Chapter 9 International Bond and Money Markets

Quiz Questions

True-False Questions

_______ 1. The abolition of the Interest Equalization Tax, Regulation M, the cold war, and the US and UK foreign exchange controls have taken away most of the reasons why euromarkets exist. As a result, we can expect these markets to decline in the near future.

_______ 2. Without the US trade deficit, the euromarkets would have developed more slowly.

_______ 3. With a floating-rate loan, the bank is free to adjust at every reset date the interest rate in light of the customer's creditworthiness.

_______ 4. One of the tasks of the lead bank under a syndicated bank loan is to make a market, at least initially.

_______ 5. The purpose of using a paying agent is to reduce exchange risk.

_______ 6. Caps and floors are options on interest rates. Because interest rates are not prices of assets, one cannot price caps and floors using an option pricing model that is based on asset prices.

_______ 7. Because euroloans are unsecured, the spread over the risk-free rate is a very reliable indicator of the borrower's general creditworthiness.

_______ 8. FRAs are not really a good hedge against future interest rates because one does not actually make the deposit or take up the loan.

_______ 9. A note issuing facility forces the borrowing company to borrow at a constant spread, while a revolving underwritten facility gives the borrower the benefit of decreased spreads without the risk of increasing spreads.

_______ 10. The fact that eurobonds are bearer securities makes this instrument less attractive to most investors.

_______ 11. Bond stripping is mostly done with a pair of scissors: you just clip off the coupons.

_______ 12. Disintermediation is the cause of the lower creditworthiness of banks, and has lead to capital adequacy rules.

_______ 13. Ignoring the small effects of marking to market, the standard quote for a eurocurrency futures price is basically a forward price on a CD.

Ans. 1. false; 2. true; 3. false; 4. false; 5. false; 6. false: any interest rate corresponds with a T-bill price; 7. false; 8. false; 9. false; 10. false; 11. false; 12. false; 13. false.

Multiple-Choice Questions

Q1. Eurocurrency and euroloan markets are attractive because:
- (a) The spread between the buy and ask exchange rates is lower than in the interbank exchange market.
- (b) The bid-ask spread between the lending and borrowing interest rates is lower.
- (c) Eurobanks are not subject to reserve requirements.
- (d) Eurobanks are not subject to capital adequacy rules (the so-called BIS rules).

A1. (b), (c).

Q2. Eurobanks borrow for short maturities and lend for longer maturities. They can reduce the interest risk by:

(a) extending fixed-rate loans.
(b) extending floating-rate loans.
(c) extending revolving loans.
(d) going short in forward forwards (that is, getting a forward contract on a loan, not on a deposit).
(e) going short in FRAs.
(f) going long in eurocurrency futures.
(g) buying forward the currency in question.

A2. (b), (c), (d), (e).

Q3. A cap on a floating-rate euroloan:
(a) protects the borrower against high short-term interest rates.
(b) protects the lender against high short-term interest rates on the funding side.
(c) is similar to a call option on short-term paper with the cap rate as nominal rate; and the borrower is the holder of the call option.
(d) is similar to a put option on short-term paper with the cap rate as nominal rate; and the borrower is the holder of the put option.
(e) is similar to a put option on short-term paper with the cap rate as nominal rate; and the lender is the holder of the put option.

A3. (a), (d).

Q4. Which of each pair best describes eurobanking?
(a) retail/wholesale
(b) individual lender/bank consortium
(c) reserve requirements/ limited or no reserve requirements
(d) unsecured/secured
(e) fixed-rate lending/floating-rate lending
(f) foreign exchange markets/money markets
(g) open to all companies/open to the better companies only

A4. (a): wholesale; (b) consortium; (c) limited or no reserve requirements; (d) unsecured; (e) floating; (f) money market; (g) better companies.

Q5. **Matching Questions:** Choose from the following list of terms to complete the sentences below: *paying agent*, *managing banks*, *trustee bank*, *placing agents*, *market*, *lead bank* (or *lead manager*), *participating banks*, *prospectus*, *gray market*, *fiscal agent*, *buy forward*, *underwrite*, *lead manager*, *red herring*.

