9 Foreign Currency Futures

Answers to Questions and Problems

1. The current spot exchange rate for the dollar against the Japanese yen is 146 yen per dollar. What is the corresponding US dollar value of one yen?

   The dollar value per yen is simply the inverse of the yen per dollar rate:

   $$1/146 = \$.0068 \text{ per yen}$$

2. You hold the current editions of *The Wall Street Journal* and *The Financial Times*, the British answer to the WSJ. In the WSJ, you see that the dollar/pound 90-day forward exchange rate is $2.00 per pound. In *The Financial Times*, the pound 90-day dollar/pound rate is £.45 per US dollar. Explain how you would trade to take advantage of these rates, assuming perfect markets.

   These rates are inconsistent because a rate of $2.00 per pound implies that the cost of one dollar should be £.50. Therefore, an arbitrage opportunity is available by trading as follows:

Geographical Arbitrage Transactions		
$t = 0$	In New York, using the WSJ rates, sell $2.00 for £1.00 90 days forward.	$0
	In London, using *The Financial Times* rates, sell £1.00 for $2.22 90 days forward	$0
		Total Cash Flow $0
$t = 90$	In New York, fulfill the forward contract by delivering $2.00 and collecting £1.00	− $2.00 + £1.00
	In London, fulfill the forward contract by delivering £1.00 and collecting $2.22	− £1.00 + $2.22
		Total Cash Flow + $.22

3. In problem 2, we assumed that markets are perfect. What are some practical impediments that might frustrate your arbitrage transactions in problem 2?

   Transaction costs would be the major impediment. Every trade of foreign exchange faces a bid-asked spread. In addition, there is likely to be some commission to be paid, either in the form of an outright commission or in the form of an implicit commission for maintaining a trading function. In addition, forward contracts sometimes require margin, and this would be an additional cost that the potential arbitrageur must bear.

4. In the WSJ, you see that the spot value of the euro is $1.25 and the Swiss franc is worth $.72. What rate of exchange do these values imply for the Swiss franc and euros? Express the value in terms of euros per franc.

   The rate of $1.25 per euro implies a value of the euro equal to € 0.8 per $. The rate of $.72 per franc implies a value of the franc equal to SF 1.3889 per $. Therefore, € 0.8 and SF 1.3889 are equivalent amounts, both equal to $1. As a consequence, the value of the euro per SF must equal 0.8/1.3889 = .575995.

5. Explain the difference between a pegged exchange rate system and a managed float.

   In a pegged exchange rate system, the value of a pegged currency is fixed relative to another currency. For example, many Caribbean countries peg the value of their currency to the US dollar. In a managed float, the value of the currency is allowed to fluctuate as market conditions require. This is the floating part of the policy. In a managed float, the central bank intervenes in the market to influence the value of the currency by buying or selling its own currency.

6. Explain why covered interest arbitrage is just like our familiar cash-and-carry transactions from Chapter 3.

   In a cash-and-carry transaction, a trader sells the futures and buys the underlying good. The trader carries the underlying good to the expiration of the futures, paying the carrying cost along the way, and delivers the good against the futures. In covered interest arbitrage, the transaction has a similar structure. The trader sells the futures and buys the foreign currency. The trader carries the foreign currency to the expiration of the futures, paying the carrying cost along the way, and delivers the good against the futures. The carrying cost for the foreign currency consists of two components. First, there is the financing cost in the home currency for the funds borrowed to buy the foreign currency. Second, the foreign currency that is carried forward to delivery against the futures earns interest. This interest on the foreign currency offsets the first component of the carrying cost.

7. For covered interest arbitrage, what is the cost-of-carry? Explain carefully.

   The cost-of-carry is the difference between the home currency interest rate and the foreign currency interest rate. For covered interest arbitrage, the trader borrows the home currency and pays the domestic interest rate for these funds. The trader uses these funds to buy the foreign currency in the spot market, and invests the foreign currency to earn the foreign interest rate. Therefore, the cost-of-carry is the domestic interest rate minus the foreign interest rate.

