

**EXAMPLE SERIES NO. 5
CURRENCY DERIVATIVES**

1. On Monday morning on the Chicago Mercantile Exchange, an investor takes a position in GBP futures. This contract has a size of 62,500 GBP and a price of $C_0 = 1.78$ USD/GBP. The last day of trading is Wednesday afternoon. The closing prices are $C_{po} = 1.79$ USD/GBP, $C_{\text{út}} = 1.80$ USD/GBP, $C_{st} = 1.785$ USD/GBP. At the close of the exchange on Wednesday, the investor kills his position. Record the daily settlement of profits and losses in the spreadsheet and find out what the investor's total outcome will be. Solve the whole example for a short position (i.e. selling futures). Next, determine how much USD the investor would have received if he had not killed the position on Wednesday but had the contract delivered.

2. Some bank and currency futures exchange lists these pound futures or pound futures contract:

forward: F (maturity 18.6.) = 1,5668 USD/GBP

Futures: Z (maturity 18.6.) = 1,5666 USD/GBP

Determine how the dealer can arbitrage and how much he would earn on GBP 62,500. Ignore potential interest gains or losses due to the timing of cash flows.

3. The American importer will have to pay GBP 50,000, but he does not know exactly when, only that it will be in the second half of November. Therefore, on 16 October, he sets a ceiling on GBP purchases by buying 4 GBP call options on the PHLX (one GBP 12,500 contract) with an exercise price of USD 1.50/GBP and an expiry date in December. The option premium on an option with this date is USD 0,0220/GBP. There is a brokerage fee of USD 8 per contract.

a) Determine the total cost of buying 4 options.

b) Determine what is the ceiling, i.e. the highest GBP buying rate the firm has secured (include brokerage fees).

On November 16, the firm receives a payment order and on that day the spot rate is USD 1.46/GBP. The premium on the call option that the firm owns is USD 0.002/GBP. The brokerage fee for selling one option is, as always, USD 8.

c) Determine whether the firm will exercise its options or not and what the cost per GBP 1 will be

- d) Determine what the adjusted cost per £1 is, given that the firm had to borrow for 1 month at an interest rate of 12% per annum to purchase the cost of the collateral.

If the spot rate on November 16 is USD 1.55/GBP and the premium on the option is USD 0.055/GBP, the firm again has two options - either to exercise the options or to sell. It chooses to sell (the brokerage fee is USD 8 per option) and buys GBP in the spot market.

- e) Determine the cost per GBP 1 and decide whether the company's actions were reasonable
- f) Determine what the adjusted cost per £1 is, given that the firm had to borrow for 1 month at the interest rate to purchase the cost of the collateral 12% p.a.

4. The Japanese company will receive a certain amount of USD sometime between June 30 and December 30. It will want to sell them and get JPY. It is concerned about the decline in the value of USD, so it buys a put option from a bank for the given amount of USD with an exercise price of 130 JPY/USD. It is a US option and has no resale value. The firm pays an option premium of JPY4/USD and there are no other fees. However, the firm has to borrow JPY for 6 months at an interest rate of 5% per annum to pay the premium.

- a) Determine the approximate lower bound on the value of USD that the firm has secured
- b) Decide whether or not the firm will exercise the option and how much JPY it will receive at best for 1 USD if the JPY depreciates to 145 JPY/USD on the payment date.
- c) Decide whether or not the firm will exercise the option and how much JPY it will receive at best for 1 USD if the JPY depreciates to 115 JPY/USD on the payment date.

5. The American company must pay the Japanese supplier 125 million. JPY for 3 months. It buys 20 call options (one contract size is JPY 6.25 million) with an exercise price of USD/JPY 0.008 to hedge against the risk of JPY appreciation. The premium is 0.015 cents per JPY. The firm's financial manager assumes that the most likely value of the JPY in 90 days will be between 0.0075 and 0.0084 USD/JPY.

- a) Determine the future reversal rate (i.e., the rate at which a loss turns into a gain and vice versa).
- b) Calculate the firm's profit or loss over the expected range of exchange rates.

- c) Graph the evolution of the expected profit or loss depending on the exchange rate.

6. On 01.06, a US firm sold goods, of which it will receive CHF 125,000 on 01.09. The firm will convert CHF to USD and is therefore concerned about exchange rate risk, or the depreciation of CHF below the current level of USD/CHF 0.6922. The firm decides between leaving the foreign exchange position unhedged, between CHF futures and two CHF option contracts.

	01.06.	01.09. (1)	01.09. (2)
prompt course	0,6922	0,6542	0,7338
futures price (September maturity)	0.6911	0,6558	0,7374
option premium 68	0,0059	0,0250	0,0001
option premium 70	0,0144	0,0447	0,0001

The table shows two versions of the results for each type of contract. Version (1) shows the CHF depreciation situation and version (2) shows the CHF appreciation situation. The selected options are chosen just above and below the spot rate on 01.06.

On 01.09. the US firm receives payment in CHF and immediately closes its positions. For futures, the firm does not let the contract mature (which is the 3rd Wednesday in September, not 01.09.), but kills it. For options, the firm has two options: exercise at the strike price or sell the options and trade on the spot market.

- Determine what the derivatives position is (long/short) and what types of options the firm must purchase.
- Calculate the result (profit/loss), expressed as the difference between the realisation at the original spot rate and the realisation at the final spot rate, caused by the unhedged position.
- Determine what the result, expressed as the difference between the result on the futures position and the result on the spot position, will be for hedging with futures.
- Determine the result, expressed as the difference between the best exercise of the option position (exercise/kill) and the exercise at the spot price using the option contracts listed.