Practice Problem Set: Solutions

BUSS386 Futures and Options

1 Margin Account

Solution:

There is a margin call if more than $1,500 is lost on one contract. This happens if the futures price falls by more than 10 cents (to below 150 cents per pound). $2,000 can be withdrawn if there is a gain on one contract of $1,000, which occurs if the futures price rises by 6.67 cents (to 166.67 cents per pound).

2 Trading Futures

Solution:

The total profit is computed as $40,000 \times (1.2120 - 1.1830)$, which is $1,160.

3 Forwards vs. Futures

Solution:

Each trader's profit in dollars is $0.03 \times 1,000,000 = \$30,000$. However, due to daily settlement, Trader B benefits by avoiding interim cash flow issues, so Trader B does better.

4 Arbitrage with Futures

Solution:

Go long one June oil contract and short one December contract. In June, take delivery using a $80 loan at 5% with interest of approximately $2 and in December sell the oil at $86. The strategy produces a profit since $86 ¿ $82 (loan repayment).

5 Minimum-Variance Hedge Ratio

Solution:

No hedging occurs when the coefficient of correlation between futures and spot price changes is zero.

6 Minimum-Variance Hedge Ratio

Solution:

The optimal hedge ratio is calculated as $0.8 \times (0.65/0.81) = 0.642$. This means the futures position should be 64.2% of the underlying exposure.

7 Minimum-Variance Hedge Ratio

Solution:

The optimal number of contracts is $1.2 \times (20,000,000/(1080 \times 250)) = 88.9$, rounded to 89 contracts. To reduce beta to 0.6, the position should be halved to 44 contracts.

8 Hedging with Futures

Solution:

The optimal hedge ratio is $0.7 \times (1.2/1.4) = 0.6$. For a 200,000-pound exposure, the beef producer should take a long position equivalent to 120,000 pounds. With contracts of 40,000 pounds each, 3 contracts are required.

9 Futures

Solution:

Daily settlement can trigger margin calls when prices move unfavorably, leading to significant cash outflows before the final asset sale, thereby causing cash flow problems.

10 Minimum-Variance Hedge Ratio with Data

Solution:

Using the provided sums and standard deviations, the correlation is about 0.981 and the hedge ratio is calculated as $0.981 \times (0.4933/0.5116) = 0.946$.

11 Forward Price

Solution:

The forward price is the contract price for future delivery, while the value of the forward contract is zero at inception but changes as the underlying price evolves.

12 Forward Price

Solution:

The futures price is calculated as $350e^[(0.08 - 0.04) \times 0.3333] = \$354.7$.

13 Forward Pricing

Solution:

a) $F = 40e^(0.1 \times 1) = \$44.21$ with an initial contract value of zero. b) After six months, with the stock at \$45, the forward price is $45e^(0.1 \times 0.5) = \$47.31$ and the contract value is approximately \$2.95.

14 Forward Pricing

Solution:

The theoretical price is $400e^[(0.10 - 0.04) \times (4/12)] = \$408.08$. Since the actual price is 405, the index is undervalued, suggesting a strategy of buying futures and shorting the underlying shares.

15 Arbitrage

Solution:

For a forward rate of 1.03, borrow Swiss francs, convert and invest in dollars and use the forward market to buy francs back for a profit. If the forward rate is 1.05, borrow dollars instead, convert to francs, invest, and sell forward to realize a profit.

16 Forward Pricing

Solution:

a) The present value of dividends is I = 1.9540 and the forward price is $(50 - I)e^(0.08 \times 0.5) = \$50.01$. b) After three months, with the stock at \$48, the forward price recalculates to = \$47.96 and the short contract's value is approximately \$2.01.

17 Forward Pricing

Solution:

No arbitrage exists if the one-year forward price is between $1249 \times 1.055 (= \$1317.70)$ and $1250 \times 1.06 (= \$1325)$.

18 Forward Pricing

Solution:

The bank adjusts K_2 so that the rolled contract retains a value of $S_1 - K_1$. In formula form, $K_2 = S_1e^[(r-r_f)(T_2 - T_1)] - (S_1 - K_1)e^(r(T_2 - T_1))$.