Topic 7

# Relationships Between Inflation, Interest Rates, and Exchange Rates

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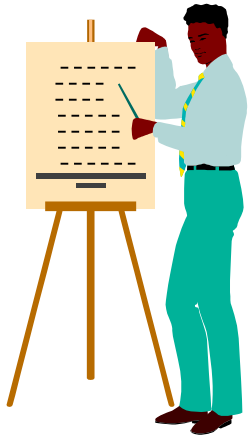
# Chapter Objectives



- To explain the theories of purchasing power parity (PPP) and international Fisher effect (IFE), and their implications for exchange rate changes; and
- To compare the PPP theory, IFE theory, and theory of interest rate parity (IRP).

# Purchasing Power Parity (PPP)

- **When one country's inflation rate rises relative to that of another country, decreased exports and increased imports depress the country's currency.**
- **The theory of *purchasing power parity (PPP)* attempts to quantify this inflation - exchange rate relationship.**

# Interpretations of PPP

- The ***absolute form of PPP***, or the "law of one price," suggests that similar products in different countries should be equally priced when measured in the same currency.
- The ***relative form of PPP*** accounts for market imperfections like transportation costs, tariffs, and quotas. It states that the rate of price changes should be similar.

# Rationale behind PPP Theory

**Suppose U.S. inflation > U.K. inflation.**

**$\Rightarrow \uparrow$ U.S. imports from U.K. and $\downarrow$ U.S. exports to U.K., so £ appreciates.**

**This shift in consumption and the appreciation of the £ will continue until**

**❶ in the U.S., $\text{price}_{\text{U.K. goods}} \geq \text{price}_{\text{U.S. goods}}$, &**

**❷ in the U.K., $\text{price}_{\text{U.S. goods}} \leq \text{price}_{\text{U.K. goods}}$.**

# Derivation of PPP

- **Assume home country's price index ($P_h$) = foreign country's price index ($P_f$)**
- **When inflation occurs, the exchange rate will adjust to maintain PPP:**

$$P_f(1 + I_f)(1 + e_f) = P_h(1 + I_h)$$

**where $I_h$ = inflation rate in the home country**
**$I_f$ = inflation rate in the foreign country**
**$e_f$ = % change in the value of the foreign currency**

# Derivation of PPP

- Since $P_h = P_f$, solving for $e_f$ gives:

$$e_f = \frac{(1 + I_h)}{(1 + I_f)} - 1$$

$\Rightarrow$ If $I_h > I_f$, $e_f > 0$ (foreign currency appreciates)

If $I_h < I_f$, $e_f < 0$ (foreign currency depreciates)

If $I_h = 5\%$ & $I_f = 3\%$, $e_f = 1.05/1.03 - 1 = 1.94\%$

$\Rightarrow$ From the home country perspective, both price indexes rise by 5%.

# Simplified PPP Relationship

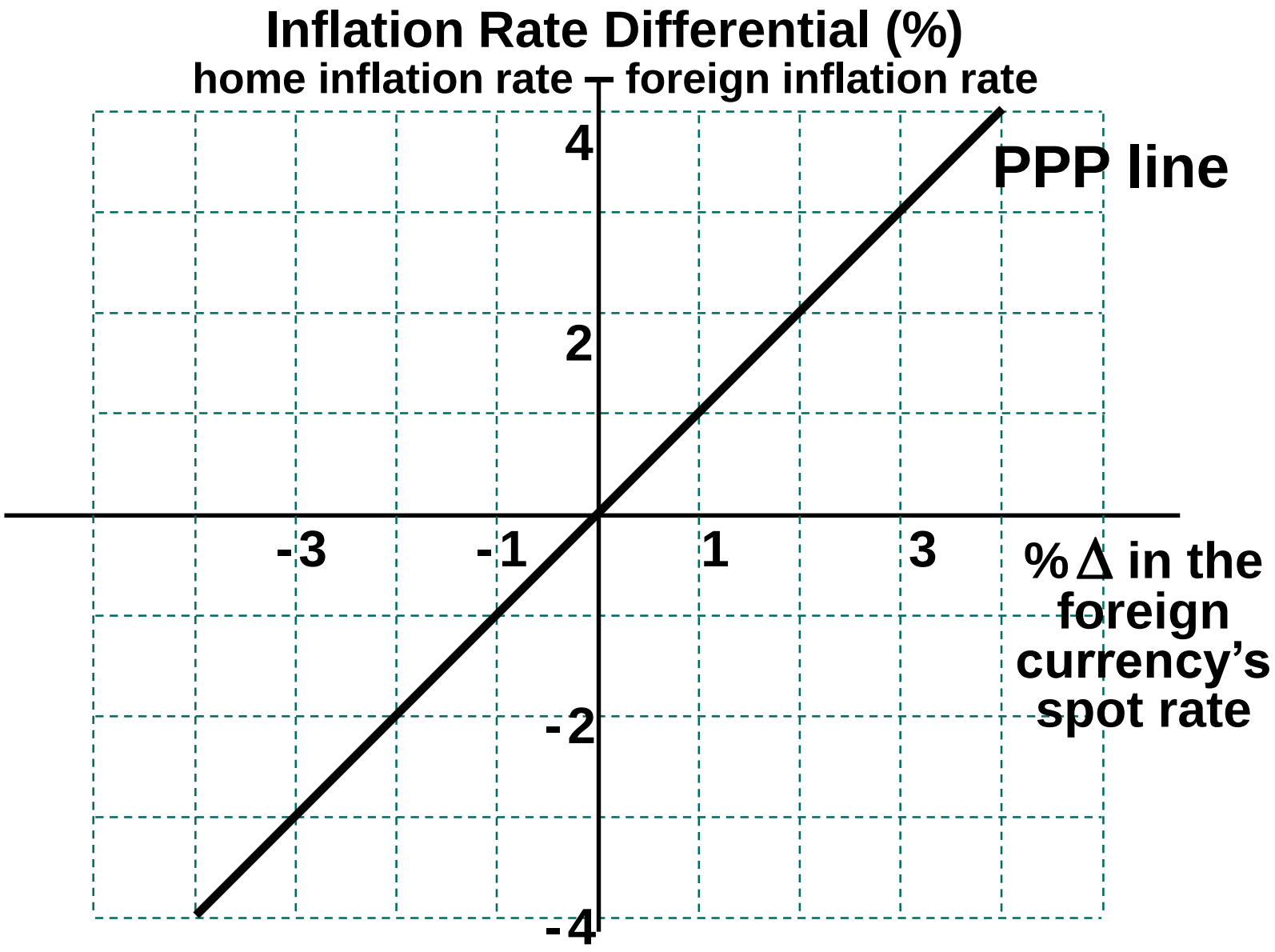
- When the inflation differential is small, the PPP relationship can be simplified as

