Foreign exchange exposure measures the potential for a firm’s
- profitability
- net cash flow
- market value
to change because of a change in exchange rates.
Types of Foreign Exchange Exposure

**Transaction exposure** measures changes in the value of financial obligations incurred before a change in exchange rates but to be settled after the change.

**Operating exposure, or economic exposure**, measures the change in the present value of the firm resulting from any change in expected future operating cash flows caused by an unexpected change in exchange rates.

**Translation exposure, or accounting exposure** measures the potential losses or gains that would appear on the consolidated financial statements following a change in exchange rates.

**Tax exposure** measures the tax consequences of foreign exchange exposure.
Why Hedge?

Hedging is the taking of a position, acquiring either a cash flow, an asset, or a contract (including a forward contract) that will rise (fall) in value and offset a fall (rise) in the value of an existing position.

- Hedging protects from a potential loss.
- Hedging reduces the variance of future cash flows.

Arguments against Currency Hedging

- Shareholders are better than management at diversifying risk.
- Currency risk management does not increase expected future cash flows; it usually consumes some of the firm’s resources and thus reduces future cash flows.
- Hedging activities may benefit management at the expense of shareholders.
Arguments against Currency Hedging

- If the market is at equilibrium, then the net present value of hedging is zero.
- Management may prefer hedging costs to unhedged losses.
- If markets are efficient, foreign exchange risks are reflected in stock prices.

Arguments in Favor of Currency Hedging

- Reducing risk improves the planning capability of the firm.
- Reducing future cash flow variability reduces the risk of financial distress.
- Management understand the firm’s risks better than shareholders.
- Markets are usually not at equilibrium.
1. Purchasing or selling on credit when prices are stated in a foreign currency.

2. Borrowing or lending funds when repayment is to be made in a foreign currency.

3. Being a party to an unperformed foreign exchange forward contract.

4. Acquiring assets or incurring liabilities denominated in a foreign currency.

Purchasing or Selling on Open Account: An Example

A U.S. firm sells merchandise on open account to a Belgian buyer for €1,800,000, payment to be made in 60 days. Current exchange rate is $1.1200/€.

Seller expects to receive

€1,800,000 \times $1.1200/€ = $2,016,000.

**Transaction exposure:**
If the euro weakens, the seller will receive less than $2,016,000. If the euro appreciates, the seller will receive more than $2,016,000.
Purchasing or Selling on Open Account

Life span of a transaction exposure: Show Exhibit 8.3

Borrowing and Lending: An Example

PepsiCo’s largest bottler outside the US is located in Mexico, Grupo Embotellador de Mexico (Gemex)

December 94: Gemex had US dollar denominated debt of $264 million. The Mexican peso (Ps$) is pegged at Ps$3.45/US$

December 22, 94: The peso is allowed to float due to internal pressures and sinks to Ps$4.65/US$

Peso traded at around Ps$5.50/US$ for most of January.
Borrowing and Lending: An Example

Gemex’s peso obligations:

- Mid-December, 1994:
  \[
  \text{US}\$264,000,000 \times \text{Ps}\$3.45/\text{US}\$ = \text{Ps}\$910,800,000.
  \]

- Mid-January, 1995:
  \[
  \text{US}\$264,000,000 \times \text{Ps}\$5.50/\text{US}\$ = \text{Ps}\$1,452,000,000
  \]

Gemex’s dollar obligation has increased by 59%.

Being a Party to a Forward Contract: An Example

When a firm buys a forward exchange contract, it deliberately creates transaction exposure; this risk is incurred to hedge an existing exposure.

A firm offsetting a transaction exposure of ¥100 million, say, to pay for an import from Japan in 90 days, can purchase ¥100 million in the forward market.

