

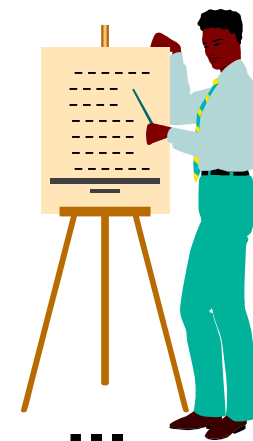
**Topic**

**6**

# International Arbitrage And Interest Rate Parity



# Chapter Objectives



- **To explain the conditions that will result in various forms of international arbitrage, along with the realignments that will occur in response; and**
- **To explain the concept of interest rate parity, and how it prevents arbitrage opportunities.**

# International Arbitrage



- ***Arbitrage*** can be loosely defined as capitalizing on a discrepancy in quoted prices. Often, the funds invested are not tied up and no risk is involved.
- In response to the imbalance in demand and supply resulting from arbitrage activity, prices will realign very quickly, such that no further risk-free profits can be made.

# International Arbitrage



- ***Locational arbitrage*** is possible when a bank's buying price (bid price) is higher than another bank's selling price (ask price) for the same currency.

- ***Example:***

<u>Bank C</u>	<u>Bid</u>	<u>Ask</u>	<u>Bank D</u>	<u>Bid</u>	<u>Ask</u>
NZ\$	\$.635	\$.640	NZ\$	\$.645	\$.650

Buy NZ\$ from Bank C @ \$.640, and sell it to Bank D @ \$.645. Profit = \$.005/NZ\$.

# International Arbitrage



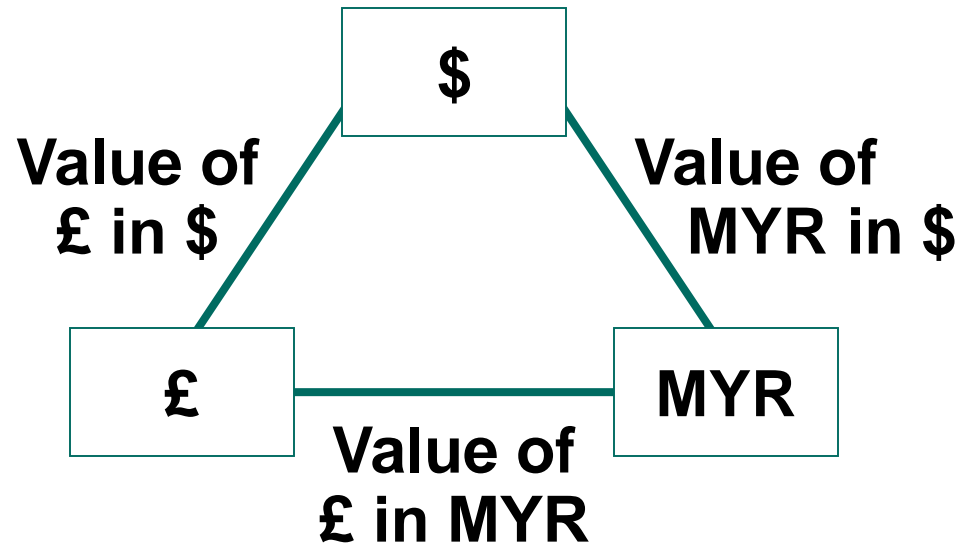
- ***Triangular arbitrage*** is possible when a cross exchange rate quote differs from the rate calculated from spot rates.

- ***Example:***

	<u>Bid</u>	<u>Ask</u>
British pound (£)	\$1.60	\$1.61
Malaysian ringgit (MYR)	\$.200	\$.202
£	MYR8.1	MYR8.2

Buy £ @ \$1.61, convert @ MYR8.1/£, then sell MYR @ \$.200. Profit = \$.01/£. ( $8.1 \times .2 = 1.62$ )

# International Arbitrage



- When the exchange rates of the currencies are not in equilibrium, triangular arbitrage will force them back into equilibrium.

# International Arbitrage



- ***Covered interest arbitrage*** is the process of capitalizing on the interest rate differential between two countries, while covering for exchange rate risk.
- Covered interest arbitrage tends to force a relationship between forward rate premiums and interest rate differentials.