$$e_f \approx I_h - I_f$$

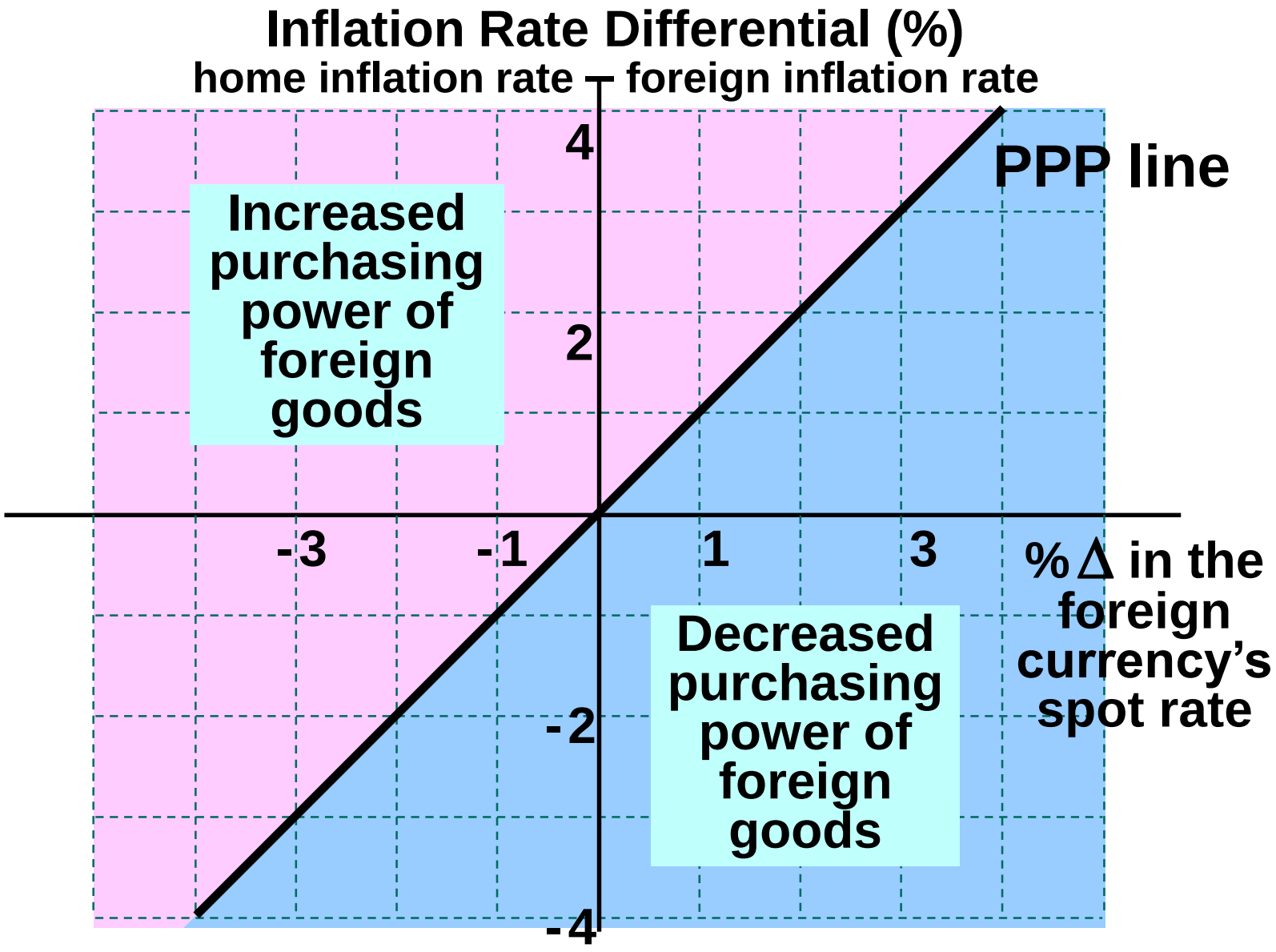
- Suppose $I_{U.S.} = 9\%$, $I_{U.K.} = 5\%$. Then PPP suggests that $e_{£} \approx 4\%$.

