

International Parity  
Relationships & Forecasting  
Exchange Rates

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Chapter Objective:

This chapter examines several key international parity relationships, such as interest rate parity and purchasing power parity.

# Chapter Outline

- Interest Rate Parity
- Purchasing Power Parity
- The Fisher Effects
- Forecasting Exchange Rates

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- Interest Rate Parity
  - Covered Interest Arbitrage
  - IRP and Exchange Rate Determination
  - Reasons for Deviations from IRP
- Purchasing Power Parity
- The Fisher Effects
- Forecasting Exchange Rates

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- Interest Rate Parity
- Purchasing Power Parity
  - PPP Deviations and the Real Exchange Rate
  - Evidence on Purchasing Power Parity
- The Fisher Effects
- Forecasting Exchange Rates

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- Interest Rate Parity
- Purchasing Power Parity
- The Fisher Effects
- Forecasting Exchange Rates
  - Efficient Market Approach
  - Fundamental Approach
  - Technical Approach
  - Performance of the Forecasters

# Interest Rate Parity

- Interest Rate Parity Defined
- Covered Interest Arbitrage
- Interest Rate Parity & Exchange Rate Determination
- Reasons for Deviations from Interest Rate Parity

# Interest Rate Parity Defined

- IRP is an *arbitrage* condition.
- If IRP did not hold, then it would be possible for an astute trader to make unlimited amounts of money exploiting the arbitrage opportunity.
- Since we don't typically observe persistent arbitrage conditions, we can safely assume that IRP holds.

# Interest Rate Parity Defined

Suppose you have \$100,000 to invest for one year.

You can either

1. invest in the U.S. at  $i_{\$}$ . Future value =  $\$100,000(1 + i_{us})$
2. trade your dollars for yen at the spot rate, invest in Japan at  $i_{¥}$  and hedge your exchange rate risk by selling the future value of the Japanese investment forward. The future value =  $\$100,000(F/S)(1 + i_{¥})$

Since both of these investments have the same risk, they must have the same future value—otherwise an arbitrage would exist.

$$(F/S)(1 + i_{¥}) = (1 + i_{us})$$

# Interest Rate Parity Defined

Formally,

$$(F/S)(1 + i_{\text{¥}}) = (1 + i_{us})$$

or if you prefer,

$$\frac{1 + i_{\$}}{1 + i_{\text{¥}}} = \frac{F}{S}$$

IRP is sometimes *approximated* as

$$(i_{\$} - i_{\text{¥}}) = \frac{(F - S)}{S}$$

# IRP and Covered Interest Arbitrage

If IRP failed to hold, an arbitrage would exist. It's easiest to see this in the form of an example.

Consider the following set of foreign and domestic interest rates and spot and forward exchange rates.

Spot exchange rate	$S(\$/\pounds)$	=	\$1.25/£
360-day forward rate	$F_{360}(\$/\pounds)$	=	\$1.20/£
U.S. discount rate	$i_{\$}$	=	7.10%
British discount rate	$i_{\pounds}$	=	11.56%

# IRP and Covered Interest Arbitrage

A trader with \$1,000 to invest could invest in the U.S., in one year his investment will be worth \$1,071 =  $\$1,000 \times (1 + i_{\$}) = \$1,000 \times (1.071)$

Alternatively, this trader could exchange \$1,000 for £800 at the prevailing spot rate, (note that £800 =  $\$1,000 \div \$1.25/\text{£}$ ) invest £800 at  $i_{\text{£}} = 11.56\%$  for one year to achieve £892.48. Translate £892.48 back into dollars at  $F_{360}(\$/\text{£}) = \$1.20/\text{£}$ , the £892.48 will be exactly \$1,071.

# Interest Rate Parity & Exchange Rate Determination

According to IRP only one 360-day forward rate,  $F_{360}(\$/\pounds)$ , can exist. It must be the case that

$$F_{360}(\$/\pounds) = \$1.20/\pounds$$

Why?