The counterparty to this transaction now faces foreign exchange exposure.
Types of Hedges

**Contractual Hedge:** Forward, money, futures and options market hedges.

**Operating Hedge:** Risk-sharing agreements, leads and lags in payment terms, swaps, and other strategies.

**Natural Hedge:** Offsetting operating cash flows.

**Financial Hedge:** Offsetting debt obligation or some type of financial derivative such as a swap.

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**Transaction Exposure Example**

Dayton, a U.S.-based manufacturer of gas turbine equipment, has just concluded negotiations for the sale of a turbine generator to a British firm for the sum of £1,000,000.

The sale is concluded in March but payment will be made three months later, in June.
Assumptions

- Spot exchange rate: $1.7640/£.
- Three-month forward rate: $1.7540/£.
- Dayton’s cost of capital: 12%.
- U.K. three-month borrowing (lending) rate: 10% (8%) per annum.
- U.S. three-month borrowing (lending) rate: 8% (6%) per annum.

Assumptions

- June put option: £1,000,000; $1.75 strike price; 1.5% premium.
- June put option: £1,000,000; $1.71 strike price; 1.0% premium.
- Dayton’s forecast of the spot rate in June: $1.76/£.
- Dayton’s minimum acceptable exchange rate: $1.7000/£.
Transaction Exposure Example

Dayton can:

- Remain unhedged
- Hedge in the forward market
- Hedge in the money market
- Hedge in the options market

Transaction Exposure Example: Unhedged Position

Suppose Dayton decides to accept the transaction risk.

If the future spot rate is $1.76/£, Dayton will receive

\[ £1,000,000 \times \frac{1.76}{£} = $1,760,000 \]

in 3 months.

However, if the future spot rate is $1.65/£, then Dayton will receive only $1,650,000, well below the acceptable rate.
The forward contract is entered at the time the A/R is created, i.e. in March.

The sale is recorded at the spot rate, in this case $1.7640/£.

If Dayton does not have an offsetting A/P of the same amount, then the firm is considered uncovered.

Hedging in the forward market here means selling £1,000,000 forward at the 3-month forward rate of $1.7540/£.

In 3 months, Dayton will received £1,000,000 and exchange them at the rate $1.7540/£, receiving $1,754,000 with certainty.

This is $6,000 less than the uncertain $1,760,000 expected from the unhedged position.

The forward contract creates a foreign exchange loss of $10,000 (£1,000,000 × (1.7640 − 1.7540)).
A money market hedge also includes a contract and a source of funds, similar to a forward contract.

In this case, the contract is a loan agreement.

The firm borrows in one currency and exchanges the proceeds for another currency.

Hedges can be left “open” (i.e. no investment) or “closed” (i.e. investment).

To hedge in the money market, Dayton will borrow pounds in London, convert the pounds to dollars and repay the pound loan with the proceeds from the sale.

To calculate how much to borrow, Dayton needs to discount the PV of the £1,000,000, i.e.

\[
\frac{\text{£1,000,000}}{1.025} = \text{£975,610}.
\]

Thus Dayton must borrow £975,610 today and repay £1,000,000 in 3 months with the proceeds from the sale.
Transaction Exposure Example: Money Market Hedge

This hedge creates a pound denominated liability that offsets with a pound denominated asset, thus creating a balance sheet hedge.

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities and Equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/R £1,000,000</td>
<td>Bank Loan (principal) £975,610</td>
</tr>
<tr>
<td></td>
<td>Interest payable £24,390</td>
</tr>
<tr>
<td></td>
<td>Total £1,000,000</td>
</tr>
</tbody>
</table>

Transaction Exposure Example: Money Market Hedge

In order to compare the forward hedge with the money market hedge, Dayton must analyze the use of the loan proceeds.

What can Dayton do with the loan?

It can exchange the £975,610 at the spot rate of $1.7640/£, which gives $1,720,976, and invest it in a US$-denominated asset.

Unlike the funds involved in a forward contract, the loan amount can be used immediately.
Transaction Exposure Example: Money Market Hedge

The loan proceeds can be:

- Invested at the US rate of 6.0% per annum;
- Used instead of a loan that would have otherwise been taken for working capital needs at the rate of 8.0% per annum;
- Invested in the firm itself, the cost of capital being 12.0% per annum.