  Then, U.K. goods will cost 5+4=9% more to U.S. consumers, while U.S. goods will cost 9-4=5% more to U.K. consumers.

# Graphic Analysis of Purchasing Power Parity



# Graphic Analysis of Purchasing Power Parity



# Testing the PPP Theory

*Conceptual Test*

- **Plot the actual inflation differential and exchange rate % change for two or more countries on a graph.**
- **If the points deviate significantly from the PPP line over time, then PPP does not hold.**

# Testing the PPP Theory

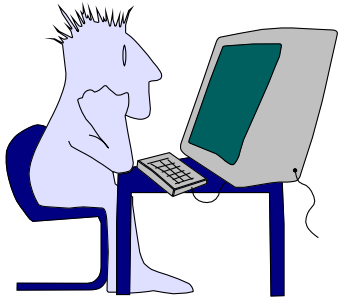
***Statistical Test***

- **Apply regression analysis to the historical exchange rates and inflation differentials:**

$$e_f = a_0 + a_1 \{ (1+I_h)/(1+I_f) - 1 \} + \mu$$

- **The appropriate *t*-tests are then applied to $a_0$ and $a_1$, whose hypothesized values are 0 and 1 respectively.**

# Online Application



- **The Consumer Price Index (CPI) measures inflation as experienced by consumers in their day-to-day living expenses. In the U.S., CPIs are computed by the Bureau of Labor Statistics. Find out more at http://www.bls.gov/cpi/.**

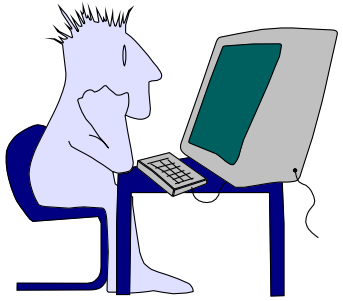
Bureau of Labor Statistics
U.S. Department of Labor

**Latest Numbers**

CPI-U, US City Average, All Items:

- **(NSA)** -0.3% in Oct 2001
- **(SA)** -0.3% in Oct 2001
- **(NSA)** +2.1% since Oct 2000

# Online Application



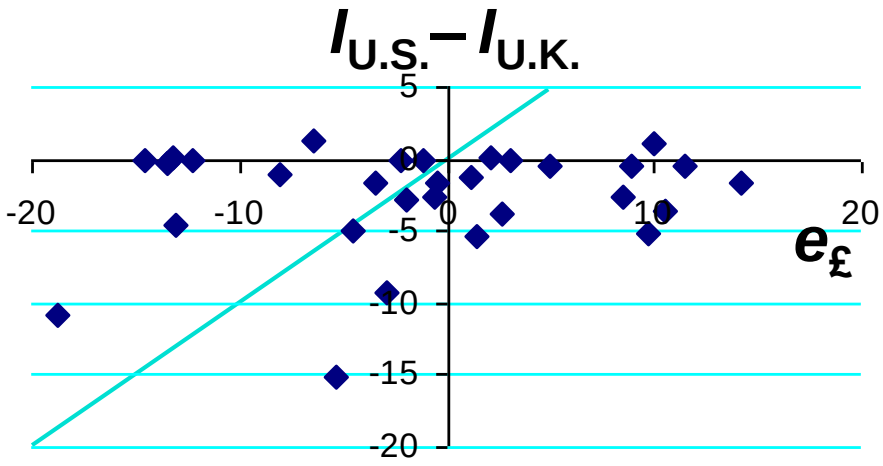
- **Annual percentage changes in inflation can be found in the IMF's World Economic Outlook database at** http://www.imf.org/external/pubs/ft/weo/2001/02/data/index.htm**,**
- **while historical exchange rates can be found at** http://pacific.commerce.ubc.ca/xr/**.**

