24	25	26	27	28	29	30	31