A consortium (or *syndicate*) that extends a euroloan consists of many banks that could play different functions. In a euroloan, the (a) negotiates with the borrower for tentative terms and conditions, obtains a mandate, and looks for banks that provide the money or undertake to provide the money if there is any shortfall in funds. The banks that provide the actual funding are called (b). Because, at the time of the negotiations, the funding is not yet arranged, the (c) often contacts a smaller number of (d) banks who (e) the loan, that is, guarantee to make up for the shortage of funds if there is any such shortfall. The (f), finally, is the bank that receives the service payments from the borrower and distributes them to the participating banks.

Placement of eurobonds is most often via a syndicate of banks or security houses. The lead bank or (g) negotiates with the borrower, brings the syndicate together, makes a (h) (at least initially), and supports the price during and immediately after the selling period. There are often, but not always, (i) that underwrite the issue and often buy part of the bonds for their own account. The (j) call their clients (institutional investors or individuals) and sell the bonds on a commission basis. The (k) takes care of withholding taxes, while the (l) monitors the bond contract. Prospective customers can find information about the issuing company and about the terms and conditions of the bond in a (m). Often an unofficial version of the prospectus is already circulating before the actual prospectus is officially approved; this preliminary prospectus is called the (n). On the basis of this document, investors can already (o) the bonds for a few weeks before the actual issuing period starts. This period of unofficial trading is called the (p) period.

A5. (a) lead bank; (b) participating banks; (c) lead manager; (d) managing; (e) underwrite; (f) paying agent; (g) lead manager; (h) market; (i) managing banks; (j) placing agents; (k) fiscal agent; (l) trustee bank; (m) prospectus; (n) red herring; (o) buy forward; (p) gray-market.

Exercises

E1. You are an A quality borrower, and you pay 10 percent on a five-year loan with one final amortization at the end. This is 1 percent above the spread paid by an AAA borrower. What will be the up-front fee for which your bank should be willing to lower the rate by 1 percent?

A1. $0.1 \times \dfrac{1 - 1.10^{-5}}{0.10}$ = 3.79 percent up front.

E2. A bank offers you the following rates: 10 percent fixed, or (when you borrow floating-rate) LIBOR + 2 percent. You prefer to borrow floating-rate, as you expect a drop in interest rates. Another bank offers you LIBOR + 1.5 percent, but asks a substantial up-front fee. How can you compute which bank offers the better terms?

A2. The savings of 0.5 percent in the spread is equivalent to $0.005 \times \dfrac{1 - 1.10^{-5}}{0.10}$ = 1.895 percent up front.

E3. On January 2, you sign a six-to-nine month FRA for FRF 10m at 10 percent *p.a.*. Six months later the three-month LIBOR rate turns out to be 8 percent *p.a.*
(a) What is the cash settlement on July 2?
(b) What are the cash flows that arise from a similar Forward Forward?
(c) Which of the two (the FRA or the FF) has the higher present value (on July 2)?

A3. (a) FRF 10m $\times \dfrac{(1/4) \times (0.10 - 0.08)}{1 + (1/4) \times 0.08}$ = FRF 49,019.6.
(b) With a FF, the cash outflow is FRF10m on July 2, and the cash inflow is FRF 10.25m on October 2.
(c) The present value of the cash flows from the FF is: $\dfrac{10.25\text{m}}{1 + (1/4) \times 0.08}$ – 10m = FRF 49,019.61 exactly as the cash settlement for the FRA.

E4. On January 2, the six- and nine-month interest rates are 5 and 5.5 percent *p.a.*, respectively. What is the six-to-nine-months forward rate? Ignore bid-ask spreads in interest rates.

A4. $\frac{1 + (3/4) \times 0.055}{1 + (1/2) \times 0.050} - 1$ = 1.58537 percent effective, or 6.34146 percent *p.a.* (simple interest).

E5. On January 2, you signed a six-to-nine FRA for LUF 100m at 10 percent *p.a.*. Three months later the LIBOR rate for three, six, and nine months are at 8.75, 8.9, and 9.5 percent, respectively. What is the market value of the outstanding FRA?

A5. The FRA has the same value as a FF. The FF provides for an outflow of LUF 100m within 3 months, and an inflow of LUF 100m $\times$ $(1 + \frac{1}{4} \times 0.1)$ within 6 months. The inflow six months hence is worth:

$$\text{LUF } \frac{100\text{m} \times (1 + (1/4) \times 0.10)}{(1 + (2/4) \times 0.089)} = \text{LUF } 98.133\text{m},$$

and the outflow three months hence is worth:

$$\text{LUF } \frac{100\text{m}}{(1 + (1/4) \times 0.0875)} = \text{LUF } 97.859\text{m}.$$

The net value, therefore, is LUF 274,078.