# International Arbitrage



- ***Example:***

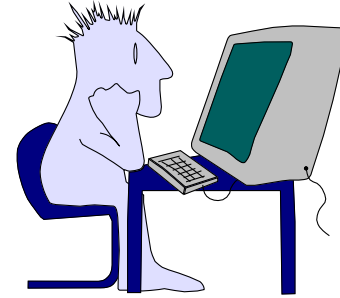
£ spot rate = 90-day forward rate = \$1.60

U.S. 90-day interest rate = 2%

U.K. 90-day interest rate = 2%

Borrow \$ at 3%, or use existing funds which are earning interest at 2%. Convert \$ to £ at \$1.60/£ and engage in a 90-day forward contract to sell £ at \$1.60/£. Lend £ at 4%.

# Online Application



- **Spot exchange rates can be found online at <http://sonnet-financial.com/rates/full.asp>, while forward rates can be found at <http://www.bmo.com/economic/regular/fxrates.html>, and interest rates at <http://www.federalreserve.gov/releases/H15/update/>.**

# International Arbitrage



- **Locational arbitrage ensures that quoted exchange rates are similar across banks in different locations.**
- **Triangular arbitrage ensures that cross exchange rates are set properly.**
- **Covered interest arbitrage ensures that forward exchange rates are set properly.**

# International Arbitrage



- **Any discrepancy will trigger arbitrage, which will then eliminate the discrepancy. Arbitrage thus makes the foreign exchange market more orderly.**

# Interest Rate Parity (IRP)

- Market forces cause the forward rate to differ from the spot rate by an amount that is sufficient to offset the interest rate differential between the two currencies.
- Then, covered interest arbitrage is no longer feasible, and the equilibrium state achieved is referred to as *interest rate parity (IRP)*.

# Derivation of IRP

- When IRP exists, the rate of return achieved from covered interest arbitrage should equal the rate of return available in the home country.

- End-value of a \$1 investment in covered interest arbitrage =  $(1/S) \times (1+i_F) \times F$   
=  $(1/S) \times (1+i_F) \times [S \times (1+p)]$   
=  $(1+i_F) \times (1+p)$

where  $p$  is the forward premium.

# Derivation of IRP

- End-value of a \$1 investment in the home country =  $1 + i_H$
- Equating the two and rearranging terms:

$$p = \frac{(1+i_H)}{(1+i_F)} - 1$$

i.e.

$$\text{forward premium} = \frac{(1 + \text{home interest rate})}{(1 + \text{foreign interest rate})} - 1$$

# Determining the Forward Premium

## *Example:*

- Suppose 6-month  $i_{\text{peso}} = 6\%$ ,  $i_{\$} = 5\%$ .
- From the U.S. investor's perspective,  
forward premium =  $1.05/1.06 - 1 \approx -.0094$
- If  $S = \$.10/\text{peso}$ , then  
6-month forward rate =  $S \times (1 + p)$   
 $\approx .10 \times (1 - .0094)$   
 $\approx \$.09906/\text{peso}$