Payoff to each alternative:

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Value in 3 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-bill</td>
<td>$1,720,976 \times 1.015 = $1,746,791</td>
</tr>
<tr>
<td>Working capital</td>
<td>$1,720,976 \times 1.020 = $1,755,396</td>
</tr>
<tr>
<td>In the firm</td>
<td>$1,720,976 \times 1.030 = $1,772,605</td>
</tr>
</tbody>
</table>
Transaction Exposure Example: Money Market Hedge

Note that the forward hedge yields $1,754,000 in three months. The money market hedge is superior to the forward hedge if the proceeds are used to replace a dollar loan (8%) or conduct general business operations (12%). If Dayton could only invest in T-bills (6%), the forward hedge would be preferable.

Money Market Hedge: Break-Even Rate of Return

At what annual rate $r$ is the money market hedge equivalent to the forward market hedge?

We want

$$1,720,976 \times \left( 1 + \frac{r}{4} \right) = 1,754,000,$$

which gives

$$r = 4 \times \left( \frac{1,754,000}{1,720,976} - 1 \right) = 7.68\%.$$
More generally, using continuous compounding, let

\[ r \equiv \text{Domestic interest rate (per annum)} \]
\[ \rho \equiv \text{Foreign interest rate (per annum)} \]
\[ T \equiv \text{Period of time until payment is received or made} \]
\[ P \equiv \text{Size of payment, in foreign currency} \]
\[ S \equiv \text{Actual spot rate ($/FC)} \]
\[ F_T \equiv T\text{-forward rate ($/FC)} \]

If \( P \) is to be received at time \( T \), then

\[ Pe^{-\rho T} \]

can be borrowed in foreign currency today. In domestic currency, this means

\[ SPe^{-\rho T} \].
Money Market Hedge: Break-Even Rate of Return

Investing $S P e^{-\rho T}$ in a domestic asset yields

$$S P e^{-\rho T} \times e^{rT} = S P e^{(r-\rho)T}$$

at time $T$. For this money market hedge to be superior to the forward hedge, we need

$$S P e^{(r-\rho)T} > P F_T \iff S e^{(r-\rho)T} > F_T.$$

Money Market Hedge: Break-Even Rate of Return

If the transaction involves a cash outflow at time $T$, then the previous values are costs and the money market hedge is superior to the forward only if

$$S P e^{(r-\rho)T} < P F_T \iff S e^{(r-\rho)T} < F_T.$$
Money Market Hedge: Break-Even Rate of Return

In the last example, we used future values. We could have also used present values. That is, the present value of the money market hedge is \( SPe^{-\rho T} \) and the present value of the forward hedge is \( PF_T e^{-rT} \).

Note that

\[
SPe^{-\rho T} \leq PF_T e^{-rT} \iff Se^{(r-\rho)T} \leq F_T.
\]

Transaction Exposure Example: Options Market Hedge

Dayton could also cover the £1,000,000 exposure by purchasing a put option.

This limits the downside risk while allowing for gains if the pound appreciates.

3-month put option with strike price $1.75/£ sells at a 1.5% premium.
Transaction Exposure Example: Options Market Hedge

Using this notation, the price of the option is

\[ \text{Notional Principal} \times \text{Premium} \times \text{Spot Rate} \]

In the present example, this means

\[ £1,000,000 \times 0.015 \times \frac{1.7640}{£} = £26,460. \]

Transaction Exposure Example: Options market hedge

Because we are using future value to compare the various hedging alternatives, it is necessary to project the cost of the option in 3 months.

Using the firm’s cost of capital, 12% p.a. (3.0% per quarter), the cost of the option as of June will be

\[ £26,460 \times 1.03 = £27,254. \]

The option won’t be exercised if the spot rate in three months is greater than $1.75/£.
Let $S_3$ (in $/£$) denote the spot rate in three months.