E6. You bought an option that limits the interest rate on a future six-month loan to at most 10 percent *p.a.*
(a) If, at the beginning of the six-month period, the interest rate is 11 percent, what is the expiration value of this option?
(b) What is the option's expiration value if the interest rate turns out to be 8 percent?

A6. (a) $\frac{(1/2) \times (0.11 - 0.10)}{1 + (1/2) \times 0.11}$ = 0.4739 percent of the nominal value.
(b) Zero.

E7. You bought an option that limits the interest rate on a future six-month deposit to at least 10 percent *p.a.*. If, at the beginning of the six-month period, the interest rate is 11 percent, what is the market value of this option? What is the option's value if the interest rate turns out to be 8 percent?

A7. (a) Zero.
(b) $\frac{(1/2) \times (0.10 - 0.08)}{1 + (1/2) \times 0.08}$ = 0.9615 percent of the nominal value.

E8. The six- and nine-month interest rates are 10 percent and 11 percent *p.a.*, respectively.
(a) What is the current six-to-nine forward interest rate?
(b) What is the forward price of a six-month (= T_1) forward contract on a nine-month (= T_2) CD?
(c) What is the futures quote (ignoring effects of marking to market)?
(d) If the underlying CD has a face value of USD 10,000, what is the marking-to-market cash flow when the six- and nine-month interest rates both increase by 0.5 percent?

A8. (a) $\frac{1 + (3/4) \times 0.11}{1 + (1/2) \times 0.10} - 1$ = 3.09523 percent effective, or 12.38095 percent *p.a.* (simple interest).

(b) 1/1.0309523 = 96.99769 percent.
(c) 100% – 12.38% = 87.62 percent.
(d) The new *p.a.* forward rate is $\frac{1 + (3/4) \times 0.115}{1 + (1/2) \times 0.105} - 1 = 3.20665$ percent effective, or 12.83 percent *p.a.* Thus, the quote drops by (12.83% – 12.38%) = 0.45 percent, and marking to market is one-fourth of this, 0.1125% × USD 10,000 = USD 11.25.

Mind-Expanding Exercises

ME1. On January 2 the six- and nine-month interest rates are 5 - 5.125 and 5.5 - 5.6125 percent *p.a.*, respectively.
(a) Use the *Law of the Worst Possible Combination*, discussed in Chapters 1 and 4, to derive the synthetic forward bid interest rate, *p.a.*; what loans or deposits are used to construct a synthetic forward deposit?
(b) Do the same for the synthetic ask rate.

A1. (a) On a forward deposit, you obtain the synthetic forward bid rate, $\frac{1 + r^{\text{bid}}_{t,T_2}}{1 + r^{\text{ask}}_{t,T_1}}$. You borrow $\frac{1}{1 + r^{\text{ask}}_{t,T_1}}$ for maturity $(T_2 - t)$ (thus securing an outflow of 1 unit at time T_1), and invest this amount until time T_2.
(b) On a synthetic forward loan, you pay the synthetic forward ask rate, $\frac{1 + r^{\text{ask}}_{t,T_2}}{1 + r^{\text{bid}}_{t,T_1}}$; you borrow $\frac{1}{1 + r^{\text{ask}}_{t,T_2}}$ for maturity $(T_2 - t)$ (thus securing an outflow at time T_2), and invest this amount until time T_1.

ME2. Prove the following claims:
(a) The cash flows from a floating-rate deposit with semi-annual coupons are identical to the cash flows from a series of independent six-month deposits where the principal is reinvested at each expiry date.
(b) Assuming a constant default risk, a FRN trades always at par (or very close to par) around the reset date.
(c) A HIBOR-bond, in contrast, could trade below par and a LIBOR-bond above par around the reset date.