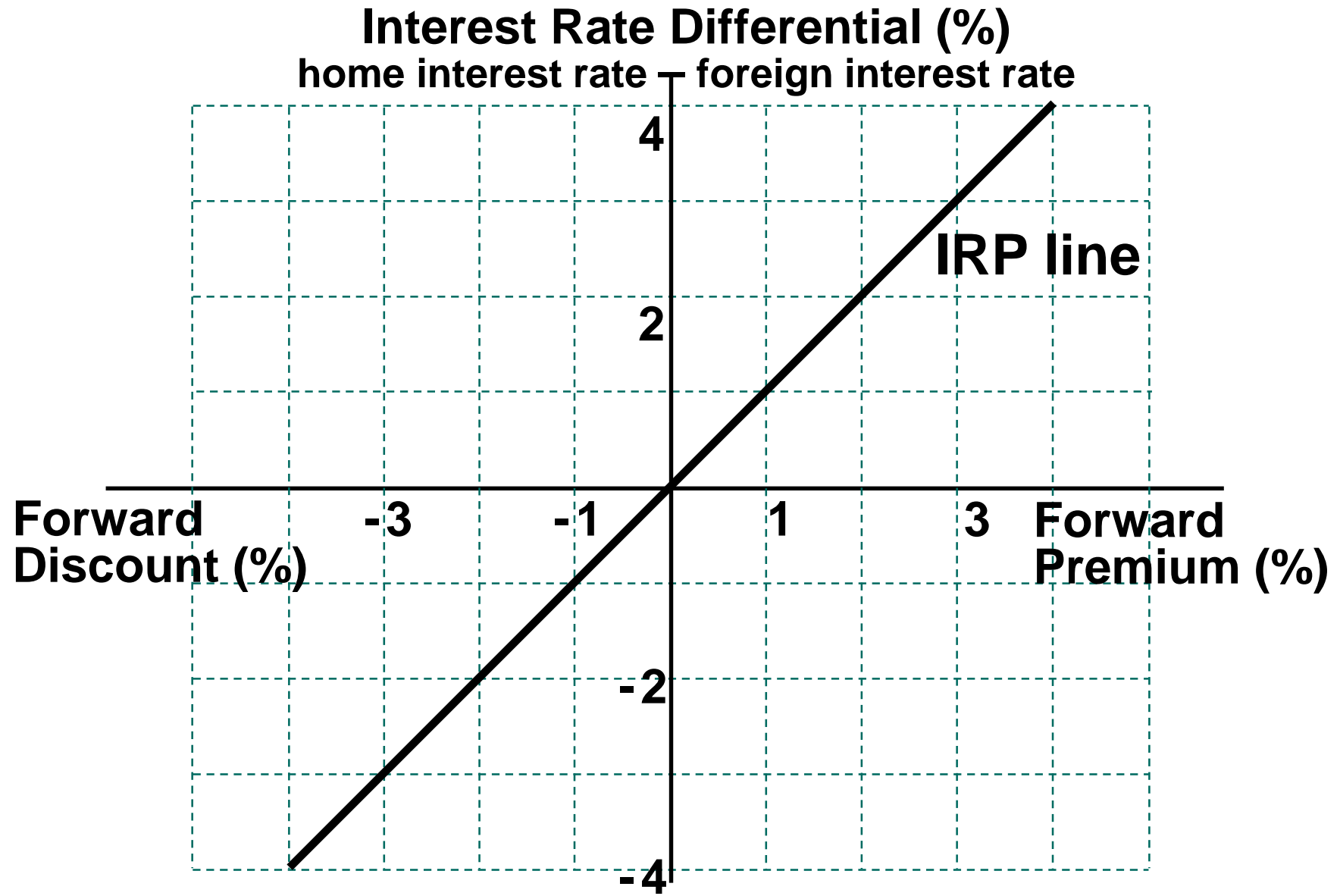
# Determining the Forward Premium

- Note that the IRP relationship can be rewritten as follows:

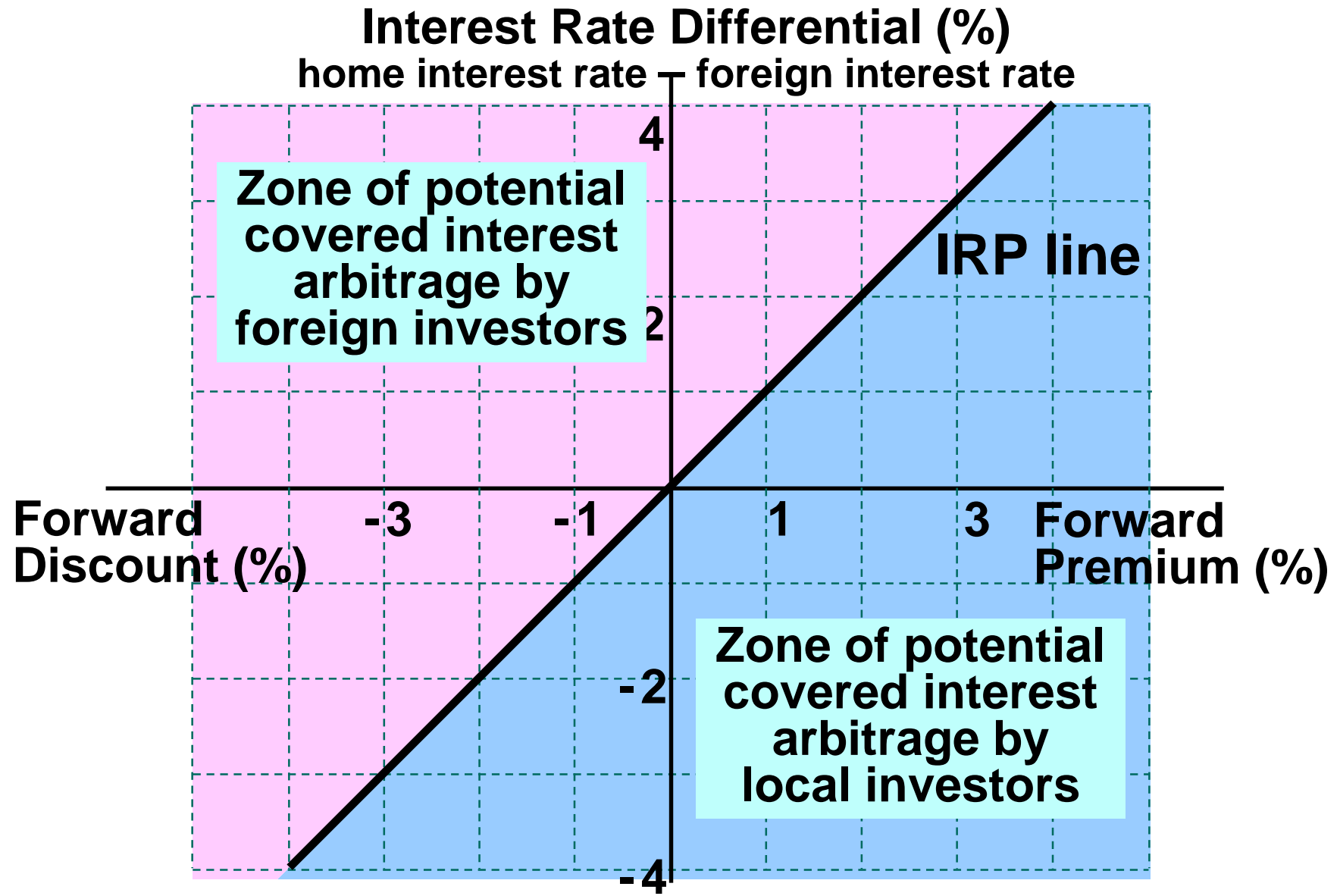
$$\frac{F - S}{S} = \frac{S(1+p) - S}{S} = p = \frac{(1+i_H)}{(1+i_F)} - 1 = \frac{(i_H - i_F)}{(1+i_F)}$$

- The approximated form,  $p \approx i_H - i_F$ , provides a reasonable estimate when the interest rate differential is small.

# Graphic Analysis of Interest Rate Parity



# Graphic Analysis of Interest Rate Parity



# Test for the Existence of IRP

- **To test whether IRP exists, collect the actual interest rate differentials and forward premiums for various currencies. Pair up data that occur at the same point in time and that involve the same currencies, and plot the points on a graph.**
- **IRP holds when covered interest arbitrage is not worthwhile.**

