

Economics 136. Financial Economics

Midterm 1, Fall 2009, Suggested solutions

1. True or false. (25 points, 5 each)

(i) False. As time passes, the maturity of Treasury bonds falls. With an upward sloping and constant yield curve this means lower yields, or equivalently, higher prices.

(ii) False. A value weighted portfolio means that you hold a constant share of the market in your portfolio. This is in general different from holding an equal number of shares of each asset: for example, you will hold many more shares of a company with large market capitalization like MSFT, than a small company.

(iii) True. Put-call parity says $C_0 + X / (1 + R_f) = P_0 + S_0$. If the right hand side $P_0 + S_0$ increases by \$2 – \$1, then so must the left-hand side – since $X / (1 + R_f)$ is constant, this means C_0 must increase by a dollar.

(iv) True. The real net simple return is $(27.85 + .5) / 25 / (1.08) - 1 = .05$ or 5%.

(v) True. A bond trading at face value would have a yield to maturity that equals the coupon rate of 4.5%. This bond has a lower price – since prices and yields in opposite direction, it must have a higher yield.

2. Mortgage backed securities and financial engineering (30 points, 5 each)

	Stock index	Treasury	Mortg pool	Senior tr	Junior tr	Bundle
State 1: good times	18	10	20	10	10	10
State 2: recession	10	10	14	10	4	9
Price today	13	9	15.6	9	6.6	

(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

$$18x + 10y = 1$$

$$10x + 10y = 0.$$

Solving these, we find $x = 0.125$ and $y = -0.125$. Hence by the LOOP, the price of AD1 must be $13 \cdot (0.125) + 9 \cdot (-0.125) = \0.5 . 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 $0.9 - 0.5 = \$0.4$. The market is complete, because both AD securities exist.

(b) The payoffs of the mortgage pool can be replicated with a portfolio of 20 shares of AD1 and 14 shares of AD2. Hence the price of the mortgage pool should be $20 \cdot 0.5 + 14 \cdot 0.4 = 15.6$.

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

(d) Since the senior tranche is identical to the Treasury bond, its price must be \$9. The junior tranche can be replicated as 10 shares of AD1 plus 4 shares of AD2, and hence has a price of $10 \cdot 0.5 + 4 \cdot 0.4 = 6.6$.

(e) Since the payoff of the senior tranche in both states of the world exceeds its price of \$9, it earns positive net returns, and hence the pension fund can invest in it. The pension fund cannot invest in the junior tranche, which pays 4, less than the price of 6.6, in state 2, and hence earns a negative net return in that state.

(f) Since the put pays \$5 in state 2 and zero in state 1, the bundle of the put and the junior tranche pays \$10 and \$9 in the two states. A replicating portfolio of 10 AD1 plus 9 AD2 has a price of \$8.6. This is lower than the payoff in either state of the world, hence the pension fund can invest in this bundled security.

3. Leveraged ETF (25 points, 5 each)

(a) The net return between $t = 0$ and $t = 1$ is $110/100 - 1 = 0.1 = 10\%$. The net return between $t = 1$ and $t = 2$ is $100/110 - 1 \approx -0.091 = -9.1\%$.

(b) The net return of SSO between $t = 0$ and $t = 1$ should be $2 \cdot 10\% = 20\%$, so its price must be $100 \cdot 1.2 = 120$ at $t = 1$. The net return from $t = 1$ to $t = 2$ must be $2 \cdot (-9.1\%) = -18.2\%$ so the price must be $120 \cdot (1 - 0.182) \approx 98.16$.

(c) The holding period return of SSO is $98.16/100 - 1 = -0.0184 = -1.8\%$. The holding period return of the SP500 is zero percent. Thus SSO does *not* earn twice the net return of the SP500 during this two day investment horizon.

(d) Now the net return of the SP500 in the two periods is $90/100 - 1 = -0.1 = -10\%$ and $100/90 - 1 = 0.111 = 11.1\%$. Thus the price of SSO at $t = 1$ must be $100 \cdot (1 - 2 \cdot 10\%) = \80 , and the price of SSO at $t = 2$ must be $80 \cdot (1 + 2 \cdot 11.1\%) = 97.6$.

(e) No, in both scenarios, SSO loses value. The caution is justified. The key is that SSO matches twice the *daily* returns of the index. As (c) has shown, this is different from matching twice the return over a longer horizon.

4. Collar. (16 points, 4 each)

a)-c) See the figure.

d) If you are worried about the downside but want to preserve the upside, you should buy (b), that is, the protective put. If you think there is only limited upside but there is risk of a substantial fall, you should buy (c), that is, the collar.