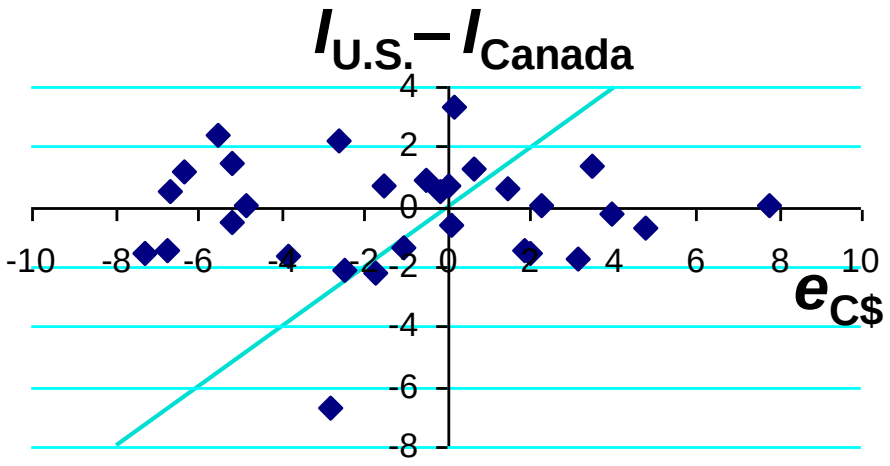
# Testing the PPP Theory

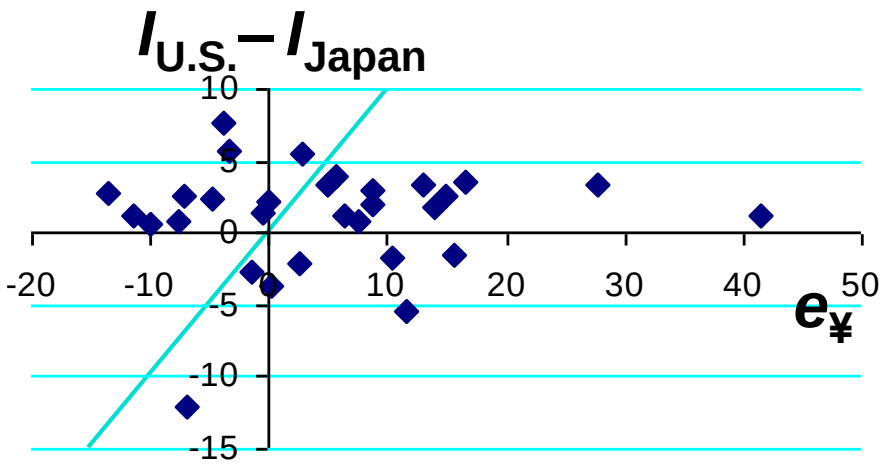
- **Empirical studies indicate that the relationship between inflation differentials and exchange rates is not perfect even in the long run.**
- **However, the use of inflation differentials to forecast long-run movements in exchange rates is supported.**

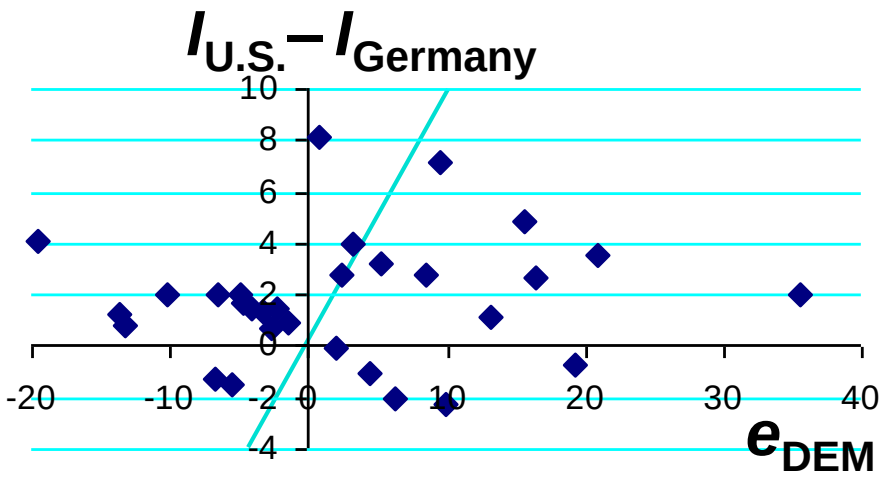
# PPP Tests for Selected Currencies

## Based on annual data for 1971-2000

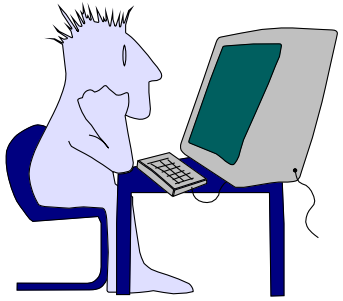


# Online Application



- **Check out the Economist's PPP-based Big Mac index of currencies at** http://www.economist.com/markets/Bigmac/index.cfm**.**
- **Also check out the work undertaken by the OECD and Eurostat on PPPs at** http://www1.oecd.org/std/ppps.htm**.**

# Why PPP Does Not Occur

**PPP may not occur consistently due to:**

❶ **confounding effects, and**

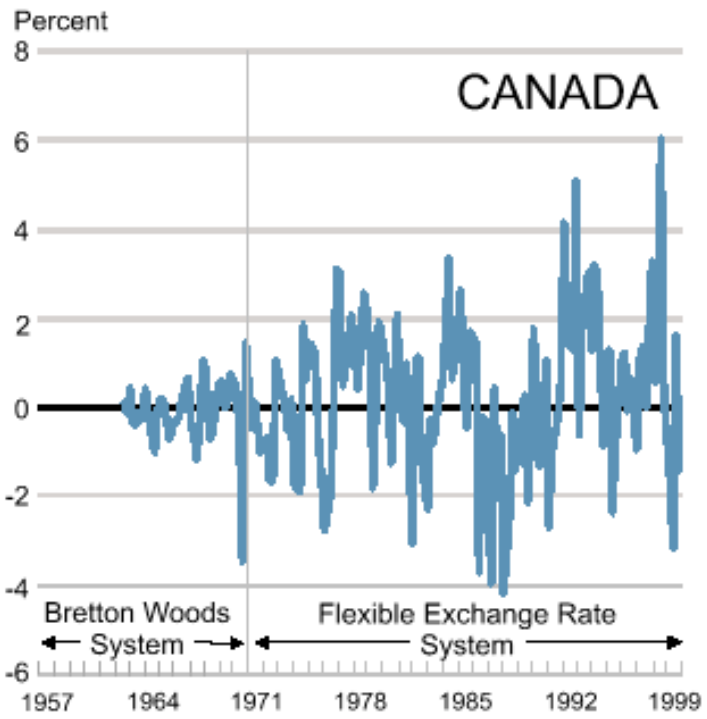
- ¤ Exchange rates are also affected by differentials in interest rates, income levels, and risk, as well as government controls.

