Exchange Rate Determination

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What determines exchange rates?

- Exchange rate determination is a complex issue
- In theory we distinguish three major schools of thought
  - Balance of payments approach
  - International parity conditions
  - Asset market approach
- More practical point of view differentiates between two categories of determinants
  - Factors that cause the supply and demand schedules of currencies to change
  - Factors affecting exchange rates
- These theories and approaches are not competing, but rather are complementary to each other

The determinants of foreign exchange rates (theoretical view)

International Parity Conditions
1. Relative inflation rates
2. Relative interest rates (international Fisher effect)
3. Forward exchange rates
4. Interest rate parity

Spot Exchange Rate

Asset Market Approach
1. Relative real interest rates
2. Prospects for economic growth
3. Supply & demand for financial assets
4. Outlook for political stability
5. Speculation & market liquidity
6. Contagion & corporate governance

Balance of Payments
1. Current account balances
2. Portfolio investment
3. Foreign direct investment
4. Official monetary reserves
5. Exchange rate regimes

The determinants of foreign exchange rates (practical view)

- Factors that cause the supply and demand schedules of currencies to change
  - Market fundamentals (economic variables)
    - Productivity, inflation rates, real interest rates, consumer preferences, and government trade policy
  - Market expectations
    - News about future market fundamentals
    - Traders' opinions about future exchange rates

- Factors affecting exchange rates
  - Short term: transfers of assets
    - Differences in real interest rates and to the shifting expectations of future exchange rates
  - Interim: cyclical factors
    - Fluctuations in economic activity
  - Long term: flows of goods, services, and investment capital
    - Inflation rates, investment profitability, consumer tastes, productivity, and government trade policy

Balance of payments approach

- Second most utilized theoretical approach in exchange rate determination (after international parity conditions)

- The basic approach argues that the equilibrium exchange rate is found when currency flows match up vis-à-vis current and financial account activities

- This framework has wide appeal as balance-of-payments transaction data is readily available and widely reported

- Critics may argue that this theory does not take into account stocks of money or financial assets

Asset market approach

- Also known as Relative Price of Bonds or Portfolio Balance Approach

- Exchange rates are determined by the supply and demand for financial assets of a wide variety, including bonds

- Shifts in the supply and demand for widely varied financial assets alter exchange rates

- The forecasting inadequacies of fundamental theories has led to the growth and popularity of technical analysis, the belief that the study of past price behavior provides insights into future price movements
  - The primary assumption is that any market driven price (i.e., exchange rates) follows trends

Monetary approach

- The exchange rate is determined by the supply and demand for national monetary stocks, as well as the expected future levels and rates of growth of monetary stocks

- Focuses on changes in the supply and demand for money as the primary determinant of inflation

- Changes in relative inflation rates in turn are expected to alter exchange rates through a purchasing power parity effect

International parity conditions

- Set of theories linking together essential economic variables and explaining changes in exchange rates

- International parity conditions may not always work out to be „true" when compared with observation in real world

- Central to any understanding of how multinational business is conducted
  - The mistake is sometimes not with the theory itself, but in the way it is interpreted or applied in practice

Prices, interest rates and exchange rates is equilibrium

- **(A) Purchasing power parity**
  - Forecasts the change in the spot rate on the basis of differences in expected rates of inflation
- **(B) Fisher effect**
  - Nominal interest rates in each country are equal to the required real rate of return (r) plus compensation for expected inflation (π)
- **(C) International Fisher effect**
  - The spot exchange rate should change in an amount equal to but in the opposite direction of the difference in interest rates between countries
- **(D) Interest rate parity**
  - The difference in the national interest rates should be equal to, but opposite in sign to, the forward rate discount or premium for the foreign currency, except for transaction costs
- **(E) Forward rate as an unbiased predictor**
  - The forward rate is an efficient predictor of the future spot rate, assuming that the foreign exchange market is reasonably efficient

