Chapter 8

Relationships among Inflation, Interest Rates, and Exchange Rates

International Finance Theories (cont)

- Purchasing Power Parity (PPP): At equilibrium, the future spot rate of a foreign currency will differ (in %) from the current spot rate by an amount that equals (in %) the inflation differential between the home and foreign countries.
- International Fisher Effect (IFE): At equilibrium, the future spot rate of a foreign currency will differ (in %) from the current spot rate by an amount that equals (in %) the nominal interest rate differential between the home and foreign countries

Chapter Objectives

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

Purchasing Power Parity (PPP)

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

Interpretations of PPP

- The absolute form of PPP is an extension of the law of one price. It suggests that the prices of the same products in different countries should be equal when measured in a common currency.
- The relative form of PPP accounts for market distortions like transportation costs, tariffs, taxes, and quotas. It states that the rate of price changes should be similar.

Rationale behind PPP Theory

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

⇒ ↑ U.S. imports from U.K. and

↓ U.S. exports to U.K.

⇒ Upward pressure is placed on the £.

This shift in consumption and the £'s appreciation 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 that PPP holds.

Over time, as inflation occurs exchange rates adjusts to maintain PPP:

$P_{h1} \rightarrow P_{h0}(1 + I_h)$

Where P_{h1}=home country's price index, year-1 end

I_h =home country's inflation rate for the year

$P_{f1} \rightarrow P_{f0}(1 + I_f)(1 + e_f)$

where P_f = foreign country's price index

I_f = foreign country's inflation rate

e_f = foreign currency's % Δ in value

Derivation of PPP

PPP holds $\Rightarrow$ $P_{h1} = P_{f1}$ and

$P_{h0}\,(1 + I_h) = P_{f0}\,(1 + I_f)\,(1 + e_f)$

Solving for e_f : $e_f =$

$I_h > I_f \Rightarrow e_f > 0$ i.e. foreign currency appreciates

$I_h < I_f \Rightarrow e_f < 0$ i.e. foreign currency depreciates

Example: Suppose $I_{U.S.} = 9\%$ and $I_{U.K.} = 5\%$.

