

Topic 4 Solutions

OPTIONS

1. **What is the difference between an American and a European option? Which one should trade at a higher price?**

An American option can be exercised at any time until it expires at maturity. A European option can be exercised only on the expiration date. An American option should trade at a higher price.

2. **If the exchange rate is \$0.66/DM, the strike price of a call option expiring in 3 months is \$0.70/DM and the option premium is \$0.06/DM, what is the intrinsic value of the option? Does it have time value?**

The intrinsic value of the option is **zero**, which is the maximum [0, -0.04]. Time value is the difference between the option premium and the intrinsic value. Hence, the time value is \$0.06.

3. **Suppose you can buy on the PHLX a call option to buy yen at \$0.01/Yen for maturity in two months. The premium is 1.26 cents per 100 yen. What would be the total cost of purchasing this call option?**

The PHLX ¥ option is for 6,250,000 Yen. If the premium is \$0.0126 per 100 Yen, the total cost of the call option is \$787.50 plus transactions costs.

4. **Citicorp sells a call option on Deutsche marks [contract size is DM 500,000 (DM 62,500 * 8)] at a premium of \$0.04 per DM. If the exercise price is \$0.71 and the spot price of the DM at expiration date is \$0.73, what is Citicorp's profit (loss) on the call option?**

Since the spot price exceeds the exercise price, the option will be exercised. Since, Citicorp sells a call option its profit is capped at the premium of \$20,000 ($\$0.04/\text{DM} * \text{DM } 500,000$) it receives from the buyer of the call option (**between \$0.71/DM and 0.75/DM the profit is diminishing**). Its loss is potentially unlimited.

At \$0.71/DM, cash flows for Citicorp are as follows

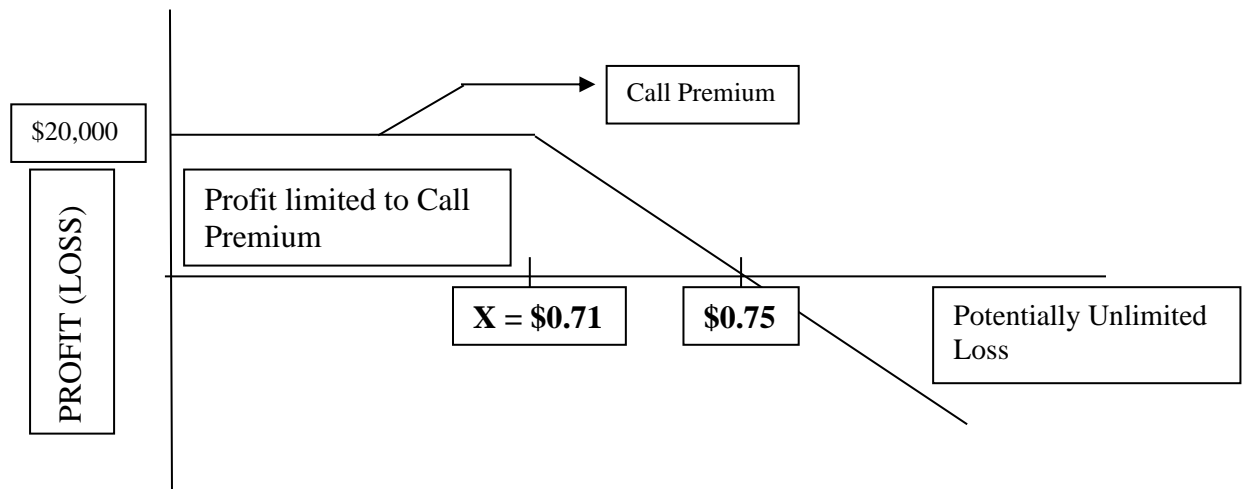
Inflows: $\$20,000 + \$355,000 (\text{DM}500000 * \$0.71) = \$375,000$

Outflows: \$365,000 (DM500000 * \$0.73)

Profit = \$10,000

The buyer of the call will exercise and the profit made is \$ 10,000 (DM 500,000 * 0.02). However, the profit is not large enough to cover the premium paid. The total loss for the buyer is \$10,000, which is less than the loss the buyer would have otherwise incurred.

Payoff diagram for the Option Seller (Citicorp)



5. Suppose that Bechtel Group wants to hedge a bid on a Japanese construction project. But because the yen exposure is contingent on acceptance of its bid, Bechtel decides to buy a put option for the ¥15 billion bid amount rather than sell it forward. In order to reduce its hedging cost, however, Bechtel simultaneously sells a call option for ¥15 billion with the same strike price. Bechtel reasons that it wants to protect its downside risk on the contract and is willing to sacrifice the upside potential in order to collect the call premium. Comment on Bechtel's hedging strategy.

The combination of buying a put option and selling a call option at the same strike price is equivalent to selling ¥15 billion forward at a forward rate equal to the strike price on the put and call options. That is, Bechtel is no longer holding an option; it is now holding a forward contract. If the yen appreciates and Bechtel loses its bid, it will face an exchange loss equal to 15 billion x (actual spot rate - exercise price).

FUTURES

1. Explain the basic differences between the operation of the currency forward market and the futures market.

The forward market is an OTC market where the forward contract for the purchase/sale of foreign currency is tailor-made between the client and its bank. There is no intermediate cash flows and delivery & receipt takes place on the maturity date.