8. The spot value of the euro is $ 1.25, and the 90-day forward rate is $ 1.20. If the U.S. dollar interest factor to cover this period is 2 percent, what is the EMU rate? What is the cost of carrying a euro forward for this period?

   From the Interest Rate Parity Theorem, we know that $1 invested in the U.S. must earn the same rate as the $1 converted into a foreign currency, investing at the foreign rate and converting the proceeds back into dollars via a forward contract initiated at the outset of the transactions. For our data:

   $$\$1(1.02) = (\$1/\$\ 1.25)(1 + r_{euro}) * \$\ 1.20$$

   where r_{euro} = the EMU interest rate for this 90-day period. Therefore, r_{euro} = .0625. This is also the cost to carry a euro forward for the 90 days.

9. The Swiss franc is worth $.21 in the spot market. The Swiss franc futures that expires in one year trades for $.22. The U.S. dollar interest rate for this period is 10 percent. What should the Swiss franc interest rate be?

   $$1.10 = (1/.21)(1 + r_{SF}).22$$

where r_{FF} = the lSwiss franc interest rate for this period. Thus, $r_{SF} = .05$.

10. Using the data in Problem 9, explain which country is expected to experience the higher inflation over the next year. If the expected inflation rate in the U.S. is 7 percent, what inflation rate for the Swiss franc does this imply?

The franc is expected to increase in value against the dollar from being worth \$.21 now to \$.22 in one year. Assuming PPP, this implies that the purchasing value of the dollar will decline relative to the franc.

If the expected inflation rate in the U.S. is 7 percent, the real rate of interest is given by the equation:

$$1.10 = (1.07)\,(1 + r^*)$$

where r^* is the real rate of interest in the U.S., and $r^* = .028$. Assuming identical real rates in the U.S. and Switzerland, the expected Swiss inflation rate is given by:

$$1.05 = [1 + E(I)](1.028)$$

where $E(I)$ is the expe· ted inflation rate in Switzerland, and it equals .0214.

11. Using the data of Problem 9, assume that the Swiss interest rate for the year is also 10 percent. Explain how you might trans act faced with these values.

Faced with the exchange rates of Problem 9 and interest rates in both the U.S. and Switzerland of 10 percent, we could sell dollars for francs in the spot market, invest the franc proceeds at 10 percent, and arrange now to convert the Swiss funds in one year at the forward rate of \$.22. Assuming an initial amount of \$100, we would:

Dollar vs. Swiss Franc Arbitrage

$t = 0$	Borrow \$100 for one year at 10%.	+ \$100.00
	Sell \$100 for SF 476.19 in the spot market.	+ SF 476.19
		- \$100.00
	Invest SF 476.19 at 10% in Switzerland.	- SF 476.19
	Sell SF 523.81 1 year forward for \$115.24.	0
		Total Cash Flow \$0
$t = 1$ year		
	Collect SF 523.81 on investment.	+ SF 523.81
	Deliver SF 523.81 on forward contract, collect \$115.24.	- SF 523.81
		+ \$115.24
	Repay debt from borrowing \$100.00.	- \$110.00
		Total Cash Flow + \$5.24

12. Many travelers say that shoes in Italy are a big bargain. How can this be, given the purchasing power parity theorem?

Travelers are wrong as a matter of fact, but we still must answer the question. If PPP held with perfection, shoes would have the same cost in any currency, and there would be no bargain shoes anywhere. Bargains can arise, however, due to market imperfections. First, transportation is costly. As a consequence, shoes in Italy could be cheaper than the same shoes in New York. The New York shoes must include the transportation cost. Second, even ignoring transportation costs, there are barriers to the free flow of shoes around the world. Governments impose tariffs and quotas, which can affect the price. Thus, if the United States protects its shoe industry by imposing tariffs or quotas on the Italian shoes, the shoes can cost more in the United States, thereby making shoes in Italy a bargain.

13. For the most part, the price of oil is denominated in dollars. Assume that you are a French firm that expects to import 420,000 barrels of crude oil in six months. What risks do you face in this transaction? Explain how you could transact to hedge the currency portion of those risks.