Then $$e_{U.K.} = \frac{(1 + .09)}{(1 + .05)} - 1 = 3.81\%$$

Simplified PPP Relationship

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

$$e_f \cong I_h - I_f$$

<u>Example</u>: **Suppose $I_{\text{U.S.}}$ = 9% and $I_{\text{U.K.}}$ = 5% .**

Then $e_{\text{U.K.}} \cong 9 - 5 = 4\%$

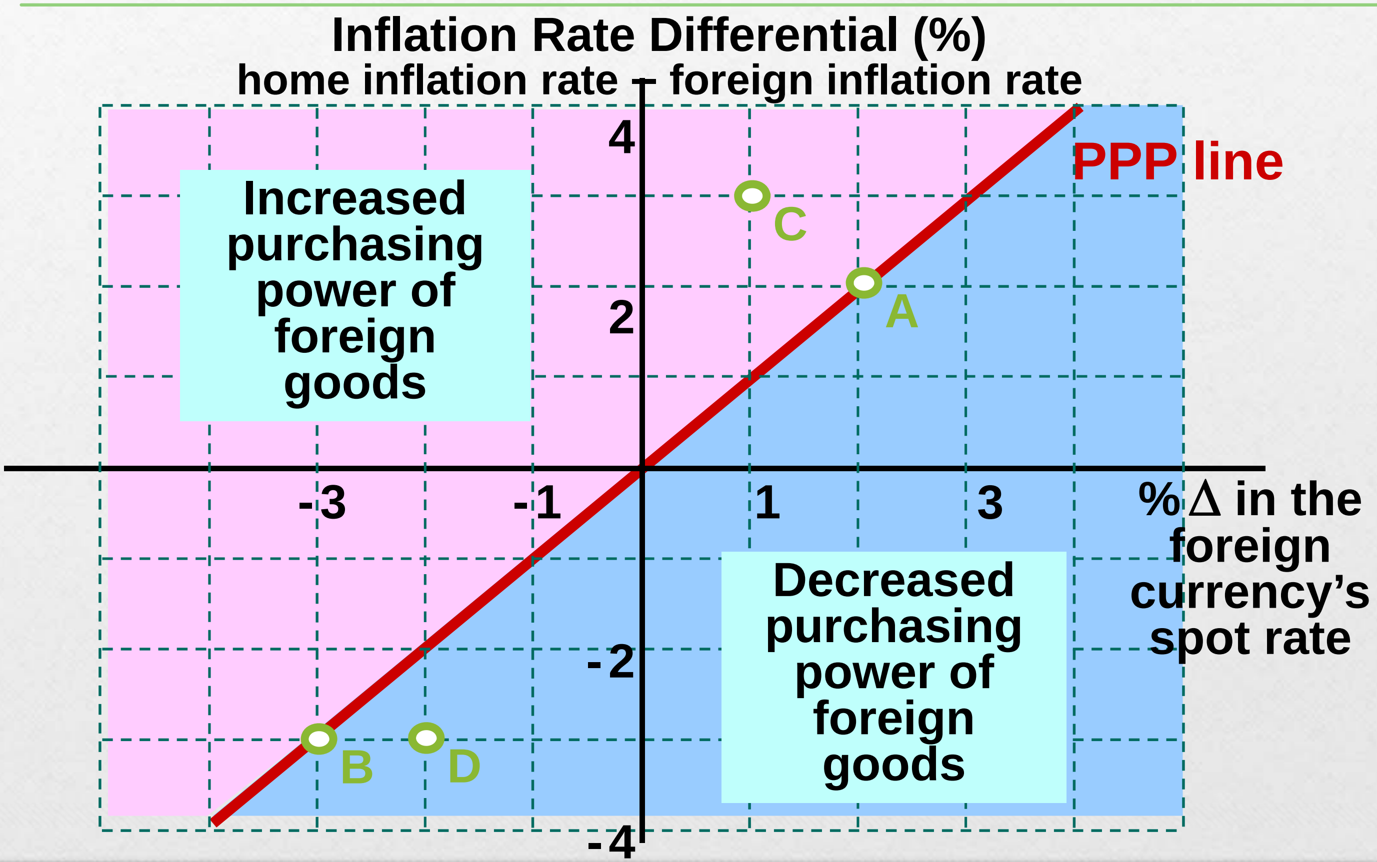
U.S. consumers: $\Delta P_{\text{U.S.}} = I_{\text{U.S.}} = 9\%$

$\Delta P_{\text{U.K.}} = I_{\text{U.K.}} + e_{\text{U.K.}} = 9\%$

U.K. consumers: $\Delta P_{\text{U.K.}} = I_{\text{U.K.}} = 5\%$

$\Delta P_{\text{U.S.}} = I_{\text{U.S.}} - e_{\text{U.K.}} = 5\%$

Graphic Analysis of Purchasing Power Parity



Testing the PPP Theory

Conceptual Test

- Plot actual inflation differentials and exchange rate % changes 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 historical exchange rates and inflation differentials:

$$e_f = a_0 + a_1 [\, (1+I_h)/(1+I_f) - 1 \,] + \mu$$

- Then apply *t*-tests to the regression coefficients. (Test for $a_0 = 0$ and $a_1 = 1$.)
- If any coefficient differs significantly from what was expected, PPP does not hold.

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.
- A limitation in the tests is that the choice of the base period will affect the result.

Why PPP Does Not Occur

PPP does not occur consistently due to:

❶ confounding effects

- Exchange rates are also affected by differences in inflation, interest rates, income levels, government controls and expectations of future rates.

❷ a lack of substitutes for some 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 the real exchange rate follows a random walk, it cannot be viewed as being a constant in the long run. Then PPP does not hold.

