Schweser Printable Answers - Session Asset Valuation: Derivative Investments: Forwards and Futures

Test ID#: 1362398

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Question 1 - #9821

Susan Baker is a new hire at Crinson Bank's Chicago office. She has joined the risk arbitrage desk where she will be training to take advantage of price discrepancies in the U.S. T-note futures and spot markets.

Her managing director, Gerald Bigelow, has asked her to calculate parameters for potential arbitrage opportunities for the bank given current market conditions. At the time he asked the question, the cheapest-to-deliver T-notes were at par, with a coupon rate of 8.5 percent. When trading futures, the risk arbitrage desk borrows at 12 percent and lends at 4 percent.

Looking at the calendar, Baker calculates that there are 184 days to the first coupon payment and 181 days from the first coupon payment to the second. Any interest accrued will be paid when the T-note is delivered against the futures contract, but Bigelow asks Baker not to concern herself in the calculations with the impact of reinvesting the coupons or with transaction costs.

To get a feel for the market, Baker first prices a 6-month futures contract that has 184 days to expiration in a "simplified scenario." She decides to use the same interest rate for borrowing and lending, taking the average of the bank's borrowing and lending rates. Calculating the futures price under these simplified assumptions, Baker tells Bigelow that the futures contract should trade at 99.7059. Bigelow explains that the futures price is below par even though the spot price is at par because of the benefit to a short seller of receiving the T-note coupon payments.

Having calculated the futures price in the "simplified scenario," Baker modifies it to reflect the bank's current borrowing and lending rates, and calculates the corresponding no-arbitrage bands. She tells Bigelow that the lower band will be at 97.7468. Bigelow checks her calculations, confirming that the higher band will be at 101.6294.

Once they know the no-arbitrage bands for current market conditions, Baker and Bigelow check the screen. They see that the market price of the futures contract for which they've been calculating no-arbitrage bands is 103. Together, they execute Baker's first arbitrage play.

Part 1)
Regarding Baker's and Bigelow's statements about the futures price in the simplified scenario:

A) Baker's statement is correct and Bigelow's statement is correct.
B) Baker's statement is correct and Bigelow's statement is incorrect.
C) Baker's statement is incorrect and Bigelow's statement is correct.
D) Baker's statement is incorrect and Bigelow's statement is incorrect.

Your answer: A was incorrect. The correct answer was B) Baker's statement is correct and Bigelow's statement is incorrect.

Since the futures contract has 184 days to expiration and the next coupon payment on the T-note is also 184 days away, the coupon will be received on the last day of the contract. Thus, the futures value using the cash and carry model will be the spot price plus interest on borrowing the money to buy the note minus interest received (in this case, the coupon payment). The interest rate Baker calculates for the "carry" will be the average of the 12 percent borrowing rate and 4 percent lending rate, or 8 percent. Since the coupon payment received will equal one-half of the 8.5% coupon rate on the note, we calculate:

$$100 \times (1 + 0.08)^{184 / 365} - 4.25 = 99.7059$$

Baker's statement is correct. Bigelow's statement is incorrect on many levels, including the fact that a short seller does not receive coupon payments.

Part 2)

Which of the following *most accurately* describes the arbitrage strategy that Baker and Bigelow executed?

A) Sell futures contract, use proceeds to buy asset, borrow difference, sell asset, buy back futures, and collect difference between finance charges and interest from asset.
B) Borrow funds, buy spot asset, buy futures, deliver asset against long futures, and repay loan and finance charges.
C) Short spot asset, lend proceeds from short sale, buy futures contract, collect principal and interest on loan, pay interest on short asset, take delivery of asset against futures, and replace short asset.
D) Borrow funds, buy spot asset, sell futures, collect accrued interest on spot asset, deliver asset against short futures, and repay loan with interest.

Your answer: A was incorrect. The correct answer was D) Borrow funds, buy spot asset, sell futures, collect accrued interest on spot asset, deliver asset against short futures, and repay loan with interest.

The arbitrage that Baker and Bigelow executed is a classic cash and carry arbitrage because the futures contract was trading above its fair value. The idea behind a cash and carry arbitrage is to make a profit on a futures contract that is trading over its fair value by buying the underlying asset with borrowed money and then selling the overpriced futures contract. The underlying asset can then be delivered against the short futures contract when the future expires.

When a Treasury futures contract is trading over its fair value, the cost of buying the underlying asset (including interest charges on the borrowed funds less interest received on the Treasury security) will be more than made up for by the price received on the sale of the futures contract.