# Interpretation of IRP

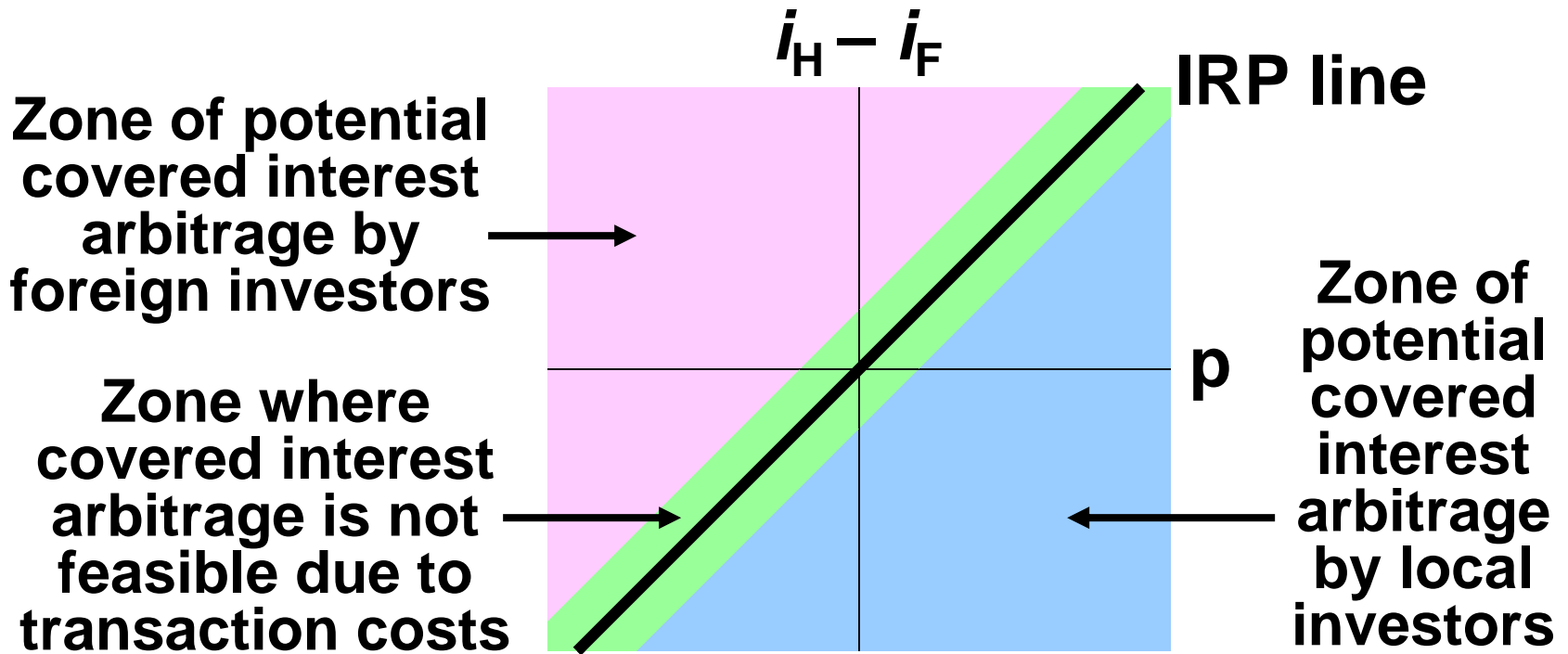
- **When IRP exists, it does not mean that both local and foreign investors will earn the same returns.**
- **What it means is that investors cannot use covered interest arbitrage to achieve higher returns than those achievable in their respective home countries.**

# Does IRP Hold?

- **Various empirical studies indicate that IRP generally holds.**
- **While there are deviations from IRP, they are often not large enough to make covered interest arbitrage worthwhile.**
- **This is due to the characteristics of foreign investments, including transaction costs, political risk, and differential tax laws.**