The firm’s payoff with this option in three months is then

$$£1,000,000 \times S_3 - $27,254$$ if $S_3 \geq $1.75/£,

$$£1,750,000 - $27,254 = $1,722,746$$ if $S_3 < $1.75/£,

The downside payoff is less than that of the forward or money market hedge, but the upside potential is unlimited.

If, for example, the expected rate of $1.76/£ materializes, the firm’s payoff is

$$£1,000,000 \times $1.76/£ - $27,254 = $1,760,000 - $27,254$$

$$= $1,732,746.$$
Options Market Hedge: Break-Even Spot Rate

What must $S_3$ be for the $1.75/£$ put with 1.5% premium to be more profitable than the forward contract?

\[
£1,000,000 \times S_3 - $27,254 \geq $1,754,000
\]

\[
\Rightarrow S_3 \geq \frac{$1,754,000 + $27,254}{£1,000,000} = $1.7813/£.
\]

Options Market Hedge: Break-Even Spot Rates

What must $S_3$ be for the $1.75/£$ put with 1.5% premium to be more profitable than remaining uncovered?

\[
£1,000,000 \times $1.75/£ - $27,254 \geq $1,000,000 \times S_3
\]

\[
\Rightarrow S_3 \leq \frac{$1,750,000 - $27,254}{£1,000,000} = $1.7227/£.
\]
Dayton, like all firms, must decide on a strategy. Which one to choose?

Two criteria can be utilized to select a strategy:

- Risk tolerance of the firm, as expressed in its stated policies.
- Firm’s own view on the expected direction and distance of the exchange rate.

<table>
<thead>
<tr>
<th>Hedging Strategy</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remain uncovered</td>
<td>unknown ($1,760,000 exp.)</td>
</tr>
<tr>
<td>Forward contract at $1.7540/£</td>
<td>$1,754,000</td>
</tr>
<tr>
<td>Money market hedge at 8% p.a.</td>
<td>$1,755,396</td>
</tr>
<tr>
<td>Money market hedge at 12% p.a.</td>
<td>$1,772,605</td>
</tr>
<tr>
<td>$1.75/£ Put at 1.5%premium</td>
<td></td>
</tr>
<tr>
<td>Minimum if exercised</td>
<td>$1,722,746</td>
</tr>
<tr>
<td>Maximum if not exercised</td>
<td>unlimited</td>
</tr>
</tbody>
</table>
Managing an Account Payable

Suppose now that the £1,000,000 is an account payable in 90 days.

If the firm remains uncovered, then it will pay £1,000,000 × $ \times S_3$ in 90 days, where $S_3$ is the spot rate in $$/£ in 90 days.

If $S_3 = $1.76/£, the firm will pay $1,760,000 but this amount is not certain.

**Forward market hedge:** The firm can purchase a forward contract locking in the $1.754/£ rate, fixing their obligation at $1,754,000.

**Money market hedge:** In the case, the pound liability has to be counterbalanced by a pound asset with the same maturity. Here the firm would exchange US dollars spot and invest the pounds for 90 days.
Managing an A/P–Money Market Hedge

To obtain exactly £1,000,000 in three months at the U.K. lending rate of 8% per annum, the firm must invest

\[ \frac{£1,000,000}{1 + .08 \times \frac{90}{360}} = £980,392.16 . \]

At the current spot rate of $1.7640/£, this means

\[ 980,392.16 \times 1.7640 = $1,729,411.77 . \]

Carrying forward this amount of money at the firm’s cost of capital gives

\[ $1,729,411.77 \times 1.03 = $1,781,294.12 , \]

which is higher than the cost of the forward hedge.
Managing an A/P–Option Hedge

This strategy consists of buying a call option on the payable. Consider a call option with strike price of $1.75/£ and 1.5% premium. The cost of this option is

\[ £1,000,000 \times 0.015 \times $1.75/£ = $26,460. \]

