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Problem 1.

You buy a call option with a strike price of $35 for $4. Do you ever exercise the option and lose money on the trade. Explain.

Yes, I would exercise if the asset price is greater than $35, but will cover the cost of the call option only if the price is greater than $39. I would exercise and lose money if the price is between $35 and $39.

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Problem 2.

A trader enters into a short forward contract on 200 million yen. The forward exchange rate is $0.0090 per yen. How much does the trader gain or lose if the exchange rate at the end of the contract is (a) $0.0084 per yen; (b) $0.0101 per yen?

1. The trader sells 200 million yen for $0.0090 per yen when the exchange rate is $0.0084 per yen. The gain is $200 x 0.0006$ millions of dollars or $120,000.
2. The trader sells 200 million yen for $0.0090 per yen when the exchange rate is $0.0101 per yen. The loss is $200 x 0.0011$ millions of dollars or $220,000.

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Problem 3.

Suppose that on October 24, 2013, a company sells one April 2014 live-cattle futures contract. It closes out its position on January 21, 2014. The futures price (per pound) is 91.20 cents when it enters into the contract, 88.30 cents when it closes out the position and 88.80 cents at the end of December 2013. One contract is for the delivery of 40,000 pounds of cattle. What is the profit? How is it taxed if the company is (a) a hedger and (b) a speculator? Assume that the company has a December 31 year end.

The total profit is 40,000 x (0.9120 – 0.8830) = $1,160

1. If the company is a hedger this is all taxed in 2014.
2. If it is a speculator 40,000 x (0.9120 – 0.8880) = $960 is taxed in 2013

and 40,000 x (0.9120 – 0.8830) = $200 is taxed in 2014.

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Problem 4.

The standard deviation of monthly changes in the spot price of live cattle is (in cents per pound) 1.5. The standard deviation of monthly changes in the futures price of live cattle for the closest contract is 1.2. The correlation between the futures price changes and the spot price changes is 0.75. It is now October 15. A beef producer is committed to purchasing 300,000 pounds of live cattle on November 15. The producer wants to use the December live-cattle futures contracts to hedge its risk. Each contract is for the delivery of 40,000 pounds of cattle. What strategy should the beef producer follow?

The optimal hedge ratio is

 h\* = ρ x (σS/σF)

 = 0.75 x (1.5/1.2)

 = $0.9375$

The beef producer requires a long position in

 N\* = h\* x (QA/ QF)

 = 0.9375 x 300,000 / 40,000

 = 7

The beef producer should therefore take a long position in 7 December contracts closing out the position on November 15.

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Problem 5.

The expected return on the S&P 500 is 10% and the risk-free rate is 3%. What is the expected return on the investment with a beta of (a) 0.2, (b) 0.5, and (c) 1.4?

1. 0.03 + 0.2 x (0.10 – 0.03) = 0.044 or 4.4%
2. 0.03 + 0.5 x (0.10 – 0.03) = 0.065 or 6.5%
3. 0.03 + 1.4 x (0.10 – 0.03) = 0.128 or 12.8%

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Problem 6.

A trader owns 55,000 units of a particular asset and decides to hedge the value of her position with futures contracts on another related asset. Each futures contract is on 5,000 units. The spot price of the asset that is owned is $28 and the standard deviation of the change in this price over the life of the hedge is estimated to be $0.43. The futures price of the related asset is $27 and the standard deviation of the change in this over the life of the hedge is $0.40. The coefficient of correlation between the spot price change and futures price change is 0.95.

1. What is the minimum variance hedge ratio?

The minimum variance hedge ratio is 0.95 × 0.43 / 0.40 = 1.02125.

1. Should the hedger take a long or short futures position?

The hedger should take a short position.

1. What is the optimal number of futures contracts with no tailing of the hedge?

The optimal number of contracts with no tailing is:

1.02125 × 55,000 / 5,000 = 11.23 (or 11 when rounded to the nearest whole number)

1. What is the optimal number of futures contracts with tailing of the hedge?

The optimal number of contracts with tailing is:

1.012125 × (55,000 × 28) / (5,000 × 27) = 11.65 (or 12 when rounded to the nearest whole number).

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Problem 7.

The cash prices of six-month and one-year Treasury bills are 94.0 and 89.0. A 1.5-year bond that will pay coupons of $4 every six months currently sells for $94.84. A two-year bond that will pay coupons of $5 every six months currently sells for $97.12. Calculate the six-month, one-year, 1.5-year, and two-year zero rates.

The 6-month Treasury bill provides a return of 6/94 = 6.383% in six months. This is 2 x 6.383 = 12.766% per annum with semiannual compounding or 2ln(1.06383) = 12.38% per annum with continuous compounding.

The 12-month rate is  with annual compounding or ln(1.1236) = 11.65% with continuous compounding.

For the 1 year bond we must have

 4*e*-0.1238x0.5 + 4*e*-0.1165x1 + 4*e*-1.5*R* = 94.84 whereis the 1 year zero rate.

It follows that

 3.76 + 3.56 + 104*e*-1.5*R*= 94.84

 *e*-1.5*R* = 0.8415

 *R* = 0.115 or 11.5%.

For the 2-year bond we must have

 4*e*-0.1238x0.5 + 4*e*-0.1165x1 + 4*e*-.115x1.5 + 105*e*-2*R* = 97.12 whereis the 2-year zero rate.

It follows that

 *e*-2*R* = 0.7977

 *R* = 0.113 or 11.3%.

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Problem 8.

A bank can borrow or lend at LIBOR. Suppose that the six-month rate is 5% and the nine-month rate is 6%. The rate that can be locked in for the period between six months and nine months using an FRA is 7%. What arbitrage opportunities are open to the bank? All rates are continuously compounded.

The forward rate is

or 8%.

The FRA rate is 7%. A profit can therefore be made by borrowing for six months at 5%, entering into an FRA to borrow for the period between 6 and 9 months for 7% and lending for nine months at 6%.

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Problem 9.

The 6-month, 12-month. 18-month, and 24-month zero rates are 4%, 4.5%, 4.75%, and 5% with semiannual compounding.

1. What are the rates with continuous compounding?

With continuous compounding the 6-month rate is  or 3.961%.

The 12-month rate is  or 4.4501%.

The 18-month rate is  or 4.6945%.

The 24-month rate is  or 4.9385%.

1. What is the forward rate for the six-month period beginning in 18 months

The forward rate (expressed with continuous compounding) is:

 or 5.6707%.

When expressed with semiannual compounding this is  or 5.7518%.

1. What is the value of an FRA that promises to pay you 6% (compounded semiannually) on a principal of $1 million for the six-month period starting in 18 months?

The value of an FRA that promises to pay 6% for the six month period starting in 18 months is:

 or $1,124.

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Problem 10.

What rate of interest with continuous compounding is equivalent to 15% per annum with monthly compounding?

The rate of interest is  where:

 

i.e.,

 

 

The rate of interest is therefore 14.91% per annum.