A2. (a) The answer follows immediately.
(b) There is no cash required to make a series of independent six-month deposits, as the principals are rolled-over. Thus, the market value at any time must equal the market value of the ongoing deposit. At the reset date and with no change in creditworthiness, the initially fixed spread is equal to the spread relevant at time *t*. Thus, the present value is the nominal value of the loan:

$$\text{PV} = (\text{nominal value}) \times \frac{(\text{nominal value}) \times (1 + \text{LIBOR}_{t,T_1} + \text{fixed spread})}{1 + \text{LIBOR}_{t,T_1} + \text{normal spread}}$$

$$= (\text{nominal value}).$$

(c) There is no cash required to make the later deposits, as the principals are rolled over. Thus, the market value at any time must be equal to the market value of the ongoing deposit. At the reset date and with no change in the creditworthiness, the initially fixed spread is equal to the spread relevant at time *t*, but the lower bound could mean that the promised rate exceeds the normal rate (LIBOR + equilibrium). Thus, the present value can be higher than the nominal value of the loan:

$$\text{PV} = [\text{nominal value}] \times \frac{[\text{nominal value}] \times [1 + \text{floor rate}_{t,T_1} + \text{fixed spread}]}{1 + \text{LIBOR}_{t,T_1} + \text{normal spread}}$$

$$\geq [\text{nominal value}] \times \frac{[\text{nominal value}] \times [1 + \text{LIBOR}_{t,T_1} + \text{fixed spread}]}{1 + \text{LIBOR}_{t,T_1} + \text{normal spread}}$$

ME3. In Section 9.1.4., we valued an FF via replication. Value the same contract using a hedging argument—that is, an investor can lock in his gain (or stop his loss), by closing the outstanding FF with a reverse FF at the current market conditions.

A3. Close out the contract by going short FRA at the new forward rate. The current effective forward rate is approximately:

$$\frac{1 + (6/12)\ 0.09125}{1 + (3/12)\ 0.09} - 1 = 2.26161 \text{ percent}$$

(or 9.04645 percent *p.a.*). Combining the old long position with a new short position yields:

Old contract	out: CHF 10m three months	in: CHF 10.250,000 six months
New contract	in: CHF 10m three months	out: CHF 10,226,161 six months
Total	0 three months	net in: 23,839 six months

This locks in CHF 23,839 six months from now, with a present value of:

$$\frac{23{,}839}{1 + (6/12)\ 0.09125} = 22{,}799.$$

ME4. Assume that the one-year forward rates for starting dates 0, 1, 2, 3, and 4 are 10, 10.25, 10.50, 10.55, and 10.60 percent. Compute the term structure of spot interest rates for maturities of one to five years.

A4.

One year	10 percent.
Two year	(1.1 × 1.1025) -1 = 21.275 percent effective, or 10.12493 percent *p.a.* (compound).
Three year	(1.1 × 1.1025 × 1.105) - 1 = 34.01 percent effective, or 10.24981 percent *p.a.*
Four year	(1.1 × 1.1025 × 1.105 × 1.1055) - 1 = 48.14681 percent effective, or 10.32478 percent *p.a.*
Five year	(1.1 × 1.1025 × 1.105 × 1.1055 × 1.1060) - 1 = 63.85 percent effective, or 10.37977 percent *p.a.*

ME5. Using the same data, compute the term structure of yields at par for loans with a single amortization at the end.

A5. Using the effective spot returns computed in ME4, the yields are found from:

$$\frac{1 - 1/(1 + r_{t,T})}{\sum_{t_i=1}^{T} \frac{1}{1 + r_{t,t_i}}}$$

The answers are 10, 10.1189, 10.23358, 10.30128, 10.34970 percent for $T = 1,\ldots,5$.

ME6. Using the same data, compute the term structure of yields at par for loans with constant annuities.

A6. The present value of the constant annuity of one unit of currency is $\sum_{t_i=1}^{T} \frac{1}{1 + r_{t,t_i}}$. This produces present values equal to 0.90909, 1.73366, 2.47988, 3.15489, and 3.76520 for $T = 1,\ldots,5$. The corresponding yields are the numbers y that satisfy:

$$\text{Present value of the annuity} = \frac{1 - (1 + y)^{-T}}{y}$$

These yields can be found numerically, and are 10, 10.0805, 10.1596, 10.2191, and 10.2656 percent, respectively, for $T = 1,\ldots,5$.

ME7. With the same data, verify how well (or how badly) the value of an n-year annuity ($n = 1,\ldots,5$) is approximated when one uses the five-year yield at par of a bullet bond rather than the complete term structure of spot returns.