The Big Mac Index

THE Big Mac Index was invented by *The Economist* in 1986 as a lighthearted guide to whether currencies are at their “correct” level. It is based on the theory of purchasing-power parity (PPP), the notion that in the long run exchange rates should move towards the rate that would equalize the prices of an identical basket of goods and services (in this case, a burger) in any two countries. For example, the average price of a Big Mac in America in January 2015 was $4.79; in China it was only $2.77 at market exchange rates. So the "raw" Big Mac index says that the yuan was undervalued by 42% at that time.

http://www.economist.com/content/big-mac-index

International Fisher Effect (IFE)

- According to the Fisher effect, nominal risk-free interest rates contain a real rate of return and anticipated inflation

  $i_n = i_r + \text{inflation}$

- If all investors require the same real return, differentials in interest rates may be due to differentials in expected inflation.
- Recall that PPP theory suggests that 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 nominal rates reflect higher expected inflation.
- Hence, investors hoping to capitalize on a higher foreign interest rate should earn a return no higher than what they would have earned domestically.

International Fisher Effect (IFE)

Investors Residing in	Attempt to Invest in	I_h	I_f	e_f	i_f	Return in Home Currency	I_h	Real Return Earned
Japan	Japan	3 %	3 %	0 %	5%	5 %	3 %	2 %
	U.S.	3	6	–3	8	5	3	2
	Canada	3	11	–8	13	5	3	2
U.S.	Japan	6	3	3	5	8	6	2
	U.S.	6	6	0	8	8	6	2
	Canada	6	11	–5	13	8	6	2
Canada	Japan	11	3	8	5	13	11	2
	U.S.	11	6	5	8	13	11	2
	Canada	11	11	0	13	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 : $$e_f = \frac{(1 + i_h)}{(1 + i_f)} - 1$$

- **$i_h > i_f \Rightarrow e_f > 0$ i.e. foreign currency appreciates $i_h < i_f \Rightarrow e_f < 0$ i.e. foreign currency depreciates**

<u>Example</u>: **Suppose $i_{U.S.} = 11\%$ and $i_{U.K.} = 12\%$.**

Then $$e_{U.K.} = \frac{(1 + .11)}{(1 + .12)} - 1 = -.89\%.$$

This will make $r_f = r_h$.