Here we assume that the price of oil is denominated in dollars. Further, contracts traded on the NYMEX in oil are also denominated in dollars. Therefore, hedging on the NYMEX will not deal with the currency risk the French firm faces. However, the French firm can hedge the currency risk it faces by trading forwards for the French franc. To see how the French firm can control both its risk with respect to oil prices and foreign exchange, consider the following data. We assume a futures delivery date in six months for the oil and for foreign exchange forward contracts. The futures price of oil is $30 barrel, and the six-month forward price of a French franc is $.20. With these prices, the French firm must expect a total outlay of $12.6 million for the oil, and a total franc outlay of FF 63 million. By trading oil futures and French franc forwards, it can lock in this French franc cost. Because the crude oil contract is for 1,000 barrels, the French firm should buy 420 contracts. This commits it to a total outlay of $12.6 million. The French firm then sells FF 63 million in the forward market for $12.6 dollars. These two transactions lock-in a price of FF 63 million for the oil.

14. A financial comptroller for a U.S. firm is reviewing the earnings from a German subsidiary. This sub earns €1 million every year with exactitude, and it reinvests those earnings in its own German operations. This plan will continue. The earnings, however, are translated into U.S. dollars to prepare the U.S. parent's financial statements. Explain the nature of the foreign exchange risk from the point of view of the U.S. parent. Explain what steps you think the parent should take to hedge the risk that you have identified.

This risk is entirely translation risk, because we assume that the funds stay strictly in Germany. If the firm enters the futures or forward market to hedge the dollar value of the €1 million, it undertakes a transaction risk to hedge a translation risk. In other words, the firm increases its economic risk to hedge a purely accounting risk. From an economic point of view, this hedge would not make sense.

15. Joel Myers works for a large international bank. He has been watching the trading screen on this hot August morning and was disappointed in the lack trading activity. He was just about to take a break when a flurry of activity in the Swiss bond and currency markets caught his attention. He quickly pulled up the following quotes:

Spot exchange rate: $0.1656/SF
1-month forward: $0.1659/SF
3-month forward: $0.1665/SF
6-month forward: $0.1673/SF

T-Bill yields (bond equivalent)
1-month: 4.95%
3-month: 5.01%
6-month: 5.11%

A. Compute the 1-month (30-day), 3-month (91-day), and 6-month (182-day) yields Joel should expect to see in the Swiss money market.

For interest rate parity to hold, the Swiss interest rates should be such that Joel would be indifferent between investing in the US money market and the Swiss money market. The interest rate parity relationship is:

$$1 + r_{DC} = \frac{1}{FC}(1 + r_{FC})F_{0,t}$$

where r_{DC} and r_{FC} are, respectively, the domestic and foreign interest rates, FC is the spot exchange rate expressed as the cost of one unit of foreign currency in terms of domestic currency, and $F_{0,t}$ is the forward exchange rate today for a transaction at time t expressed as the domestic currency cost of one foreign currency unit.

Solving for the foreign interest rate, r_{FC}, we have:

$$r_{FC} = \frac{FC}{F_{0,t}}(1 + r_{DC}) - 1$$

1-month rate: $$r_{FC} = \left[\frac{0.1656}{0.1659}\left(1 + \frac{.0495 \times 30}{365}\right) - 1\right]\frac{365}{30} = 2.74\%$$

3-month rate: $$r_{FC} = \left[\frac{0.1656}{0.1665}\left(1 + \frac{.0501 \times 91}{365}\right) - 1\right]\frac{365}{91} = 2.81\%$$

6-month rate: $$r_{FC} = \left[\frac{0.1656}{0.1673}\left(1 + \frac{.0511 \times 182}{365}\right) - 1\right]\frac{365}{182} = 3.02\%$$

B. Suppose Joel sees that the 6-month yield in the Swiss money market is 4%. Assuming there are no market frictions, is arbitrage possible? If so, show the arbitrage transactions and compute the profit for a $1 million arbitrage.