# Considerations When Assessing IRP

## *Transaction Costs*



# **Considerations When Assessing IRP**

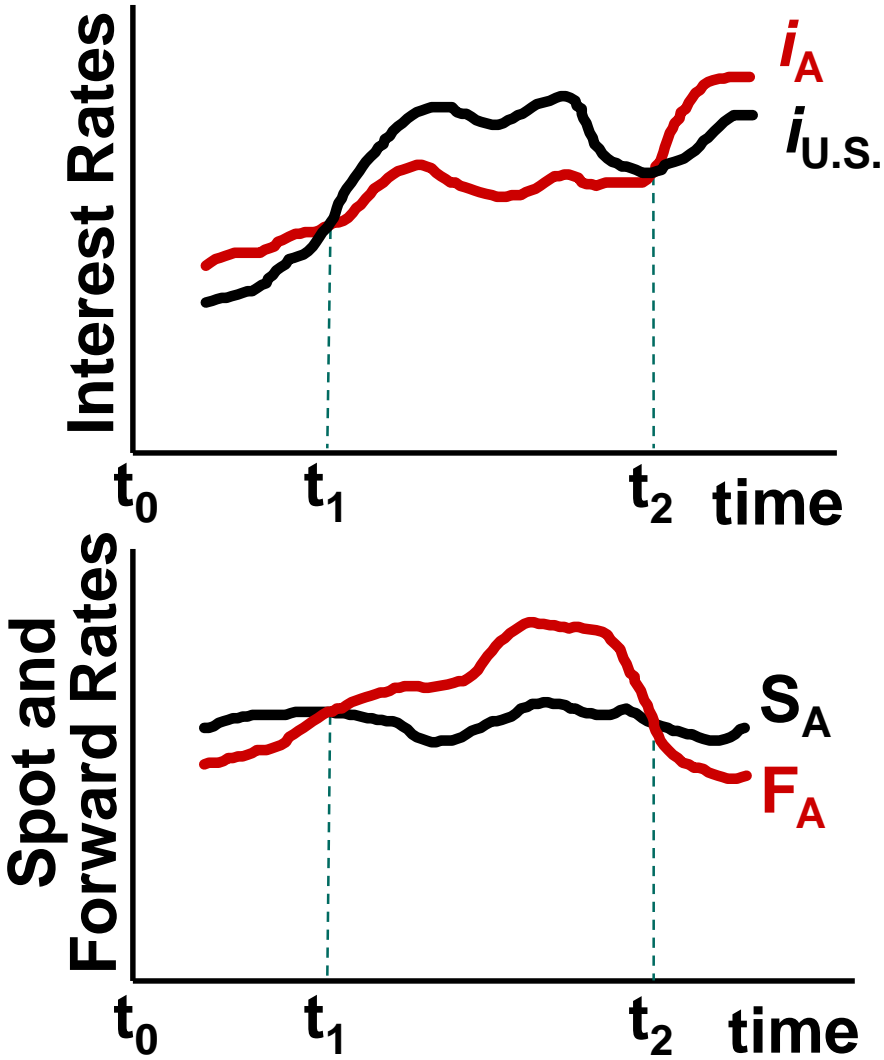
## ***Political Risk***

- ⌘ A crisis in the foreign country could cause its government to restrict any exchange of the local currency for other currencies.
- ⌘ Investors may also perceive a higher default risk on foreign investments.

## ***Differential Tax Laws***

- ⌘ If tax laws vary, after-tax returns should be considered instead of before-tax returns.

# Explaining Changes in Forward Premiums



Because of IRP, a forward rate will normally move in tandem with the spot rate.

This correlation depends on interest rate movements, i.e.  $p \approx i_H - i_F$

# Explaining Changes in Forward Premiums

- **During the 1997-98 Asian crisis, the forward rates offered to U.S. firms on some Asian currencies were substantially reduced for two reasons.**
  - ① **The spot rates of these currencies declined substantially during the crisis.**
  - ② **Their interest rates had increased as their governments attempted to discourage investors from pulling out their funds.**

# Online Application



- Find out more about the 1997-98 Asian financial crisis by visiting <http://www.stern.nyu.edu/globalmacro/>.

# Impact of Arbitrage on an MNC's Value

Forces of Arbitrage

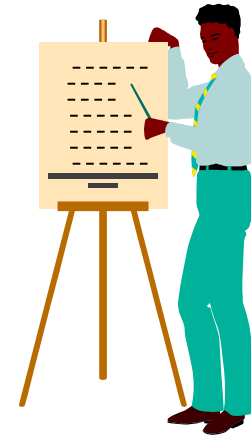
$$\text{Value} = \sum_{t=1}^n \left\{ \frac{\sum_{j=1}^m [E(CF_{j,t}) \times E(ER_{j,t})]}{(1+k)^t} \right\}$$

$E(CF_{j,t})$  = expected cash flows in currency  $j$  to be received by the U.S. parent at the end of period  $t$

$E(ER_{j,t})$  = expected exchange rate at which currency  $j$  can be converted to dollars at the end of period  $t$

$k$  = weighted average cost of capital of the parent

# Chapter Review



- **International Arbitrage**
  - Locational Arbitrage
  - Triangular Arbitrage
  - Covered Interest Arbitrage
  - Comparison of Arbitrage Effects

# Chapter Review

- **Interest Rate Parity (IRP)**
  - Derivation of IRP
  - Determining the Forward Premium
  - Graphic Analysis of IRP
  - Test for the Existence of IRP
  - Interpretation of IRP
  - Does IRP Hold?
  - Considerations When Assessing IRP

# **Chapter Review**

- **Explaining Changes in Forward Premiums**
- **Impact of Arbitrage on an MNC's Value**