Part 3)
Regarding Baker's and Bigelow's statements about the no-arbitrage bands, which is **CORRECT**?

A) Baker's statement is correct and Bigelow's statement is correct.
B) Baker's statement is correct and Bigelow's statement is incorrect.
C) Baker's statement is incorrect and Bigelow's statement is incorrect.
D) Baker's statement is incorrect and Bigelow's statement is correct.

Your answer: A was incorrect. The correct answer was A) Baker's statement is correct and Bigelow's statement is correct.

Using the cash and carry model and the risk arbitrage desk's borrowing rate of 12 percent, the calculation of the higher band is:

$$100 \times (1 + 0.12)^{184 / 365} - 4.25 = 101.6294$$

Using the reverse cash and carry model and the bank's lending rate of 4 percent, the calculation of the lower band is:

$$100 \times (1 + 0.040)^{184 / 365} - 4.25 - 0.0000 = 97.7468.$$

Baker's statement is correct and Bigelow's statement is correct.

Part 4)
If the T-notes that Baker priced in the "simplified scenario" were not the cheapest to deliver, and the cheapest-to-deliver note had a conversion factor of 1.07, what would be the no-arbitrage futures price?

A) 106.6853.
B) 93.1831.
C) 137.6041.
D) 98.6359.

Your answer: A was incorrect. The correct answer was B) 93.1831.

If the cheapest-to-deliver note has a conversion factor of 1.07, the no-arbitrage futures price is:

(99.7059 / 1.07) = 93.1831.

Part 5)
How much does Baker expect to earn in profits on her first arbitrage play (in dollars per contract, ignoring transaction costs and any reinvestment of coupon payments)?

A) $523,000.
B) $1,371.
C) $40,003.
D) $370.

Your answer: A was incorrect. The correct answer was B) $1,371.

Since the futures are overpriced relative to the spot price, we calculate profit per contract as a cash and carry arbitrage relative to the upper bound:

$$103 - [100 \times (1 + 0.12)^{184 / 365} - 4.25] = 1.371$$

Since Baker will make 1.371 points on each contract, and a Treasury future has a face value of $100,000, Baker expects to make $1,371 on each contract she trades.

Part 6)
If the bank enters an arbitrage play involving the cheapest-to-deliver Treasury bond, which of the following statements is **INCORRECT**?

A) The short position decides which bond to deliver.
B) The long position has the advantage in the arbitrage play.
C) The arbitrage play is no longer risk-free if the bank has a long position in the cheapest-to-deliver bond.
D) The cheapest-to-deliver bond may change during the life of the contract.

Your answer: A was incorrect. The correct answer was B) The long position has the advantage in the arbitrage play.

An arbitrage play involving the cheapest-to-deliver bond may not be risk free since the cheapest-to-deliver bond may change during the life of the contract. This provides an advantage to the short (not the long) since the short position makes the decision about which bond to deliver.

Question 2 - #38448

Monica Lewis, CFA, has been hired to review data on a series of forward contracts for a major client. The client has asked for an analysis of a contract with each of the following characteristics:

1. A forward contract on a U.S. Treasury bond
2. A forward rate agreement (FRA)
3. A forward contract on a currency

Information related to a forward contract on a U.S. Treasury bond: The Treasury bond carries a 6 percent coupon and has a current spot price of $1,071.77 (including accrued interest). A coupon has just been paid and the next coupon is expected in 183 days. The annual risk-free rate is 5 percent. The forward contract will mature in 195 days.

Information related to a forward rate agreement: The relevant contract is a 3 x 9 FRA. The current annualized 90-day money market rate is 3.5 percent and the 270-day rate is 4.5 percent. Based on the best available forecast, the 180-day rate at the expiration of the contract is expected to be 4.2 percent.

Information related to a forward contract on a currency: The risk-free rate in the U.S. is 5 percent and 4 percent in Switzerland. The current spot exchange rate is $0.8611 per Swiss France (SFr). The forward contract will mature in 200 days.

Part 1)

Based on the information given, what initial price should Lewis recommend for a forward contract on the Treasury bond?

A) $1,070.02.
B) $1,035.12.
C) $1,073.54.
D) $1,053.66.

Your answer: A was incorrect. The correct answer was A) $1,070.02.