A7. Using the yields at par for bullet bonds computed in ME4, we compute $\frac{1 - (1 + y)^{-T}}{y}$ as 0.90909, 1.73277, 2.47666, 3.14930, 3,75716. For maturities two to five years, the errors amount to 0.05 percent, 0.13 percent, 0.17 percent, and 0.25 percent of the true values as computed in ME6.

Chapter 10 Currency and Interest Rate Swaps

Quiz Questions

Q1. In what way does a fixed-for-fixed currency swap differ from a spot contract and a reverse forward contract?

A1. A forward contract can be viewed as an exchange of two *zero-coupon* bonds with identical times to maturity—one bond having a face value equal to X units of home currency, and the other bond having a face value equal to one unit of foreign currency. Default risk is low, and there is a right of offset. If, at time t, X is set equal to $X = F_{t,T}$, the initial values of the two zero-coupon bonds are equal:

$$\text{PV of HC leg} = \frac{F_{t,T}}{1 + r_{t,T}} = S_t \times \frac{1}{1 + r^*_{t,T}} = S_t \times [\text{PV, in FC, of FC leg}]$$

which implies that the forward contract has zero initial net value.

A fixed-for-fixed currency swap can be viewed as an exchange of two *coupon* bonds with identical times to maturity—one bond having a face value equal to X units of home currency, and the other bond having a face value equal to one unit of foreign currency. Default risk is low, and there is a right of offset. Both bonds pay out the "yield at par" that is normal for their time to maturity and currency, and each bonds' initial market value is, therefore, equal to its par value. If, at time t, X is set equal to $X = S_t$, the initial values of the two zero-coupon bonds are equal:

$$\text{PV of HC leg} = \sum_{i=1}^{n} \frac{S_t\, y}{(1+y)^{T_i - t}} + \frac{S_t}{(1+y)^{T_n - t}} = S_t, \text{ by definition of } y$$

$$\text{PV, in FC, of FC leg} = \sum_{i=1}^{n} \frac{y^*}{(1+y^*)^{T_i - t}} + \frac{1}{(1+y^*)^{T_n - t}} = 1, \text{ by definition of } y^*$$

which implies that the swap has zero initial net value:

$$\text{PV of HC leg} = S_t \times [\text{PV, in FC, of FC leg}].$$

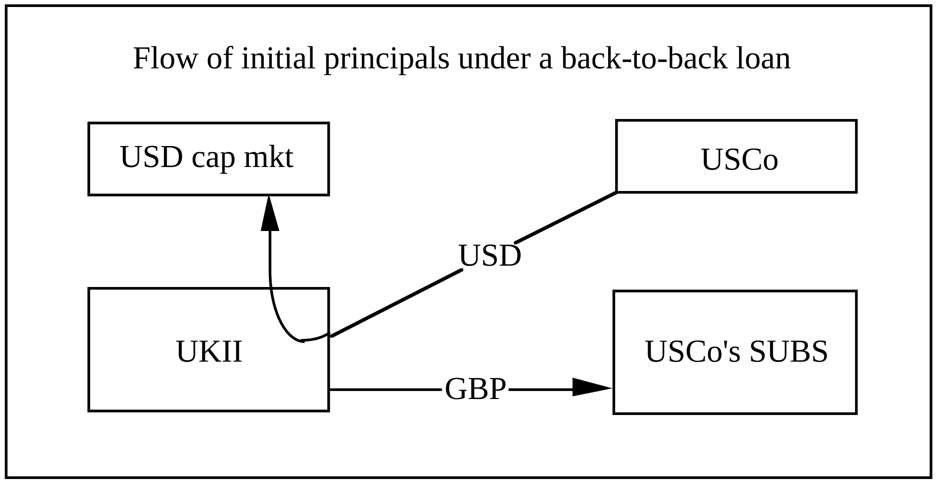
Thus, with a swap,

- Interest is paid periodically rather than all at once (at the end). This implies that:
  (1) There are n future exchanges of moneys, not just one, and
  (2) X has to be set differently because the face value of the swap does not include interest.
- The PV of *all* inflows taken together equals, initially, the PV of *all* outflows taken together. The PV of the two amounts exchanged at *one* particular date T_i need not be equal.