Joel has already determined that the no-arbitrage 6-month return in the Swiss money market would be 3.02%. If the 6-month yield in the Swiss market is 4%, then Joel could borrow domestically, exchange the dollars for Swiss francs and invest in the Swiss money market. At the same time he would lock in a 6-month forward exchange rate to convert the francs back to dollars so the borrowing can be repaid. The profit on a $1 million arbitrage would be computed as:

Date	Cash Market	Forward Market
Today	Borrow $1 million for 6 months at 5.11%. Convert $1 million to SF at spot exchange rate of $0.1656/SF. Invest SF6.0386 million for 6 months at 4%. Anticipated proceeds are SF6.1591 million.	Sell SF6.1591 million 6 months forward at $0.1673/SF.
	Net Investment = 0	
6 months	Receive anticipated SF6.1591 million. Repay borrowing; Amount due is $1.0255 million.	Deliver SF6.1591 million and receive $1.0304 million.
	Profit = ($1.0304 - $1.0255) million = $4,936	

16. As the fall semester starts, David McElroy is making arrangements for Oklahoma State University's Summer in London program for the next summer. This is a program in which OSU faculty teach courses to OSU students at Regents College in London, England. Room and board is £1,500 per participant to be paid May 15th. The enrollment is capped at 42 people, and OSU always operates at the cap. In the past, the Summer in London program has been burned by adverse movements in exchange rates. This happens because OSU has borne the exchange rate risk between the dollar denominated room and board rate quoted to the students and the British pound rate paid to Regents College. David wonders if there is some way that OSU could pass this risk off to someone else.

A. Does OSU face translation or transaction exposure?

A trader faces transaction exposure when one currency must be converted into another. This differs from translation exposure in which one currency is restated in but not converted to another currency. OSU faces transaction exposure because it will be converting dollars to pounds in May.

B. What could OSU do to reduce this exchange rate risk?

There are several ways OSU could reduce its exchange rate risk. First, OSU could negotiate a room and board contract denominated in dollars. This would transfer the risk to Regents College. This may be a

viable alternative for future years, but it is too late for this year, as the contract has already been made. The second alternative is to buy British pounds forward using the futures market. This transfers the risk to a third party.

C. David asks a finance professor for advice. The professor pulls up the following \$/£ quotes on the £62,500 futures contract:

Delivery	\$/£
SEP (this year)	1.6152
DEC (this year)	1.6074
MAR (next year)	1.6002
JUN (next year)	1.5936

What strategy might the professor recommend to reduce OSU's exchange rate exposure? (Make a recommendation.)

The professor might suggest buying British pounds using the June futures contract. The amount of exposure OSU has is equal to the enrollment in the program multiplied by the pound-denominated room and board rate. The exposure will be:

$$\text{Exposure} = 42 \times £1500 = £63{,}000$$

To hedge this exposure, OSU should buy one June British pound futures contract at \$1.5936 per £.

D. May 15th arrives, and the following situation is realized:

# of participants:	42
Dollar room and board rate:	\$2,400
\$/£ exchange rate:	\$1.65
June futures contract:	\$1.6451 per £

Compute OSU's gains and losses in the cash market and the futures market. Was the hedging strategy successful?

When May arrives, exchange rates have risen. That is, the British pound has become more expensive in dollar terms. Luckily, the June futures price has also increased, resulting in gains from OSU's futures position. The gains and losses are as follows:

Date	Cash Market	Futures Market
Today	Anticipate the need for \$100,397 on May 15th to make £63,000 room and board payment.	Buy one June £62,500 futures contract at \$1.5936 per £.
May 15th	Buy £63,000 in the spot market at \$165 per £ for \$103,950	Sell one June futures contract at \$1.6451 per £.
	Opportunity loss = − \$3,553	Profit = \$3,219
	Net Loss = −\$334	

While the hedge did not totally eliminate OSU's transaction exposure, it did reduce it. Therefore, the hedge was a success.