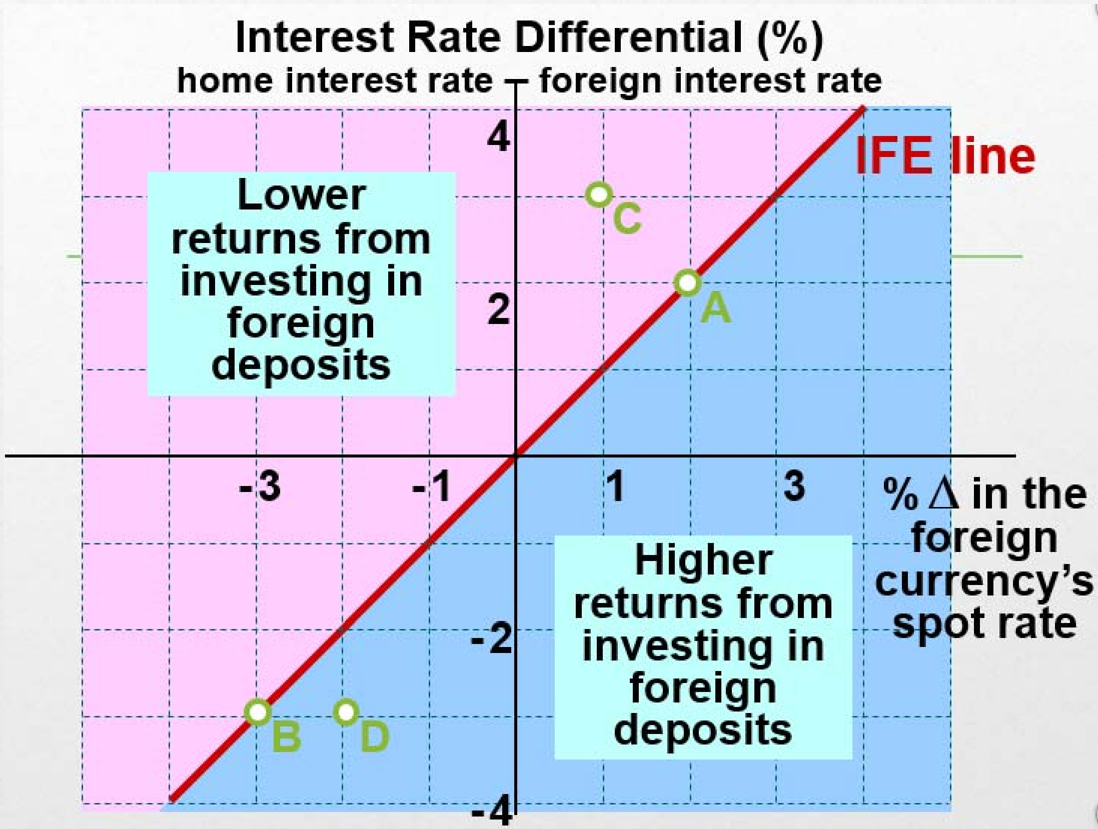
Derivation of the IFE

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

$$e_f \cong i_h - i_f$$

- **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



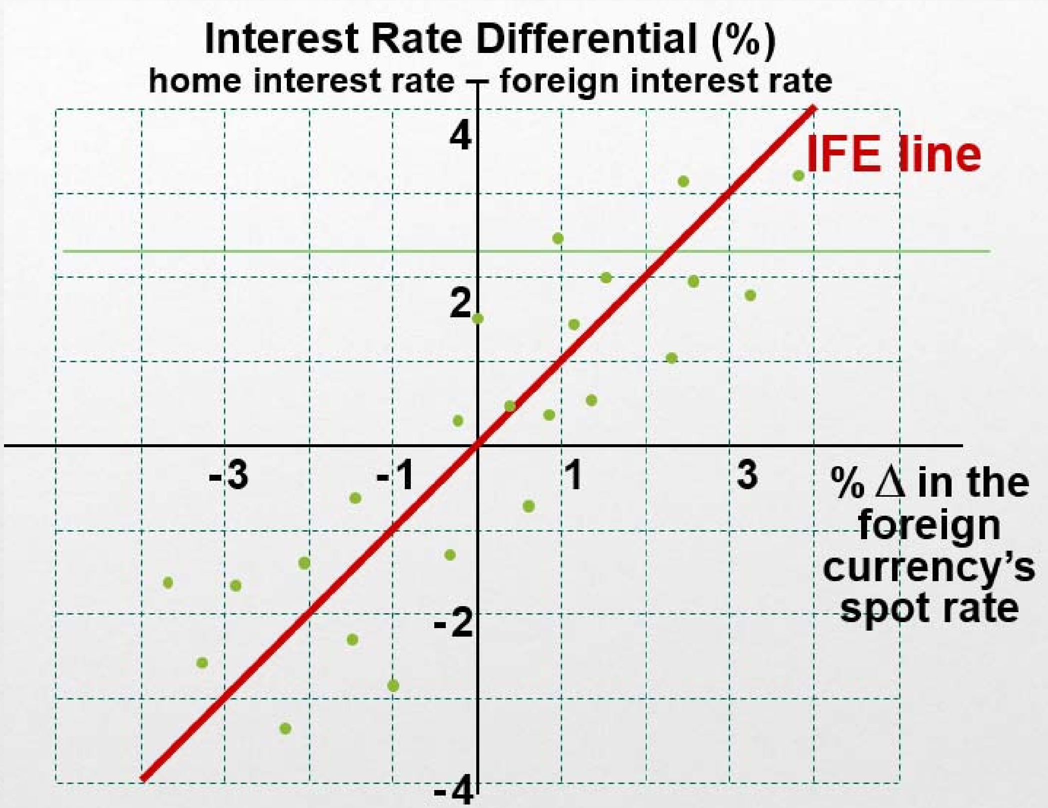
Graphic Analysis of the IFE

- 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 average, the yield achieved by the firm would be similar to that achieved by another firm that makes domestic deposits only.