Carrying this amount forward 90 days, at the firm’s cost of capital, gives

\[ $26,460 \times 1.03 = $27,253.80. \]

Managing an A/P–Option Hedge

Let \( S_3 \) denote the spot exchange rate in three months in $/£. Total expense with a $1.75/£ call at a 1.5% premium is

\[ \begin{align*}
$1,750,000 + $27,253.80 &= $1,777,253.80 \quad \text{if } S_3 \geq $1.75/£, \\
£1,000,000 \times S_3 + $27,253.80 &= \text{if } S_3 < $1.75/£,
\end{align*} \]
Strategy Choice and Outcome

<table>
<thead>
<tr>
<th>Hedging Strategy</th>
<th>Outcome (cost)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remain uncovered</td>
<td>unknown ($1,760,000 exp.)</td>
</tr>
<tr>
<td>Forward contract at $1.7540/£</td>
<td>$1,754,000</td>
</tr>
<tr>
<td>Money market hedge</td>
<td>$1,781,294</td>
</tr>
<tr>
<td>$1.75/£ Call at 1.5% premium</td>
<td></td>
</tr>
<tr>
<td>Maximum if exercised</td>
<td>$1,777,253.80</td>
</tr>
<tr>
<td>Minimum if not exercised</td>
<td>$27,253.80</td>
</tr>
</tbody>
</table>

Foreign Currency Accounting

In the example where Dayton manufacturing was selling a turbine to a British firm, the sale would have been recorded at the spot rate prevailing on the date the equipment was shipped to the British buyer. At a spot rate of $1.7640/£, this represents a sale of

\[ £1,000,000 \times $1.7640/£ = $1,764,000. \]

If no hedging takes place, the difference between what was booked and what was received will enter the financial statements as a foreign exchange gain or loss.
For example, if the spot rate at the payment date is $1.7600/£, the foreign exchange loss would be calculated as

\[
\begin{array}{l}
\text{A/R booked at } $1.7640/£ \quad \$1,764,000 \\
\text{A/R settled at } $1.7600/£ \quad \$1,760,000 \\
\text{Foreign exchange gain (loss)} \quad \$4,000
\end{array}
\]

Gains and losses are reported in a firm’s income statement in the period in which they occur.

---

**Accounting for Forward Contracts as Hedges**

Suppose Dayton has entered a forward contract at the rate $1.7540/£, and suppose that the spot exchange rate at the settlement date is $1.7600/£. The details recorded in Dayton’s books would be
**Accounting for Forward Contracts as Hedges**

*Receivable*

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/R booked at $1.7640/£</td>
<td>$1,764,000</td>
</tr>
<tr>
<td>A/R settled at $1.7600/£</td>
<td>$1,760,000</td>
</tr>
<tr>
<td>Foreign exchange gain (loss)</td>
<td>($4,000)</td>
</tr>
</tbody>
</table>

*Forward Contract*

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward contract gain (loss)</td>
<td>($6,000)</td>
</tr>
<tr>
<td>($1,754,000 – $1,760,000)</td>
<td></td>
</tr>
<tr>
<td>Total foreign exchange gain (loss)</td>
<td>($10,000)</td>
</tr>
</tbody>
</table>

---

**Risk Management in Practice**

Which Goals?

The treasury function of most firms is usually considered a cost center; it is not expected to add to the bottom line.

However, in practice some firms’ treasuries have become aggressive in currency management and act as profit centers.
Risk Management in Practice

Which Exposures?
Transaction exposures exist before they are actually booked yet some firms do not hedge this backlog exposure.
However, some firms are selectively hedging these backlog exposures and anticipated exposures.

Risk Management in Practice

Which Contractual Hedges?
Transaction exposure management programs are generally divided along an “option-line”; those which use options and those that do not.
Also, these programs vary in the amount of risk covered; these proportional hedges are policies that state which proportion and type of exposure is to be hedged by the treasury.