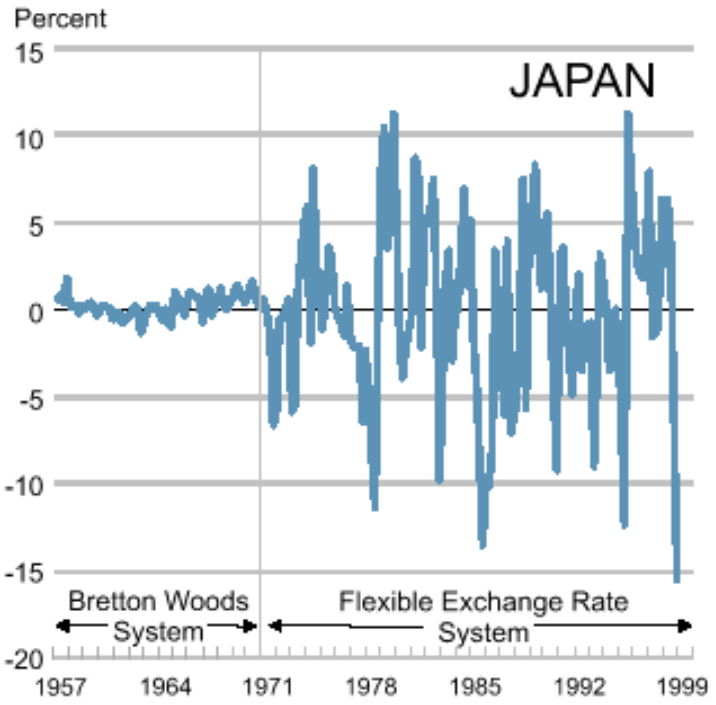
❷ **lack of substitutes for traded goods.**

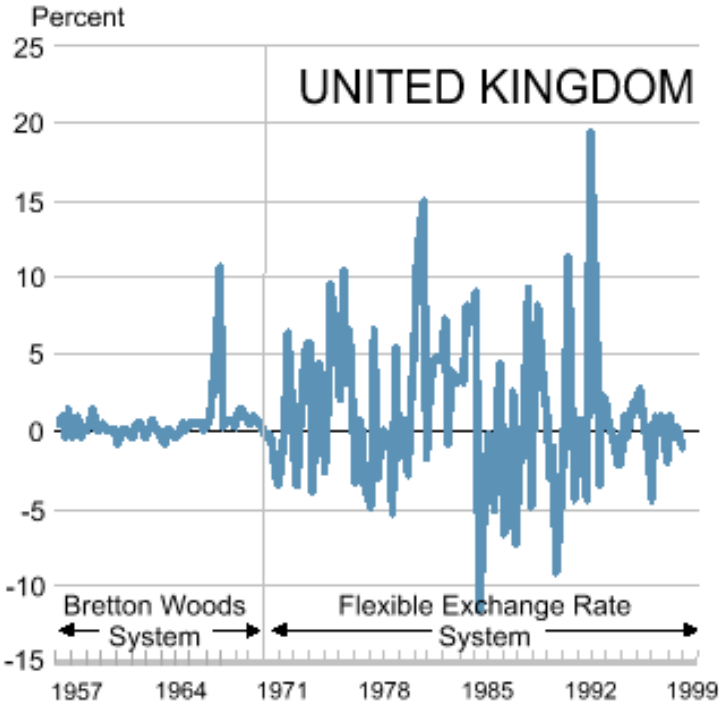
# PPP in the Long Run

- **PPP can be tested by assessing a "real" exchange rate over time.**
  - The real exchange rate is the actual exchange rate adjusted for inflationary effects in the two countries of concern.
- **If this rate reverts to some mean level over time, this would suggest that it is constant in the long run.**

# Quarterly Growth Rates of Real Exchange Rates



# International Fisher Effect (IFE)

- **According to the *Fisher effect*, nominal risk-free interest rates contain a real rate of return and an anticipated inflation.**
- **If the same real return is required, differentials in interest rates may be due to differentials in expected inflation.**
- **According to PPP, exchange rate movements are caused by inflation rate differentials.**

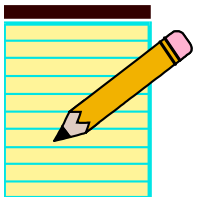
# International Fisher Effect (IFE)

- **The *international Fisher effect (IFE)* theory suggests that currencies with higher interest rates will depreciate because the higher rates reflect higher expected inflation.**
- **Hence, investors hoping to capitalize on a higher foreign interest rate should earn a return no better than what they would have earned domestically.**

# International Fisher Effect (IFE)

| Investors Residing in | Attempt to Invest in | $i_h$ | $i_f$ | $e_f$ | Return in Home Currency | $I_h$ | Real Return Earned |
|---|---|---|---|---|---|---|---|
| Japan | Japan | 5% | 5% | 0% | 5% | 3% | 2% |
| | U.S. | 5 | 8 | - 3 | 5 | 3 | 2 |
| | Canada | 5 | 13 | - 8 | 5 | 3 | 2 |
| U.S. | Japan | 8 | 5 | 3 | 8 | 6 | 2 |
| | U.S. | 8 | 8 | 0 | 8 | 6 | 2 |
| | Canada | 8 | 13 | - 5 | 8 | 6 | 2 |
| Canada | Japan | 13 | 5 | 8 | 13 | 11 | 2 |
| | U.S. | 13 | 8 | 5 | 13 | 11 | 2 |
| | Canada | 13 | 13 | 0 | 13 | 11 | 2 |