Tests of the IFE

- If actual 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 hold consistently.

Tests of the International Fisher Effect



Tests of the IFE

- To test the IFE statistically, apply regression analysis to historical exchange rates and nominal interest rate differentials:

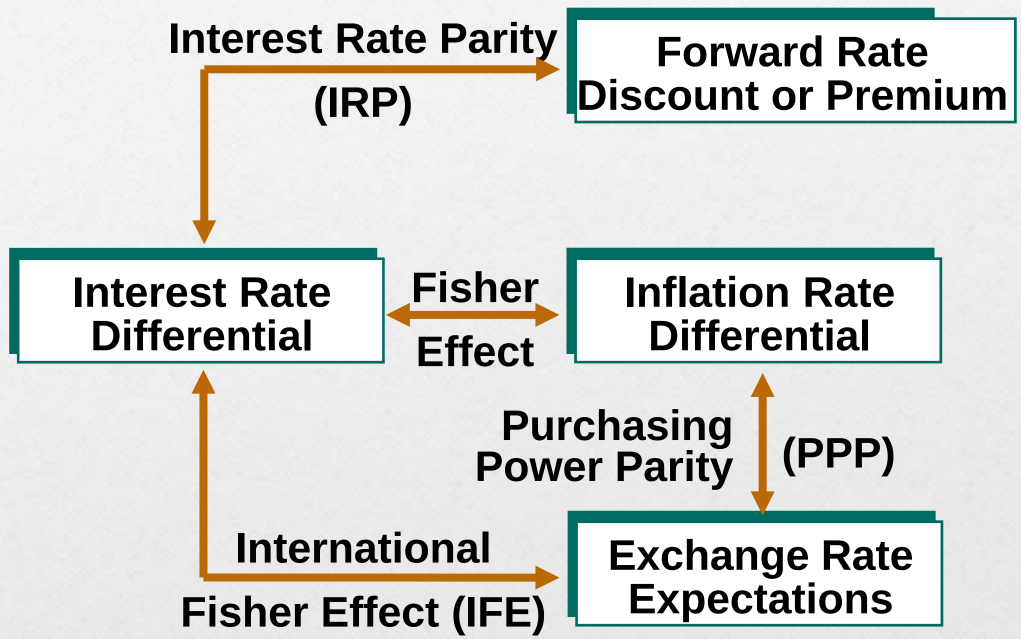
$$e_f = a_0 + a_1 [(1+i_h)/(1+i_f) - 1] + \mu$$

- Then apply *t*-tests to the regression coefficients. (Test for $a_0 = 0$ and $a_1 = 1$.)
- IFE does not hold if any coefficient differs significantly from what was expected.

Why the IFE Does Not Occur

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

Comparison of the IRP, PPP, and IFE Theories



Comparison of the IRP, PPP, and IFE Theories

Interest rate parity

Forward rate premium p
Interest rate differential $i_h - i_f$

$$p = \frac{(1+i_h)}{(1+i_f)} - 1 \cong i_h - i_f$$

Purchasing power parity

% Δ in spot exchange rate e_f
Inflation rate differential $I_h - I_f$

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

International Fisher effect

% Δ in spot exchange rate e_f
Interest rate differential $i_h - i_f$

$$e_f = \frac{(1+i_h)}{(1+i_f)} - 1 \cong i_h - i_f$$