Economics 136. Financial Economics

Sample midterm 1B, Fall 2009, Suggested solutions

1. True or false. (20 points, 5 each)

(i) True. The price of a zero-coupon bond is $P = F/(1+R)^T$ and when $R > 0$, this is les than F.

(ii) False. A price weighted portfolio means that you hold an equal number of shares of each company in your portfolio, and hence requires no rebalancing when prices change.

(iii) False. By put-call parity, $C_0 = S_0 + P_0 - X/(1+R_f)$. Since S_0, X and R_f are unchanged, an increase in the put price P_0 must result in an increase in the call price C_0.

2. Mortgage-backed securities(28 points, 7 each)

	Stock index	Treasury	Mortg pool	Tranch A	Tranch B
State 1: good times	16	10	20	10	10
State 2: recession	8	10	8	0	8
Price today	10	9			

(a) To construct AD1, consider a portfolio of x shares of the stock index and y shares of the bond.For this to be a replicating portfolio, we need

$$16x + 10y = 1$$
$$8x + 10y = 0.$$

Solving these, we find $x = 0.125$ and $y = -0.1$. Hence by the LOOP, the price of AD1 must be $10 \cdot (0.125) + 9 \cdot (-0.1) = \$0.35$. To price AD2, note that the price of a portfolio of AD1 and AD2 must cost \$0.9, because it gives a sure payoff of \$1 in both states, just like 1/10 of a share of the Treasury-bond. As a result, the price of AD2 must be $0.9 - 0.35 = \$0.55$. The market is complete, because both AD securities exist.

(b) The payoffs of the morgage pool can be replicated with a portfolio of 20 shares of AD1 and 8 shares of AD2. Hence the price of the mortgage pool should be $20 \cdot 0.35 + 8 \cdot 0.55 = 11.4$.

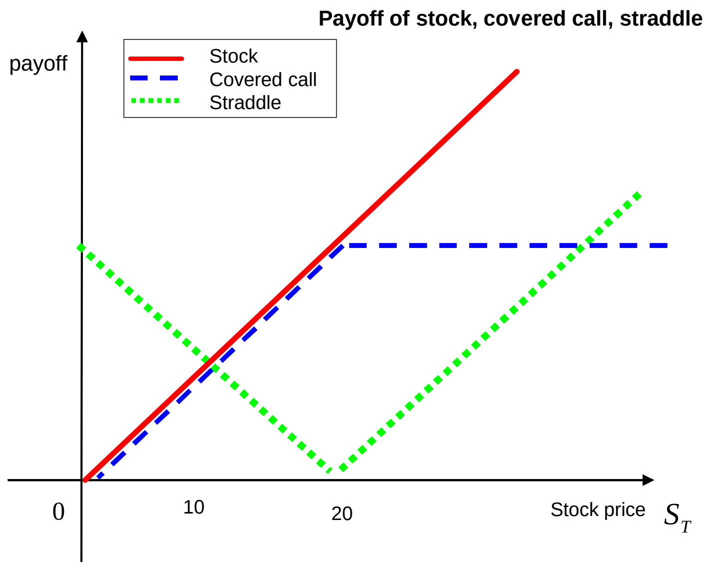
(c) The payoffs of tranches A and B are given in the table.

(d) Since tranch A can be replicated as 10 shares of AD1, its price should be \$3.5. Since Tranch B can be replicated as 10 shares of AD1 and 8 shares of AD2, its price should be 7.9.

3. Option portfolios (20 points, 5 each)

a)-c) See the figure.

d) The straddle is the best, because it pays both when the price rises a lot and when it falls a lot.



4. Bond pricing (14 points, 7 each)

(a) The semi-annual yield R_s must satisfy $(1+R_s)^2 = 1.1025$ which implies $R_s = 5\%$. The bond price is then

$$P = \sum_{t=1}^{30} \frac{C}{(1+R_s)^t} + \frac{F}{(1+R_s)^{30}} = \frac{C}{R_s}\left(1 - \frac{1}{(1+R_s)^{30}}\right) + \frac{F}{(1+R_s)^{30}}$$
$$= 9223.47 + 2313.77 = 11537.25$$

(b) The bond is trading at face value, so the coupon rate and yield must be the same. The semi-annual coupon rate is 6%, thus the semi-annual yield must also be 6%, and then the annual yield is given by $(1.06)^2 = 1.1236$, i.e., the annual yield is $R = 12.36\%$. Thus the annual yield must have risen by 2.11 percentage points.

5. Who should buy long term bonds? (20 points, 4 each)

(a) The total rate of return between t=0 and t=2 if there was a boom is $1.042 * 1.06 - 1 = 10.5\%$. If there was a recession, then the total rate of return is $1.042 * 1.02 - 1 = 6.3\%$.

(b) The net holding period return on the T-bond is $F/P_0 - 1 = 100/92 - 1 = 8.7\%$.

(c) The price of the Treasury bond is the discounted value of its future payment. Since both the T-bond and the T-bill are riskfree between t=1 and t=2, the appropriate discount rate is the T-bill rate, which is 6% if the economy is in a boom, yielding $P_1 = 100/1.06 = \$94.34$. Similarly, if the economy is in a recession, we obtain $P_1 = 100/1.02 = \$98.04$.

(d) The return on the Treasury bond between t=0 and t=1 is $94.34/92 - 1 = 2.5\%$ if the economy enters a boom, and $98.04/92 = 6.6\%$ if the economy enters a recession.

(e) The T-bill is safe for a short-temr investor who invests between $t = 0$ and $t = 1$ only. The T-bill is risky if you invest between $t = 0$ and $t = 2$, i.e., for a long-term investor. The safe asset for a long-term investor is the T-bond.