37011 Financial Markets Instruments

Assignment Part 2

due 13 April 2025

Solutions must be submitted on Canvas as a Jupyter notebook

The file `Crude Oil May 24.xlsx` contains daily data (sourced from Yahoo Finance) on the price of the CME Group West Texas Intermediate (WTI) Light Sweet Crude Oil futures contract maturing in May 2024. Contract size is 1,000 barrels and prices are quoted in U.S. dollars and cents per barrel. For all calculations required below, use the prices in the `Close*` column. The file

`Cushing_OK_WTI_Spot_Price_FOB.csv`

contains daily data (sourced from the U.S. Energy Information Administration) on the WTI spot price for delivery in Cushing, Oklahoma, in U.S. dollars and cents per barrel. The file

`U.S._Gulf_Coast_Kerosene-Type_Jet_Fuel_Spot_Price_FOB.csv`

contains daily data (sourced from the U.S. Energy Information Administration) on the spot price of kerosene jet fuel for delivery on the U.S. Gulf Coast, in U.S. dollars and cents per gallon.

1. Suppose that on 15 November 2023, a company wants to hedge a purchase of two million gallons of kerosene jet fuel on 19 March 2024.

   (a) What is the optimal hedge using the CME Group West Texas Intermediate (WTI) Light Sweet Crude Oil futures contract maturing in May 2024? You may ignore "tailing the hedge." Note that when determining the optimal hedge position to enter on 15 November 2023, you may only use information that would have been available on that day. *(4 marks)*

   (b) Ignoring interest on the futures margin account transactions, what is the outcome of the hedge, i.e., what is the net price that the company pays for kerosene jet fuel on 19 March 2024? *(2 marks)*

   (c) Comment briefly on the hedging outcome. Was there any basis risk? *(1 mark)*

2. Suppose that on 12 January 2022, a small hedge fund had the opportunity to enter a long position in a (cash–settled) forward contract on WTI crude oil at a forward price of USD 78.00 per barrel, for a total of one million barrels, maturing on 8 December 2023. Sensing an arbitrage opportunity, the hedge fund manager decided to enter into this position, and to lock in a profit (as much as possible) by hedging this position by going short 1000 CME Group West Texas Intermediate (WTI) Light Sweet Crude Oil futures contracts maturing in May 2024.

(a) Ignoring futures margin account transactions during the life of the hedge, what is the outcome of the hedge, i.e., what is the net profit or loss to the hedge fund when on 8 December 2023 the forward contract is settled in cash (no physical delivery of oil) and the hedge fund manager closes out their futures position? *(3 marks)*

(b) In reality, one cannot ignore the futures margin account transactions. For simplicity, assume that both the initial and the maintenance margin are USD 6,000 per contract. Suppose that the hedge fund has a total capital of USD 18 million, kept in a cash account earning interest at 4% per annum continuously compounded. The hedge fund manager can draw on this account to post the initial margin on the futures contracts and satisfy any margin calls if and when they occur. Suppose further that the margin account earns 3% per annum interest, compounded daily. Track the margin account balance over the life of the hedge, highlighting the days on which margin calls occur. Assuming that no funds are withdrawn from or injected into the hedge fund, what is the hedge fund's total capital on 9 December 2023? *(8 marks)*

(c) If the hedge fund manager had only taken the long position in the forward contract and not hedged it using futures, assuming that no funds are withdrawn from or injected into the hedge fund, what would have been the hedge fund's total capital on 9 December 2023?

(d) Discuss briefly the outcomes in the three different cases above. *(2 marks)*