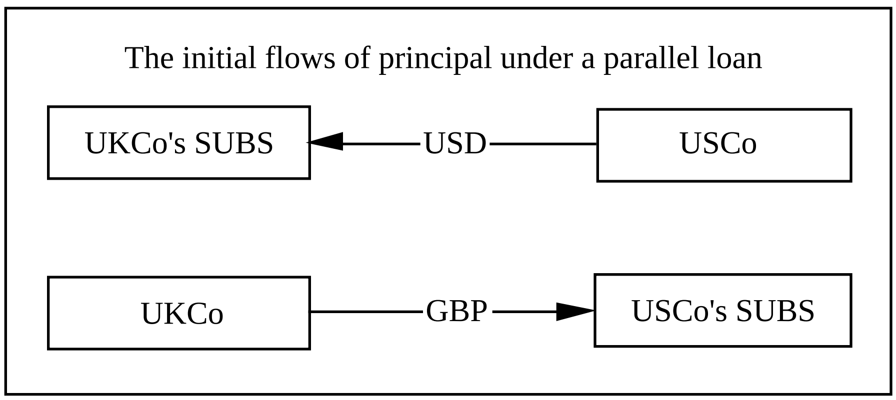
Q2. Describe some predecessors to the currency swap, and discuss the differences with the modern swap contract.

A2. Short-term swap and repurchase order: see question 1.

Back-to-back loan:



Parallel loan:



Both predecessors use two separate loan contracts, usually linked by a right of offset. The swap is one contract with a right of offset.

Q3. What are the reasons why swaps may be useful for companies who want to borrow?

A3. Swaps may be useful because companies can:

1) Take advantage of comparative informational advantages in the home market, subsidized loans, off-balance-sheet reporting and favorable tax treatment.
2) Get around capital market restrictions.
3) Avoid transaction costs.

Q4. How are swaps valued in general? How does one value the floating-rate leg (if any), and why?

A4. First, to value a new swap, the present value of one leg of the swap is computed, for instance, for the foreign currency leg. Then based on the exchange rate, we look for a home currency loan with the same present value. Both loans must be of the same type, that is, both are either bullet loans or amortized loans but not a mixture.

If the swap is an outstanding one, the present value of the interest payments (based on the historical interest rate) plus the principal are valued for each leg of the swap using the current swap rate. Then the foreign currency leg is converted into home currency using the prevailing spot rate. From the perspective of the company in the home country, the value of the swap equals the home currency leg minus the foreign currency leg as it is translated into home currency.

The value of a floating-rate leg of a swap is the same as the present value of a short-term deposit with the same nominal value as the swap, expiring at the next reset date, and paying out the same interest as the interest fixed for the swap at the most recent reset date.

Exercises

E1. The traditional short-term swap is:
- (a) A spot transaction and a reverse forward transaction.
- (b) A foreign-currency loan covered in the forward market.
- (c) A loan converted into another currency by a spot transaction (for the time-*t* proceeds) and forward transaction (for the time-*T* service payment).
- (d) A loan in one currency combined with a loan in another currency.
- (e) A loan in one currency combined with loan in another currency and a right of offset between the two.
- (f) A loan in one currency combined with loan in another currency for the same time-*T* value.

A1. (a); in (e), "zero intial NPV" and "long versus short" are missing.

E2. A repurchase order is:
- (a) A spot transaction of a low-risk asset combined with a short-term reverse forward transaction.
- (b) A loan covered against default risk by using a low-risk asset as security.
- (c) A fixed-for-floating currency swap.

A2. (a), (b).

E3. A back-to-back loan provides:
- (a) A way to avoid the cost of forward transctions.
- (b) A way to obtain secured loans without openly acknowledging them on the balance sheet.
- (c) A way to avoid the investment dollar premium.

A3. (c).

E4. The modern long-term currency swap can be viewed as:
- (a) A spot sale and a forward purchase.
- (b) A combination of forward contracts, each of them having zero initial market value.
- (c) A combination of forward contracts, each of them having, generally, a non-zero initial market value but with a zero initial market value for all of them taken together.
- (d) A spot transaction and a combination of forward contracts, each of them having, generally, a non-zero initial market value but with a zero initial market value for all of them taken together.

A4. (d).

E5. The swap rate for a long-term swap is:
- (a) The risk-free rate plus the spread usually paid by the borrower.