# Derivation of the IFE

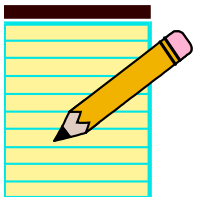


- **According to the IFE, E($r_f$), the expected effective return on a foreign money market investment, should equal $r_h$, the effective return on a domestic investment.**
- $r_f = (1 + i_f)(1 + e_f) - 1$

  $i_f$ = interest rate in the foreign country

  $e_f$ = % change in the foreign currency's value
- **$r_h = i_h$ = interest rate in the home country**

# Derivation of the IFE



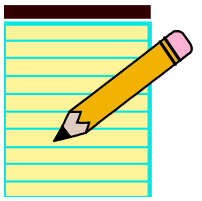
- Setting $r_f = r_h$ : $(1 + i_f)(1 + e_f) - 1 = i_h$
- Solving for $e_f$ : $$e_f = \frac{(1 + i_h)}{(1 + i_f)} - 1$$

$\Rightarrow$ If $i_h > i_f$, $e_f > 0$ (foreign currency appreciates)
If $i_h < i_f$, $e_f < 0$ (foreign currency depreciates)

If $i_h = 8\%$ & $i_f = 9\%$, $e_f = 1.08/1.09 - 1 = -.92\%$

$\Rightarrow$ This will make the return on the foreign investment equal to the domestic return.

# Derivation of the IFE

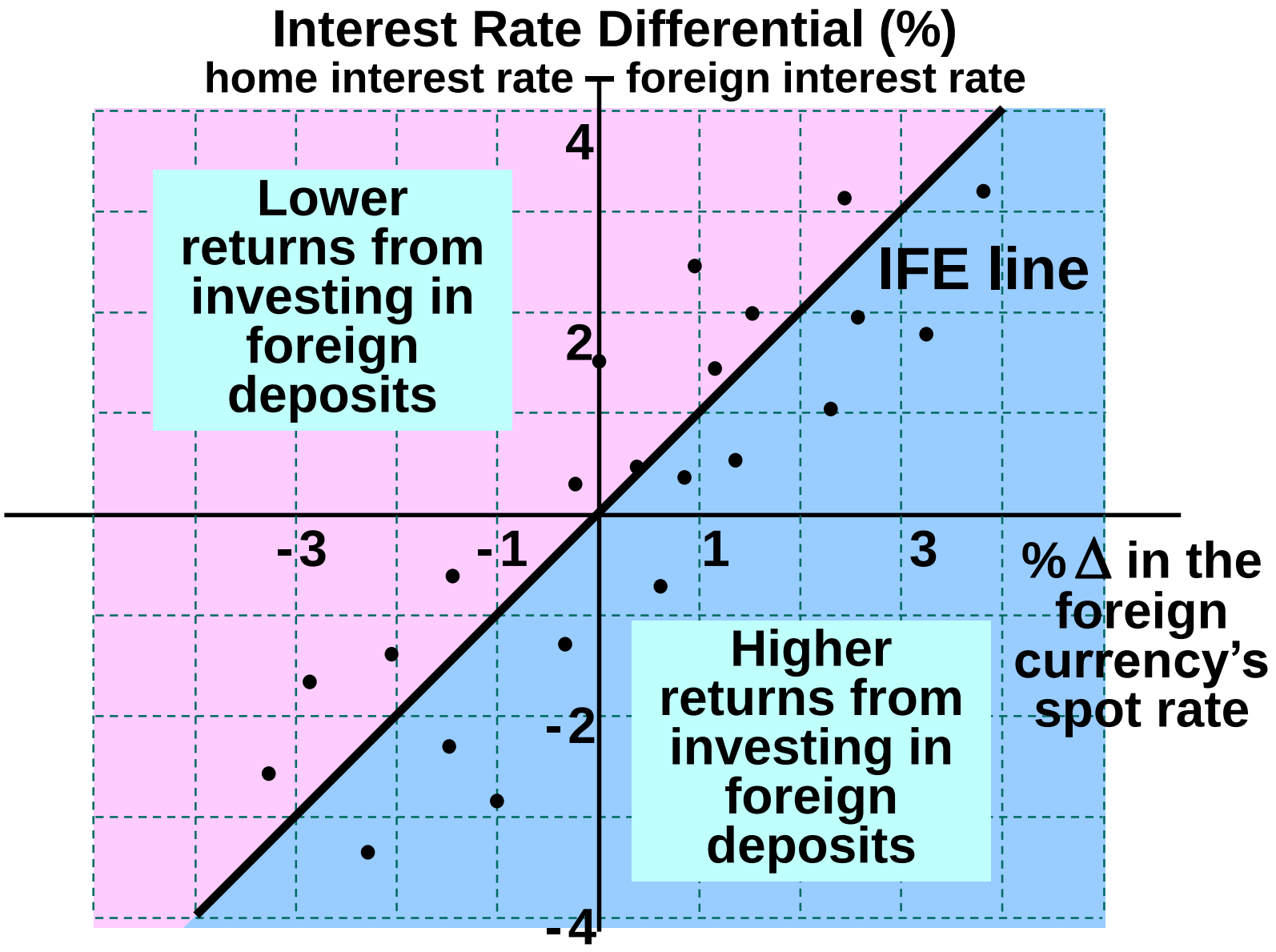


- When the interest rate differential is small, the IFE relationship can be simplified as

$$e_f \approx i_h - i_f$$

- If the British rate on 6-month deposits were 2% above the U.S. interest rate, the £ should depreciate by approximately 2% over 6 months. Then U.S. investors would earn about the same return on British deposits as they would on U.S. deposits.