If  $F_{360}(\$/\pounds) \neq \$1.20/\pounds$ , an astute trader could make money with one of the following strategies:

# Arbitrage Strategy I

If  $F_{360}(\$/\pounds) > \$1.20/\pounds$

- i. Borrow \$1,000 at  $t = 0$  at  $i_{\$} = 7.1\%$ .
- ii. Exchange \$1,000 for £800 at the prevailing spot rate, (note that £800 = \$1,000 ÷ \$1.25/£) invest £800 at 11.56% ( $i_{\pounds}$ ) for one year to achieve £892.48
- iii. Translate £892.48 back into dollars, if  $F_{360}(\$/\pounds) > \$1.20/\pounds$ , £892.48 will be more than enough to repay your dollar obligation of \$1,071.

## Arbitrage Strategy II

If  $F_{360}(\$/\pounds) < \$1.20/\pounds$

- i. Borrow  $\pounds 800$  at  $t = 0$  at  $i_{\pounds} = 11.56\%$ .
- ii. Exchange  $\pounds 800$  for  $\$1,000$  at the prevailing spot rate, invest  $\$1,000$  at  $7.1\%$  for one year to achieve  $\$1,071$ .
- iii. Translate  $\$1,071$  back into pounds, if  $F_{360}(\$/\pounds) < \$1.20/\pounds$ ,  $\$1,071$  will be more than enough to repay your  $\pounds$  obligation of  $\pounds 892.48$ .

# IRP and Hedging Currency Risk

You are a U.S. importer of British woolens and have just ordered next year's inventory. Payment of £100M is due in one year.

Spot exchange rate	$S(\$/\pounds)$	=	\$1.25/£
360-day forward rate	$F_{360}(\$/\pounds)$	=	\$1.20/£
U.S. discount rate	$i_{\$}$	=	7.10%
British discount rate	$i_{\pounds}$	=	11.56%

IRP implies that there are two ways that you fix the cash outflow

- Put yourself in a position that delivers £100M in one year—a long forward contract on the pound. You will pay  $(\pounds 100\text{M})(1.2/\pounds) = \$120\text{M}$
- Form a forward market hedge as shown below.

## IRP and a Forward Market Hedge

To form a forward market hedge:

Borrow \$112.05 million in the U.S. (in one year you will owe \$120 million).

Translate \$112.05 million into pounds at the spot rate  $S(\$/\pounds) = \$1.25/\pounds$  to receive £89.64 million.

Invest £89.64 million in the UK at  $i_{\pounds} = 11.56\%$  for one year.

In one year your investment will have grown to £100 million—exactly enough to pay your supplier.

# Forward Market Hedge

Where do the numbers come from? We owe our supplier £100 million in one year—so we know that we need to have an investment with a future value of £100 million. Since  $i_{\text{£}} = 11.56\%$  we need to invest £89.64 million at the start of the year.

$$\text{£}89.64 = \frac{\text{£}100}{1.1156}$$

How many dollars will it take to acquire £89.64 million at the start of the year if  $S(\$/\text{£}) = \$1.25/\text{£}$ ?

$$\$112.05 = \text{£}89.64 \times \frac{\$1.00}{\text{£}1.25}$$

# Reasons for Deviations from IRP

- Transactions Costs

- The interest rate available to an arbitrageur for borrowing,  $i^b$ , may exceed the rate he can lend at,  $i^l$ .
- There may be bid-ask spreads to overcome,  $F^b/S^a < F/S$
- Thus

$$(F^b/S^a)(1 + i_{\text{¥}}^l) - (1 + i_{\text{¥}}^b) \leq 0$$

- Capital Controls

- Governments sometimes restrict import and export of money through taxes or outright bans.