Diagram of international parity conditions
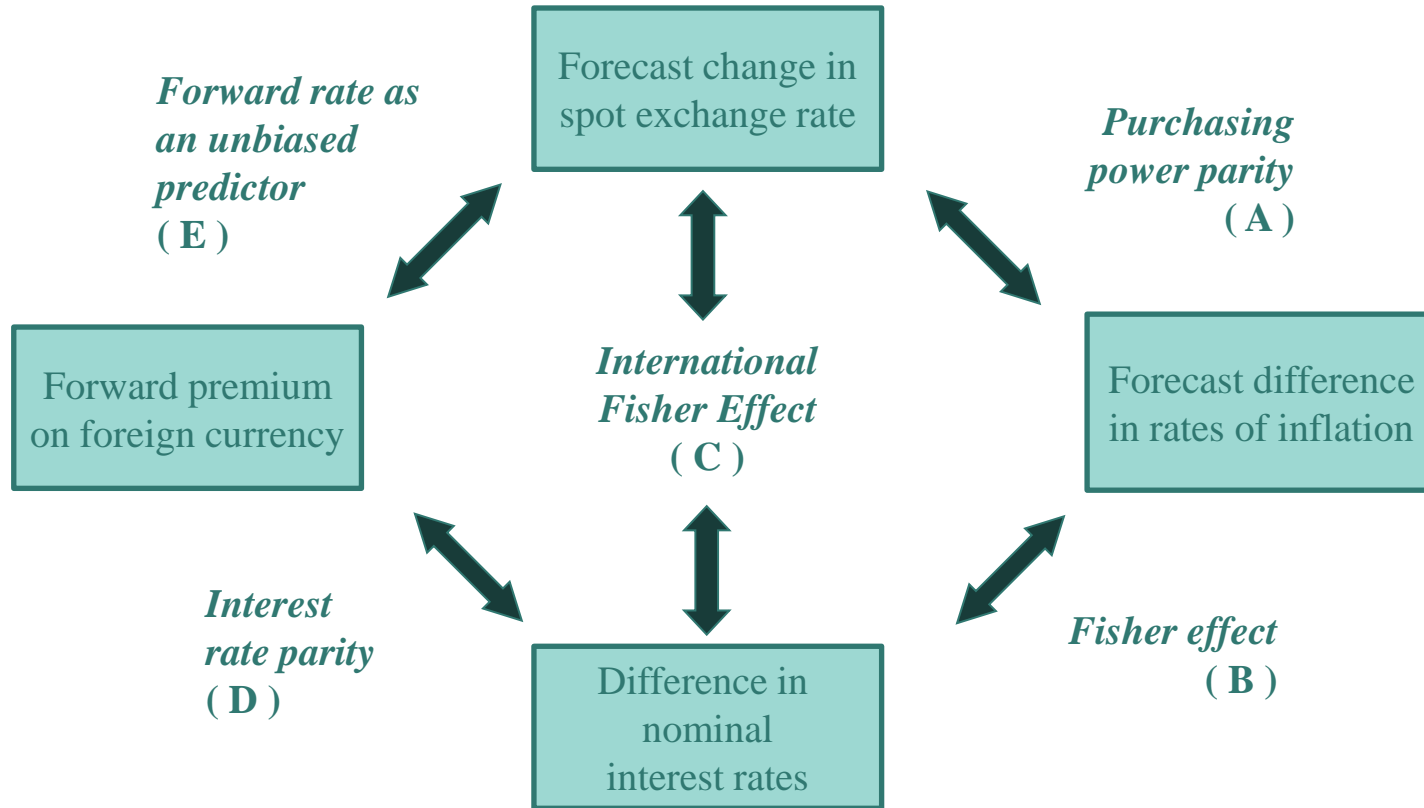
Prices and exchange rates

- Law of one price
  - All else being equal (no transaction costs) a product's price should be the same in all markets
- Even if prices for a particular product are in different currencies, the law of one price states that
  - $P * SR = P^*$
  - Where the price in domestic market (P) multiplied by the spot exchange rate (SR, foreign currency per domestic currency), equals the price of the product in the foreign market (P*)
- Conversely, if prices stated in local currencies, and markets are efficient, the exchange rate can be deducted from the relative local product prices
  - $SR = P^* / P$

Absolute purchasing power parity

- If the law of one price were true for all goods, the purchasing power parity (PPP) exchange rate could be found from any set of prices

- Absolute theory of PPP
  - Through price comparison, prices of individual products can be determined through the PPP exchange rate

- Absolute PPP states that the spot exchange rate is determined by the relative prices of an identical basket of goods
  - $SR = P^* / P$

The Big Mac Index

- Invented by *The Economist* in 1986 as a lighthearted guide to whether currencies are at their "correct" level

- The Big Mac PPP is the exchange rate that would leave a burger in any country costing the same as in the USA

- Burgernomics was never intended as a precise gauge of currency misalignment, merely a tool to make exchange-rate theory more digestible

- There is also an adjusted index which addresses the criticism that you would expect average burger prices to be cheaper in poor countries than in rich ones because labour costs are lower

Selected rates from the Big Mac Index

Country and Currency	Symbol	(1) Big Mac Price in Local Currency	(2) Actual Dollar Exchange Rate January 2015	(3) Big Mac Price in Dollars	(4) Implied PPP of the Dollar	(5) Under/Over Valuation Against Dollar**
United States	$	5.04	—	5.04	—	—
Britain	£	2.99	1.3179*	3.94	1.6856*	−21.8%
Canada	C$	6.00	1.3030	4.60	1.190	−8.6%
China	Yuan	18.6	6.6780	2.79	3.690	−44.7%
Denmark	DK	30.0	6.7572	4.44	5.952	−11.9%
Euro area	€	3.82	1.1010*	4.21	1.319*	−16.6%
India	Rupee	162.0	67.200	2.41	32.143	−52.2%
Japan	¥	370	106.725	3.47	73.413	−31.2%
Mexico	Peso	44.0	18.535	2.37	8.730	−52.9%
Norway	kr	46.8	8.4936	5.51	9.286	9.3%
Peru	Sol	10.0	3.306	3.02	1.984	−40.0%
Russia	Ruble	130.0	63.4076	2.05	25.794	−59.3%
Switzerland	SFr	6.50	0.98610	6.59	1.290	30.8%
Thailand	Baht	119.0	34.965	3.40	23.611	−32.5%

* These exchange rates are stated in US$ per unit of local currency, $/£ and $/€.