(b) The risk-free rate plus a spread that depends on the security offered on the loan.
(c) Close to the risk-free rate, because the risk to the financial institution is very low.
(d) The average difference between the spot rate and forward rates for each of the maturities.

A5. (c).

E6. The general effect of a swap is:
(a) To replace the entire service payment schedule on a given loan by a new service payment schedule on an initially equivalent loan of another type (for instance, another currency, or another type of interest).
(b) To replace the risk-free component of the service payment schedule on a given loan by a riskfree component of the service payment schedule on an initially equivalent loan of another type (for instance, another currency, or another type of interest).
(c) To change the currency of a loan.
(d) To obtain a spot conversion at an attractive exchange rate.

A6. (b).

E7. You borrow USD 1m for six months, and you lend DEM 1.5m—an initially equivalent amount—for six months, at *p.a.* rates of 6 percent and 8 percent, respectively, with a right of offset. What is the equivalent spot and forward transaction?

A7. The spot transaction is USD 1m for DEM 1.5m (at S_t = DEM/USD 1.5), and the forward transaction is an exchange ofUSD 1m $\times$ 1.03 for DEM 1.5m $\times$ 1.04 = 1.56, with an implied forward rate of DEM/USD 1.56m/1.03m = 1.5145631. This forward rate can be computed directly from the spot and interest rates as DEM/USD 1.5 $\times$ (1.04/1.03) = $F_{t,T}$.

E8. Your firm has USD debt outstanding with a nominal value of USD 1m and a coupon of 9 percent, payable annually. The first interest payment is due three months from now, and there are five more interest payments afterwards.
(a) If the yield at par on bonds with similar risk and time to maturity is 8 percent, what is the market value of this bond in USD? In Yen (at S_t = YEN/USD 100)?
(b) Suppose you want to exchange the service payments on this USD bond for the service payments of a 5.25-year JPY loan at the going yield, for this risk class, of 4 percent. What should be the terms of the JPY loan?

A8. (a) USD 1m $\times$ [1 + (0.09 – 0.08) a(6 years, 8%)] $1.08^{0.75}$ = 1,108,396.1, or JPY 110,839,609.
(b) The face value must satisfy (face value) $\times$ 1 $\times$ $1.04^{0.75}$ = JPY 110,839,480. Thus, the face value is JPY 110,839,482/$1.04^{0.75}$ = 107,626,564.

E9. You borrow FIM 100m at 10 percent for seven years, and you swap the loan into DEM at a spot rate of FIM/DEM 4 and the seven-year swap rates of 7 percent (DEM) and 8 percent (FIM). What are the payments on the loan, on the swap, and on the combination of them? Is there a gain if you could have borrowed DEM at 9 percent?

A9.

		Swap		
	FIM loan	DEM 25m at 7%	FIM 100m at 8%	combined
Principal at t	FIM 100	DEM 25	<FIM 100>	DEM 25
Interest	<FIM 10>	<DEM 1.75>	FIM 8	<DEM 1.75 + FIM 2>

Principal at *T*	<FIM 100>	<DEM 25>	FIM 100	<DEM 25>

Thus, the 2 percent spread on DEM 25m in a direct fixed-rate loan is replaced by the 2 percent spread on FIM 100m. The DEM spread, when discounted at 9 percent and translated into FIM, is worth more than the FIM spread, which must be discounted at 10 percent. Thus, there still is a (small) gain in swapping.

E10. Use the same data as in the previous exercise, except that you now swap the loan into floating-rate (at FIBOR). What are the payments on the loan, on the swap, and on the combination of them? Is there a gain if you could have borrowed DEM at FIBOR + 1 percent?

A10.

	FIM loan	Swap: DEM 25m at FIBOR	Swap: FIM 100m at 8%	combined
Principal at *t*	FIM 100	DEM 25	<FIM 100>	DEM 25
interest	<FIM 10>	<DEM 25 × FIBOR>	FIM 8	<DEM 25 × FIBOR + FIM 2>
Principal at *T*	<FIM 100>	<DEM 25>	FIM 100	<DEM 25>

Thus, the 1 percent spread above FIBOR that you would have paid on a direct floating rate loan of DEM 25m in a direct loan is replaced by the 2 percent spread on FIM 100m. The former, when discounted at 9 percent and translated into FIM, is worth less than the latter, even though it must be discounted at 10 percent. Thus, the swap is not recommendable.

