

## FINA 690K – Structured Products and Exotic Options

### Homework One

1. An investor purchases a 10-year AA corporate bond that is puttable to the issuer at year 5. The puttable bond yields 7.00% pa (versus the comparable yield on conventional ten year non-puttable 10-year AA corporate bond of 7.5% pa). How to monetize the puttable right using a swaption? Describe the nature of payoff of the swaption. What would be the option premium charged on the swaption per annum in order that it is more advantageous for the investor to own the puttable bond (which has a lower yield than that of its non-puttable counterpart)?
2. Assume that the following market conditions exist:
  - 5-year AA corporate bonds with a one time call at the end of third year are trading at 8.3% pa
  - 5-year AA corporate non-callable bonds are trading at 7.50% pa
  - Receiver swaption at 7.50% pa is priced at a 180bps premium, where the dealer can require the investor to pay 7.5% pa and receive US\$ LIBOR for Year 4 and Year 5
  - 5-year AA non-callable floating rate bond yielding US\$LIBOR
  - 3-year and 5-year fixed-floating interest rate swaps, where the floating rate is US\$LIBOR

Assume that an investor wishes to create a “synthetic” callable bond (same as the first bond listed above) using a non-callable bond (either fixed rate or floating rate) and swaps and / or swaption. Discuss various strategies that can be adopted using the instruments listed above. Describe the cash flows under different scenarios. Is it more advantageous to own the “synthetic” callable bond (make your own assumptions about the swap rates in the interest rate swaps)?

3. The Z corporation issues a 10%, 20-year bond at a time when yields are 10%. The bond has a call provision that allows the corporation to force a bondholder to redeem his or her bond at face value plus 5%. After 5 years the corporation finds that exercise of this call provision is advantageous. What can you deduce about the yield at that time? (Assume one coupon payment per year).

*Hint*

Consider the yield such that the present value of the future coupons (from 6<sup>th</sup> to 20<sup>th</sup> year) plus the par at maturity and compare it with the call price offered by the issuer upon call.

4. A Merrill Lynch note structure called a liquid yield option note (LYON) is a zero-coupon instrument that is convertible into the common stock of the issuer. The issuer has the right to call the bond at pre-determined set of times. The bond is structured such that the call price increases over time. Is this structuring design reasonable for a zero-coupon bond?

5. Consider a convertible bond as follows:

- par value = \$1,000
- coupon rate = 9.5%
- market price of convertible bond = \$1,000
- conversion ratio = 37.383
- estimated straight value of bond = \$510
- yield to maturity of straight bond = 18.7%

We define the following terms

- (a) market conversion price = market price of convertible bond / conversion ratio
- (b) market conversion premium per share  
= market conversion price – current market price
- (c) market conversion premium ratio  
= conversion premium per share / market price of common stock

Calculate each of the following quantities:

- (i) conversion value
- (ii) market conversion price
- (iii) conversion premium per share
- (iv) conversion premium ratio
- (v) premium over straight bond value.

Suppose that the price of the common stock increases from \$23 to \$46. What will be the approximate return realized from investing in the convertible bond? Why the return on investing in the common stock directly is higher than investing in the convertible bond?

6. A 3-year convertible bond with a face value of \$100 has been issued by company ABC. It pays a coupon of \$5 at the end of each year. It can be converted into ABC's equity at the end of the first year or at the end of the second year. At the end of the first year, it can be exchanged for 3.6 shares immediately after the coupon date. At the end of the second year, it can be exchanged for 3.5 shares immediately after the coupon date. The current stock price is \$25 and the stock volatility is 25%. No dividends are paid on the stock. The riskfree interest rate is 5% with continuous compounding. The yield on bonds issued by ABC is 7% with continuous compounding.

- (a) Use a 3-step tree to calculate the value of the bond.
- (b) How much is the conversion option worth?
- (c) What difference does it make to the value of the bond and the value of the conversion option if the bond is callable any time within the first two years for \$115?
- (d) Explain how your analysis would change if there were a dividend payment of \$1 on the equity at the 6-month, 18-month and 30-month point. Detailed calculations are not required.

7. Consider the Convertible Exchangeable Preferred issued by Microsoft, the terminal payoff structure is

- If  $\$79.875 \leq \text{MSFT} \leq \$102.24$ , the investor receives one share of MSFT.
- If  $\text{MSFT} \leq \$79.875$ , the investor receives the number of MSFT shares equivalent

in value to \$79.875.

If  $MSFT \geq \$102.24$ , the investor receives the number of MSFT shares equivalent in value to \$102.24.

Show that the Preferred can be decomposed into one unit of stock, one put and one call. Find the respective strike price of the call and put.