A futures contract is an exchange-traded instrument with standardized features with the contract size and delivery date being specified. It is marked-to-market on a daily basis and this reflects changes in settlement price.

2. Why are most future positions closed out through a reversing trade rather than held to delivery?

While, futures contracts are useful for speculation and hedging, their standardized delivery dates make them unlikely to correspond to the actual future dates when foreign exchange transactions will occur. Thus, they are generally closed out in a reversing trade.

3. What is the major difference in the obligation of one with a long position in a futures (or forward) contract in comparison to an options contract?

A futures (or forward) contract is a vehicle for buying or selling a stated amount of foreign exchange at a stated price per unit at a specified time in the future. If the contract is held long till the delivery date, the holder pays the effective contractual futures (or forward) price, regardless of whether it is an advantageous price in comparison to the underlying spot price.

The options contract provides the holder with the right and not the obligation to buy/sell the underlying asset at a specified price. This allows the holder to exercise the option if the spot price is more favorable than the exercise price. Therefore, doesn't have to exercise the option if it is to his disadvantage and the only loss incurred is the premium.

4. The price of the March 2002 Mexican Peso (MXP) futures contract is \$ 0.10068. You believe the spot price in December will be \$ 0.11000. What speculative position would you enter into to attempt to profit from your beliefs? Calculate your anticipated profit assuming you take a position in three contracts. What is the size of your profit (loss) if the futures price is indeed an unbiased predictor of the future spot price and this price materializes?

If the expectation is that the MXP is likely to rise in the future, the speculator will take a long position as the futures position is lower than the expected spot price.

Anticipated profit = $3 \times (\$0.11000 - \$0.10068) \times \text{MXP } 500,000 = \$13,980$ (MXP 500,000 is the contract size).

If the futures price is an unbiased predictor of the expected spot price, the expected spot price is the futures price of \$0.10068/MXP. If this materializes, then profit (loss) would equal zero [$3 \times (\$0.10068 - \$0.10068) \times \text{MXP } 500,000$].

5. On Monday morning, an investor takes a long position in a Pound futures contract that matures on Wednesday afternoon. The agreed-upon price is \$1.78 for £62,500. At the close of trading on Monday, the futures price has risen to \$1.79. At Tuesday close, the price rises further to \$1.80. At Wednesday close, the price falls to \$1.785, and the contract matures. The investor takes delivery of the Pounds at the prevailing price of \$1.785. Detail the daily settlement process. What will be the investor's profit (loss)?

Time	Action	Cash Flow
Monday Morning	Buy £ futures contract that matures in 2 days. Price = \$1.78	None
Monday Close	Futures price ↑s to \$1.79. <i>Contract is marked-to-market</i>	Receives $62,500 \times (1.79 - 1.78) = \625
Tuesday Close	Futures price ↑s to \$1.80. <i>Contract is marked-to-market</i>	Receives $62,500 \times (1.80 - 1.79) = \625
Wed. Close	Futures price ↓s to \$1.785. <i>Contract is marked-to-market &</i> <i>Investor takes delivery of £62,500</i>	Pays $62,500 \times (1.80 - 1.785) = \937.50 Investor pays $£62,500 \times 1.785 = \$111,562.50$

- 6. Suppose that DEC buys a Swiss Franc futures contract (size is SFr \$125,000) at a price of \$0.83. If the spot rate for the Swiss Franc at the date of settlement is SFr 1 = \$0.8250, what is DEC's gain or loss on this contract?**

DEC has bought Swiss Francs worth \$0.8250 at a price of \$0.83. Thus it has lost \$0.005 per franc for a total loss of $\$125,000 \times 0.005 = \625

- 7. Suppose that Texas Instruments (TI) must pay a French supplier €10 million in 90 days.**

- a. Explain how TI can use currency futures to hedge its exchange risk. How many futures contracts will TI need to fully protect itself?**

TI can hedge its exchange risk by buying euro futures contracts whose expiration date is the closest to the date on which it must pay its French supplier. Given a contract size of €125,000, TI must buy $10,000,000/125,000 = 80$ futures contracts to hedge its euro payable.

- b. Explain how TI can use currency options to hedge its exchange risk. How many options contracts will TI need to fully protect itself?**

TI can hedge its exchange risk by buying euro call options contracts whose expiration date is the closest to the date on which it must pay its French supplier. Given a contract size of €62,500, TI must buy $10,000,000/62,500 = 160$ options contracts to hedge its payable.

- c. Discuss the advantages and disadvantages of using currency futures versus currency options to hedge TI's exchange risk.**

A futures contract is most valuable when the quantity of foreign currency being hedged is known, as in the case here. An option contract is most valuable when the quantity of foreign currency is unknown. Other things being equal, therefore, TI should use futures contracts to hedge its currency risk. However, TI must honor its futures contracts even if the spot rate at settlement is less than the futures price. In contrast, TI can choose not to exercise currency call options if the call price exceeds the spot price. Although this feature is an advantage of currency options, it is fully priced out in the market via the call premium. Hence, options are not unambiguously *better* than futures. In this case, since the quantity of the future French franc outflow is known, TI should use currency futures to hedge its risk.