E11. You can borrow CAD at 8 percent, which is 2 percent above the swap rate, or at CAD LIBOR + 1 percent. If you want to borrow fixed rate, what is the best way: direct, or synthetic (that is, using a floating-rate loan and a swap)?

A11. Synthetic: you borrow at LIBOR + 1, and the swap replaces LIBOR by the fixed swap rate, 6 percent. Thus, the borrowing cost of the synthetic fixed-rate loan is LIBOR + 1% – LIBOR + 6% = 7 percent fixed, which is below your (direct) fixed-rate interest cost.

E12. You have an outstanding fixed-for-fixed FIM/DEM swap for FIM 100m, based on a historic spot rate of FIM/DEM 4 and initial 7-year swap rates of 7 percent (DEM) and 8 percent (FIM). The swap now has three years to go, and the current rates at FIM/DEM 4.5, 6 percent (DEM three years) and 5 percent (FIM three years). What is the market value of the swap contract?

A12. The DEM leg is worth {DEM 25m × (1 + (0.07 – 0.06) × *a*(3 years, 6 percent)} × 4.5 = FIM 115.507m, while the FIM leg is worth FIM 100 × (1 + (0.08 – 0.05) × *a*(3 years, 5 percent) = FIM 108.170m. Thus, the net value is FIM 7.337m.

E13. Use the same data as in the previous exercise, except that now the DEM leg is a floating rate. The rate has just been reset. What is the market value of the swap?

A13. The DEM leg is at par in DEM, so its FIM value is 25m × 4.5 = FIM 112.5m. The FIM leg was valued at FIM 108.170 in the previous exercise. Thus, the net value of the swap is FIM 4.33m.

Mind-Expanding Exercise

ME1. Sometimes a fixed-for-fixed currency swap is described as a combination of independent forward contracts. Show that, to replicate a fixed-for-fixed currency swap by a series of independent contracts, one needs identical term structures across the two currencies.

Hint: Denote the foreign swap rate by s^*, and the domestic swap rate by s. Consider a swap where the foreign leg has a nominal value of one unit of foreign currency, and the home currency leg has a value of S_t units of home currencies. The foreign-currency cash flows from a swap are s^* units of foreign currency at every interim date, and $1 + s^*$ at the end; and the home-currency cash flows from a swap are $S_t \times s$ units of home currency at every interim date, and $S_t \times (1 + s)$ at the end. What home-currency cash flows does one receive or pay if each of the foreign-currency cash flows is converted separately into home currency by a forward contract of that specific maturity, rather than exchanging the entire series into a series of home currency cash flows by one single swap contract? Under what conditions on the term structure of returns are the resulting home-currency cash flows of the form ($S_t \times s$ at the interim dates, and $S_t \times (1 + s)$ at the end)?

A1. Consider a series of forward contracts where you deliver, periodically, a constant amount s^* of FC except for the last payment, where you deliver an amount of FC equal to $1 + s^*$ units of FC. This is like the FC leg of a swap, if s^* is the initial yield at par.

If under a forward contract signed at time t you promise to pay s^* units of foreign currency at T_i, you will receive:

$$s^*\ \mathrm{F}_{t,T_i} = s^*\ S_t \frac{1 + r_{t,T_i}}{1 + r^*_{t,T_i}}$$

units of home currency in return; likewise, the last payment will produce:

$$(1 + s^*)\ S_t \frac{1 + r_{t,T\mathrm{n}}}{1 + r^*_{t,T\mathrm{n}}}$$

units of home currency at the final date. This series of home currency flows is not of the form [$S_t \times s$ at the interim dates, $S_t \times (1 + s)$ at the end] unless $r_{t,T_i} = r^*_{t,T_i}$ for all dates T_i. Note also that, if the term structures are identical, all forward rates are equal to the current spot rate. In addition, the two swap rates must be identical too. Thus, with identical term structures, the interim payments are $S_t \times s = S_t \times s^*$ home currency units in return for s^* units of foreign currency, and at the final date $S_t \times (1 + s) = S_t \times (1 + s^*)$ home currency units in return for $1 + s^*$ units of foreign currency. Without identical term structures, the "interest part" of the home currency inflows from the series of separate forward contracts is not a constant.