# Graphic Analysis of the International Fisher Effect



# Graphic Analysis of the IFE

- **The point of the IFE theory is that if a firm periodically tries to capitalize on higher foreign interest rates, it will achieve a yield that is sometimes above and sometimes below the domestic yield.**
- **On the average, the firm would achieve a yield similar to that by a corporation that makes domestic deposits only.**

# Tests of the IFE

- **If the actual points of interest rates and exchange rate changes are plotted over time on a graph, we can see whether the points are evenly scattered on both sides of the IFE line.**
- **Empirical studies indicate that the IFE theory holds during some time frames. However, there is also evidence that it does not consistently hold.**

# Tests of the IFE

- **A statistical test can be developed by applying regression analysis to the historical exchange rates and nominal interest rate differentials:**

$$e_f = a_0 + a_1 \{ (1+i_h)/(1+i_f) - 1 \} + \mu$$

- **The appropriate *t*-tests are then applied to $a_0$ and $a_1$, whose hypothesized values are 0 and 1 respectively.**

# Why the IFE Does Not Occur

- **Since the IFE is based on PPP, it will not hold when PPP does not hold.**
- **For example, if there are factors other than inflation that affect exchange rates, the rates will not adjust in accordance with the inflation differential.**

# Application of the IFE to the Asian Crisis

- **According to the IFE, the high interest rates in Southeast Asian countries before the Asian crisis should not attract foreign investment because of exchange rate expectations.**
- **However, since some central banks were maintaining their currencies within narrow bands, some foreign investors were motivated.**

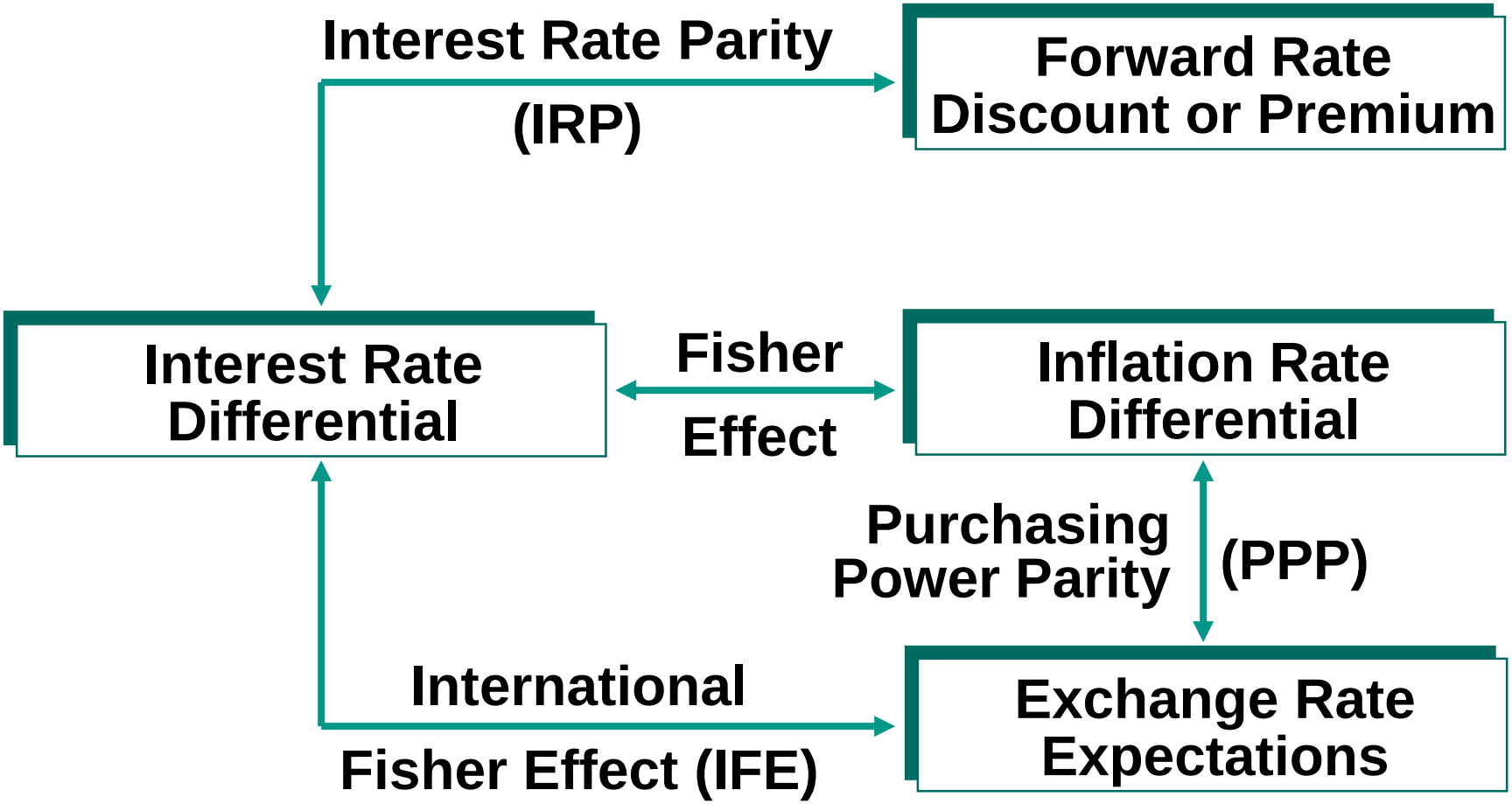
# Application of the IFE to the Asian Crisis