# Purchasing Power Parity

- Purchasing Power Parity and Exchange Rate Determination
- PPP Deviations and the Real Exchange Rate
- Evidence on PPP

# Purchasing Power Parity and Exchange Rate Determination

- The exchange rate between two currencies should equal the ratio of the countries' price levels.

$$S(\$/\pounds) = P_{\$} \div P_{\pounds}$$

- Relative PPP states that the rate of change in an exchange rate is equal to the differences in the rates of inflation.

$$e = \pi_{\$} - \pi_{\pounds}$$

- If U.S. inflation is 5% and U.K. inflation is 8%, the pound should depreciate by 3%.

## PPP Deviations and the Real Exchange Rate

The real exchange rate is

$$q = \frac{1 + \pi_{\$}}{(1 + e)(1 + \pi_{\pounds})}$$

If PPP holds,  $(1 + e) = (1 + \pi_{\$})/(1 + \pi_{\pounds})$ , then  $q = 1$ .

If  $q < 1$  competitiveness of domestic country improves with currency depreciations.

If  $q > 1$  competitiveness of domestic country deteriorates with currency depreciations.

# Evidence on PPP

- PPP probably doesn't hold precisely in the real world for a variety of reasons.
  - Haircuts cost 10 times as much in the developed world as in the developing world.
  - Film, on the other hand, is a highly standardized commodity that is actively traded across borders.
  - Shipping costs, as well as tariffs and quotas can lead to deviations from PPP.
- PPP-determined exchange rates still provide a valuable benchmark.

# The Fisher Effects

- An increase (decrease) in the expected rate of inflation will cause a proportionate increase (decrease) in the interest rate in the country.
- For the U.S., the Fisher effect is written as:

$$i_{\$} = \rho_{\$} + E(\pi_{\$})$$

Where

$\rho_{\$}$  is the equilibrium expected “real” U.S. interest rate

$E(\pi_{\$})$  is the expected rate of U.S. inflation

$i_{\$}$  is the equilibrium expected nominal U.S. interest rate

# International Fisher Effect

If the Fisher effect holds in the U.S.