The forward price (FP) of a fixed income security is the future value of the spot price net of the present value of expected coupon payments during the life of the contract. In a formula:

$FP = (S_0 – PVC) \times (1 + R_f)^T$

A 6 percent coupon translates into semiannual payments of $30. With a risk-free rate of 5 percent and 183 days until the next coupon we can find the present value of the coupon payments from:

$PVC = \$30/(1.05)^{183/365} = \$29.28.$

With 195 days to maturity the forward price is:

$FP = (\$1,071.77 – \$29.28) \times (1.05)^{195/365} = \$1,070.02.$

Part 2)
Suppose that the price of the forward contract for the Treasury bond was negotiated off-market and the initial value of the contract was positive as a result. Which party makes a payment and when is the payment made?

A) The long pays the short at the maturity of the contract.
B) The short pays the long at the initiation of the contract.
C) The short pays the long at the maturity of the contract.
D) The long pays the short at the initiation of the contract.

Your answer: A was incorrect. The correct answer was D) The long pays the short at the initiation of the contract.

If the value of a forward contract is positive at initiation then the long pays the short the value of the contract at the time it is entered into. If the value of the contract is negative initially then the short pays the long the absolute value of the contract at the time the contract is entered into.

Part 3)
Suppose that instead of a forward contract on the Treasury bond, a similar futures contract was being considered. Which one of the following alternatives correctly gives the preference that an investor would have between a forward and a futures contract on the Treasury bond?

A) The forward contract will be preferred to the futures contract.
B) The futures contract will be preferred to the forward contract.
C) An investor would be indifferent between the two types of contracts.
D) It is impossible to say for certain because it depends on the correlation between the underlying asset and interest rates.

Your answer: A was incorrect. The correct answer was A) The forward contract will be preferred to the futures contract.

The forward contract will be preferred to a similar futures contract precisely because there is a negative correlation between bond prices and interest rates. Fixed income values fall when interest rates rise. Borrowing costs are higher when funds are needed to meet margin requirements. Similarly reinvestment rates are lower when funds are generated by the mark to market of the futures contract. Consequently the

mark to market feature of the futures contract will not be preferred by a typical investor.

Part 4)
Based on the information given, what initial price should Lewis recommend for the 3 x 9 FRA?

A) 4.96%.
B) 4.66%.
C) 5.96%.
D) 5.66%.

Your answer: A was incorrect. The correct answer was A) 4.96%.

The price of an FRA is expressed as a forward interest rate. A 3 x 9 FRA is a 180-day loan, 90 days from now. The current annualized 90-day money market rate is 3.5 percent and the 270-day rate is 4.5 percent. The actual (unannualized) rates on the 90-day loan (R90) and the 270-day loan (R270) are:

R90 = 0.035 x (90/360) = 0.00875

R270 = 0.045 x (270/360) = 0.03375

The actual forward rate on a loan with a term of 180 days to be made 90 days from now (written as FR (90, 180)) is:

$$FR(90,180) = \frac{1+R270}{1+R90} - 1 = \frac{1.03375}{1.00875} - 1 = 0.02478$$

Annualized = 0.02478 x (360/180) = 0.04957 or 4.96%.

Part 5)
Based on the information given and assuming a notional principal of $10 million, what value should Lewis place on the 3 x 9 FRA at time of settlement?

A) $37,218 paid from long to short.
B) $38,000 paid from short to long.
C) $19,000 paid from long to short.
D) $19,000 paid from short to long.

Your answer: A was incorrect. The correct answer was A) $37,218 paid from long to short.

The value of the FRA at maturity is paid in cash. If interest rates increase then the party with the long position will receive a payment from the party with a short position. If interest rates decline the reverse will be true. The annualized 180-day loan rate is 4.96 percent. Given that annualized interest rates for a 180-day loan 90 days later are expected to drop to 4.2 percent, a cash payment will be made from the party with the long position to the party with the short position. The payment is given by:

$$\left[\left(0.0496 \times \frac{180}{360}\right) - \left(0.042 \times \frac{180}{360}\right)\right] \times \$10{,}000{,}000 = \$38{,}000$$

The present value of the FRA at settlement is:

38,000 / [1+(.042 x 180/360)] = 38,000 / 1.021 = $37,218

Part 6)
Based on the information given, what initial price should Lewis recommend for a forward contract on Swiss Francs based on a discrete time calculation?

A) $1.1552.
B) $1.0053.
C) $0.9947.

D) $0.8656.

Your answer: A was incorrect. The correct answer was D) $0.8656.

The value of a forward currency contract is given by:

$$F_T = S_0 \frac{(1+R_{domestic})^T}{(1+R_{foreign})^T}$$

Where F and S are quoted in domestic currency per unit of foreign currency. Substituting:

$$F_T = \$0.8611 \times \frac{(1+0.05)^{200/365}}{(1+0.04)^{200/365}} = \$0.8656$$

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