- **Unfortunately for these investors, the efforts made by the central banks to stabilize the currencies were overwhelmed by market forces.**
- **In essence, the depreciation in the Southeast Asian currencies wiped out the high level of interest earned.**

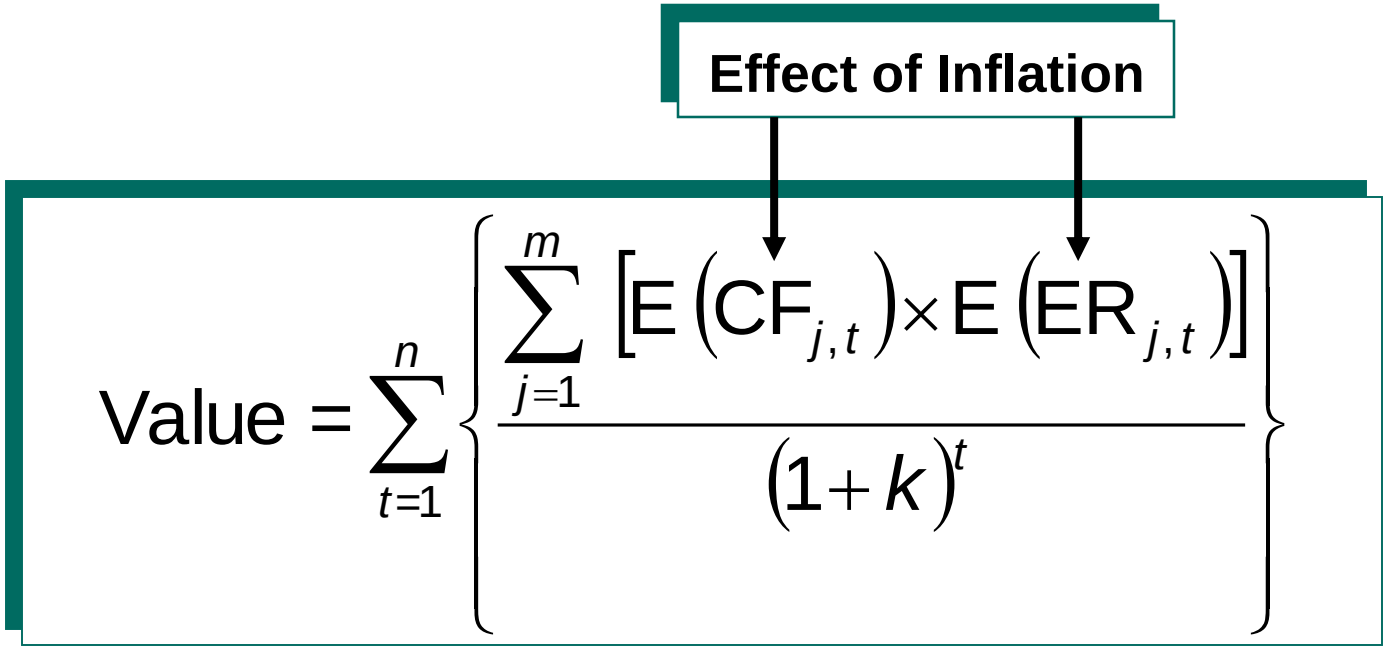
# Online Application

- **Forecasts/consensus for various exchange rates, interest rates, and inflation rates can be found at http://biz.yahoo.com/ifc/.**

# Comparison of IRP, PPP, and IFE Theories



# Impact of Inflation on an MNC's Value

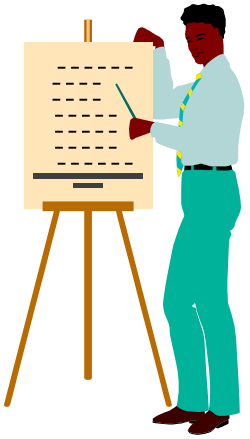



**$E(CF_{j,t})$ = expected cash flows in currency *j* to be received by the U.S. parent at the end of period *t***

**$E(ER_{j,t})$ = 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



- **Purchasing Power Parity (PPP)**
  - Interpretations of PPP
  - Rationale behind PPP Theory
  - Derivation of PPP
  - Using PPP to Estimate Exchange Rate Effects
  - Simplified PPP Relationship
  - Graphic Analysis of PPP

# Chapter Review

- **Purchasing Power Parity (PPP) … continued**
  - Testing the PPP Theory
  - Why PPP Does Not Occur
  - PPP in the Long Run

# Chapter Review

- **International Fisher Effect (IFE)**
  - Derivation of the IFE
  - Graphic Analysis of the IFE
  - Tests of the IFE
  - Why the IFE does Not Occur
  - Application of the IFE to the Asian Crisis
- **Comparison of IRP, PPP, and IFE Theories**
- **Impact of Foreign Inflation on the Value of the MNC**