$$i_{\$} = \rho_{\$} + E(\pi_{\$})$$

and the Fisher effect holds in Japan,

$$i_{¥} = \rho_{¥} + E(\pi_{¥})$$

and if the real rates are the same in each country

$$\rho_{\$} = \rho_{¥}$$

then we get the International Fisher Effect

$$E(e) = i_{\$} - i_{¥} .$$

# International Fisher Effect

If the International Fisher Effect holds,

$$E(e) = i_{\$} - i_{\pounds}$$

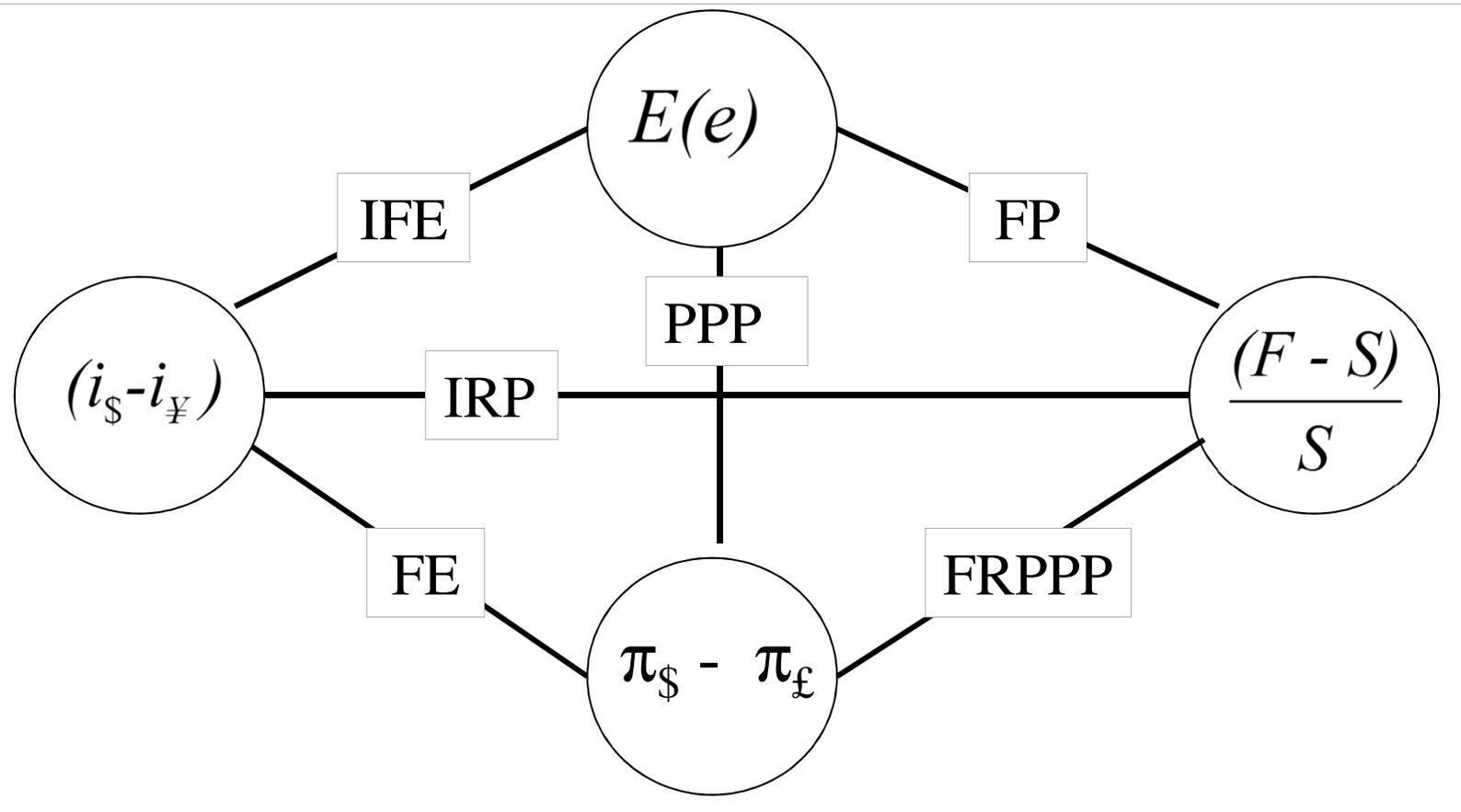
and if IRP also holds

$$i_{\$} - i_{\pounds} = \frac{(F - S)}{S}$$

then forward parity holds.

$$E(e) = \frac{(F - S)}{S}$$

# Equilibrium Exchange Rate Relationships



# Forecasting Exchange Rates

- Efficient Markets Approach
- Fundamental Approach
- Technical Approach
- Performance of the Forecasters

# Efficient Markets Approach

- Financial Markets are *efficient* if prices reflect all available and relevant information.
- If this is so, exchange rates will only change when new information arrives, thus:

$$S_t = E[S_{t+1}]$$

and

$$F_t = E[S_{t+1} | I_t]$$

- Predicting exchange rates using the efficient markets approach is affordable and is hard to beat.

# Fundamental Approach

- Involves econometrics to develop models that use a variety of explanatory variables. This involves three steps:
  - step 1: Estimate the structural model.
  - step 2: Estimate future parameter values.
  - step 3: Use the model to develop forecasts.
- The downside is that fundamental models do not work any better than the forward rate model or the random walk model.

# Technical Approach

- Technical analysis looks for patterns in the past behavior of exchange rates.
- Clearly it is based upon the premise that history repeats itself.
- Thus it is at odds with the EMH

# Performance of the Forecasters

- Forecasting is difficult, especially with regard to the future.
- As a whole, forecasters cannot do a better job of forecasting future exchange rates than the forward rate.
- The founder of *Forbes* Magazine once said:  
“You can make more money selling advice than following it.”

# End Chapter Five