

## Economics 136. Financial Economics

Midterm 1, Fall 2009

Write your name and section time on your blue book. You may use a calculator and one double sided sheet of handwritten notes.

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

Are the following statements true or false? Explain your answer in no more than two sentences. You will be graded on your explanation.

(i) If the yield curve is upward sloping and does not move over time, then the prices of Treasury bonds are falling as time passes.

(ii) A value-weighted portfolio requires no rebalancing, because value-weighting implies that one must hold an equal number of shares of all companies in the portfolio.

(iii) Consider a European call and a European put option on ABC stock with the same strike price  $X$  and expiration date  $T$ . Suppose that, due to a change in market conditions, the price of ABC stock increases by \$2, and the put price falls by \$1. If the riskfree rate is unchanged, and LOOP holds, then the call price must increase by \$1.

(iv) The stock price of MSFT on January 1 was \$25; its stock price on December 31 was \$27.85; the company paid a dividend of \$.50 per share on December 31, and the inflation rate was 8% that year. Then the real simple net return of MSFT that year was 5%.

(v) Consider a coupon bond with face value \$10,000 and maturity of 12 years which makes coupon payments of \$450 once a year. If the price of this bond is \$9,980, then its yield to maturity must be higher than 4.5%.

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

Consider the following economic data about the prices and payoffs of a stock index and a treasury bond:

	Stock index	Treasury
State 1: good times	18	10
State 2: recession	10	10
Price today	13	9

(a) Is the market in the table complete? What are the Arrow-Debreu securities' prices?

(b) An investment bank just purchased a mortgage pool, which pays off \$20 in state 1, but only \$14 in state 2 (due to distressed home prices and foreclosure). Under LOOP, what should be the price of the mortgage pool today?

(c) The investment bank splits the mortgage pool into two tranches, both with face value \$10. The tranches are structured so that the junior tranche only gets payments from

the pool after the entire face value of the senior tranche is paid out. What are the payoffs of the senior and the junior tranche in the two states of the world?

(d) Under LOOP, what should be the price of the two tranches today?

(e) The investment bank wants to sell the tranches to a pension fund. Suppose that, due to regulations, the pension fund can only invest in assets whose realized net simple return is at least zero in every state of the world. Can the pension fund invest in the senior tranche? In the junior tranche?

(f) Now suppose that the junior tranche is bundled with a put option on the stock index that has a strike price of \$15. What are the payoffs of this bundled security (i.e., a portfolio of the junior tranche plus the put)? What is its price? Can the pension fund invest in this bundled security?

### 3. Leveraged ETF (25 points, 5 each)

*Note:* in this question, round all net simple returns to one digit after the decimal point, e.g., round 9.0909% to 9.1%.

The security SSO is an exchange traded fund (ETF) that each day earns a net return that equals twice the net return earned by the S&P 500 index on that day. This question explores how SSO behaves over a longer investment horizon.

(a) Suppose that at  $t = 0$ , the S&P 500 index has a value of 100. The next day ( $t = 1$ ) the index goes up to 110, and the day after ( $t = 2$ ), the index goes back to 100. What is the net simple return of the index between  $t = 0$  and  $t = 1$ ? Between  $t = 1$  and  $t = 2$ ? (No securities pay dividends during these days.)

(b) Suppose that SSO has an initial price of \$100 at  $t = 0$ . If the net return of SSO is twice the net return of the S&P500 between  $t = 0$  and  $t = 1$ , what should its price be at  $t = 1$ ? If the net return of SSO is twice that of the S&P 500 between  $t = 1$  and  $t = 2$ , what should be the price of SSO at  $t = 2$ ?

(c) Consider buying one share of SSO at  $t = 0$  and holding it until  $t = 2$ . What is the net holding period return? What is the net return of the S&P 500 between  $t = 0$  and  $t = 2$ ? Does SSO earn twice the net return of the S&P 500 over the *two-period horizon* from  $t = 0$  and  $t = 2$ ?

(d) Now consider a different price path for the index. Suppose that at  $t = 0$ , the S&P500 has a value of 100, but at  $t = 1$  it goes down to 90, and at  $t = 2$  it comes back up to 100. If the price of SSO is \$100 at  $t = 0$ , what is its price at  $t = 1$  and at  $t = 2$ ?

(e) Does SSO earn a positive net return between  $t = 0$  and  $t = 2$  in either scenario (a) or scenario (d)? Financial advisors often warn investors to stay away from leveraged ETFs like SSO over longer investment horizons, because the daily ups and downs of the stock market can quickly erode their value. Is this caution justified?

**4. Collar** (16 points, 4 each)

Draw the payoff of each of the following three portfolios in a payoff diagram, where the horizontal axis is the share price of ABC next period ( $S_T$ ), and the vertical axis is your payoff next period. Note: *do not* include the price today of the portfolios in the diagrams.

(a) Buying one share of ABC.

(b) Buying one share of ABC and a put option on one share of ABC that has a strike price \$30 and expiration date next period. This portfolio is called a protective put.

(c) Buying one share of ABC and one put option with strike \$30 as in (b), and *selling* a call option on one share of ABC with strike \$50 and expiration next period. This portfolio is called a collar.

(d) Suppose that the current price of ABC stock is \$35 per share. Which of the above portfolios is a better investment if you think that ABC has considerable upside potential, but there is also a chance that the share price might fall substantially? Which strategy is better if you think the share price might increase by some but not too much, and it might fall substantially? [For simplicity, ignore the price today of the portfolios in your answer.]