

Problem Set 2

Instructions: This problem set is due on 2/5 at 11:59 pm CST and is an individual assignment. All problems must be handwritten. Scan your work and submit a PDF file.

Problem 1. A stock index currently stands at 5,000. The risk-free interest rate is 8% per year with continuous compounding and the dividend yield on the index is 4% per year. What should be the futures price for an 8-month contract?

Problem 2. The current EUR/USD exchange rate is \$1.05 per €. The interest rate in USD is 5% whereas the interest rate in EUR is 3%.

- Compute the 8-month EUR/USD no-arbitrage forward price. Express your answer with four decimals.
- If you enter into a short-forward as described in a. over a notional of €10,000,000, how many dollars and euros will be exchanged in eight months from now? Be explicit about which currency you're buying and which currency you are selling.
- If the EUR/USD forward price is \$1.08 per €, is there an arbitrage opportunity? If so, explain how to exploit it. Assume that you can buy or sell a maximum of €100 million forward.

Problem 3. Consider a stock that currently trades at \$120. Analysts expect the stock to pay dividends of \$4 every three months. The next dividend is expected next month. The risk-free rate is 8% per year with continuous compounding and assumed the same for all maturities.

- Compute the 6-month no-arbitrage forward price for the stock.
- If the forward price is 120, is there an arbitrage opportunity? If so, explain how to exploit it.

Problem 4. The spot price of silver is \$31.04 per ounce. The storage costs are \$1.10 per ounce per year payable quarterly in advance. Assuming that interest rates are 8% per annum for all maturities, calculate the futures price of silver for delivery in 12 months.

Problem 5. The E-mini S&P 500 futures contract is one of the most liquid and actively traded futures in the world. The contract value is defined as $\$50 \times$ the value of the S&P 500 Index.

Say you deposit \$30,000 in your margin account and sell one S&P 500 E-mini futures at \$6,101.24. Complete the following table describing the evolution of your margin account.

| Day | Futures Price | Gain/Loss | Margin Account |
|-----|---------------|-----------|----------------|
| 0 | 6,101.24 | — | 30,000.00 |
| 1 | 6,084.32 | | |
| 2 | 6,105.89 | | |
| 3 | 6,110.21 | | |

Problem 6. On January 24, 2025, AAPL stock closed at \$222.78. A June call option on AAPL with strike \$225 traded at \$14.40 per share. If the stock price at maturity is \$250, compute the profit per share of buying such a call option.

Problem 7. On January 24, 2025, TSLA stock closed at \$406.58. A December put option on TSLA with strike \$400 traded at \$103.90 per share. If the stock price at maturity is \$380, compute the profit per share of buying such a put option.

Problem 8. The price of a stock is \$120. The price of a one-year European put option on the stock with a strike price of \$90 is quoted as \$21 and the price of a one-year European call option on the stock with a strike price of \$150 is quoted as \$15. Suppose that an investor buys 100 shares, shorts 100 calls, and buys 100 puts. Complete the following table for the strategy.

| Stock Price | 105 | 135 | 165 | 195 |
|-------------|-----|-----|-----|-----|
| Payoff | | | | |
| Profit | | | | |

Problem 9. Suppose you think that there is a small possibility that XYZ stock might depreciate substantially in value in the next six months. Say the stock's current price is \$120, and put options expiring in six months with an exercise price of \$100 are selling at a premium of \$5 per share. With \$20,000 to invest, you are considering investing \$12,000 in the stock, \$5,000 in puts, and the rest in a risk-free account. The risk-free rate is 5% per year with continuous compounding. Compute the profit of your portfolio six months from now if the price of XYZ stock at point in time is \$90.