17. Viva Soda is an up-and-comer in the highly competitive sports drink market. Viva owns three regional bottling facilities in the United States and one Canadian subsidiary that meets the demand for Viva in the Canadian provinces. Great North Bottling, the Canadian subsidiary, accounts for 25 percent of Viva's total

sales and net earnings at the present exchange rates. Dave Baker, CFO for Viva, is very concerned about Viva's translation exposure. Viva will be in the debt refinancing market in one year. Dave is acutely aware of the relationship between the cost of debt and earnings results. Dave's assistant has made the following forecasts of Great North's earnings before taxes for the next four quarters:

Quarter	Great North Earnings before Taxes
DEC	CAN$ 10 million
MAR99	CAN$ 7.5 million
JUN	CAN$ 8.5 million
SEP	CAN$ 12 million

A. What risks does Viva face with regard to its Canadian operations? What could Dave Baker do to hedge the risk?

The risk Viva faces with regard to its Canadian subsidiary is primarily translation exposure. Since Great North Bottling meets the demand of the Canadian provinces, Viva has a natural transaction hedge. This occurs when sales and expenses are denominated in the same local currency. The only risk then is the restatement (translation) of results in the home currency. Adverse movements in exchange rates could hurt Viva's reported results, which could, in turn, impact their cost of debt. Dave Baker could hedge the translation exposure by selling Canadian dollars forward. Any adverse impacts of exchange rates on Great North's contribution to Viva's bottom line will be offset by gains in the futures market.

B. Dave's assistant notes the following futures exchange rates for the Canadian dollar:

Delivery	US$/CAN$
DEC	0.6603
MAR99	0.6609
JUN	0.6615
SEP	0.6621

Design a hedge that will solve Dave's problem. Assume one futures contract is for $100,000 Canadian.

To hedge the translation exposure, Dave should sell each of Great North's anticipated pretax earnings in the futures market. To do this, Dave would sell 100 December contracts, 75 March contracts, 85 June contracts, and 120 September contracts.

C. Assuming the spot prices shown in the following table are realized, compute the translated earnings each quarter and the net impact on Viva's results considering the hedging activities.

Month	US$/CAN$
DEC	0.6271
MAR99	0.6827
JUN	0.5961
SEP	0.7100

The anticipated contribution of Great North to pretax earnings each quarter is:

Quarter	Anticipated US$/CAN$	Anticipated Pretax Earnings in US$ (millions)
DEC	0.6603	6.603
MAR99	0.6609	4.957
JUN	0.6615	5.623
SEP	0.6621	7.945

The realized contribution of Great North to earnings before taxes each quarter is:

Quarter	Realized US$/CAN$	Realized Earnings before Taxes in US$ (millions)
DEC	0.6271	6.271
MAR99	0.6827	5.120
JUN	0.5961	5.067
SEP	0.7100	8.520

The impact of the exchange rate changes on the translated quarterly earnings is the anticipated earnings before taxes minus the realized earnings before taxes. These are:

Quarter	Realized EBT (US$ millions)	Anticipated EBT (US$ millions)	Gain (Loss) (US$ millions)
DEC	6.271	6.603	(.332)
MAR99	5.120	4.957	.163
JUN	5.067	5.623	(.556)
SEP	8.520	7.945	.575

The gains and losses in the futures market are calculated as:

$$100{,}000(\text{Selling price} - \text{Buying price}) \times \#\ \text{contracts}$$

Quarter	Selling Price	Buying Price	# Contracts	Gain (Loss) (US$ millions)
DEC	0.6603	0.6271	100	.332
MAR99	0.6609	0.6827	75	(.163)
JUN	0.6615	0.5961	85	.556
SEP	0.6621	0.7100	120	(.575)

The gains (losses) in the futures markets offset the translation losses (gains). One thing to keep in mind is that the translation gains and losses are accounting in nature. As long as Great North cash flows are not converted back into US dollars, the gains and losses are only on paper. The futures trading gains and losses are cash gains and losses. Unless there is some cash benefit to reducing the translated earnings volatility, hedging the translation exposure might not be a good idea.