** Percentage under/over valuation against the dollar is calculated as (Implied-Actual)/(Actual), except for the Britain and Euro area calculations, which are (Actual-Implied)/(Implied)

Source: Data for columns (1) and (2) drawn from "The Big Mac Index," *The Economist*, July 21, 2016.

The Big Mac Index (July 2017)
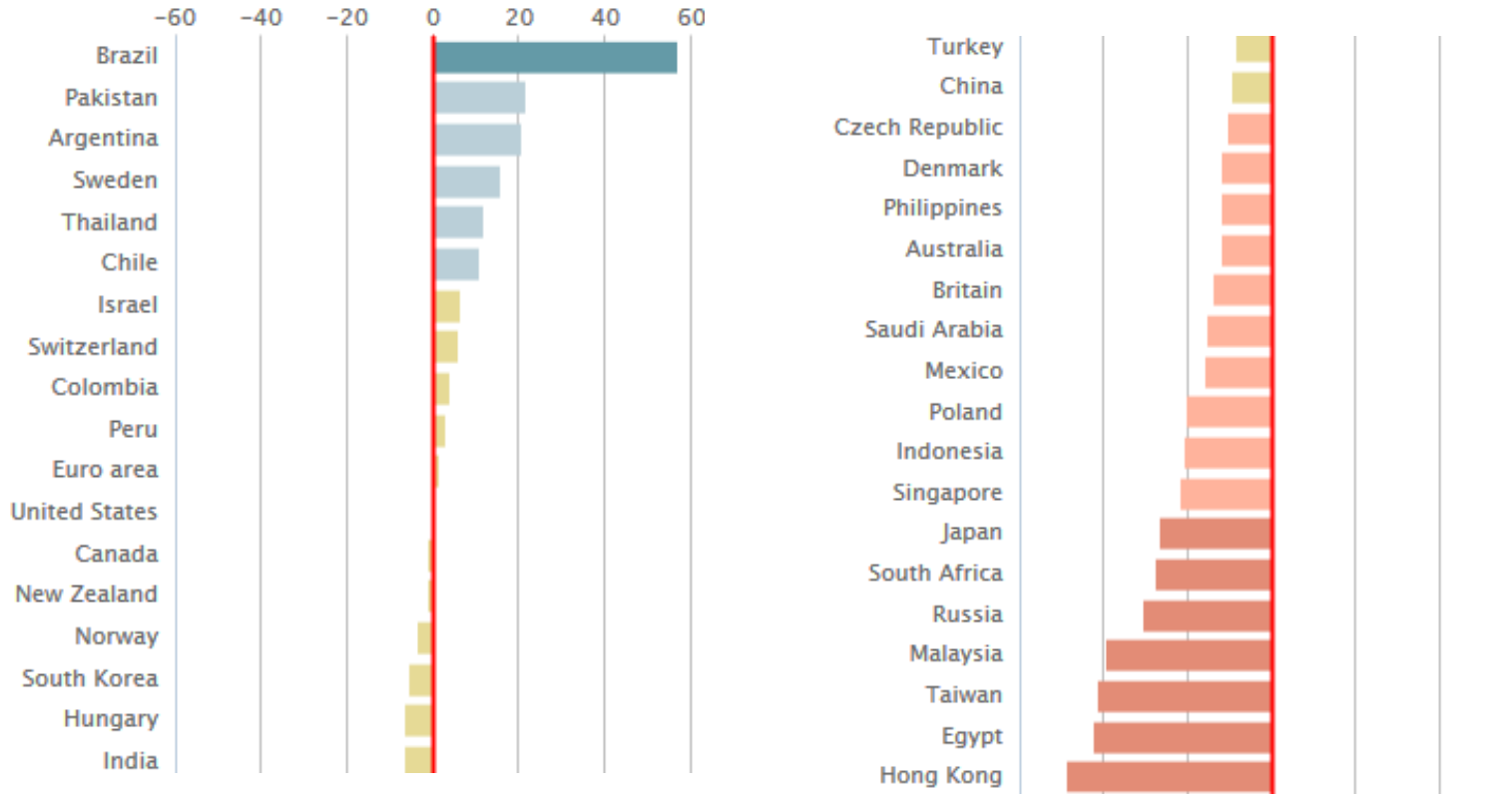
Relative purchasing power parity

- Not particularly helpful in determining what the spot exchange rate today, but that the relative change in prices between two countries over a period of time determines the change in the exchange rate over that period

- More specifically, the spot exchange rate should change in an equal amount but in the opposite direction to the difference in inflation rates between two countries
  - Thus, the currency with higher (lower) inflation rate will depreciate (appreciate)

Relative purchasing power parity
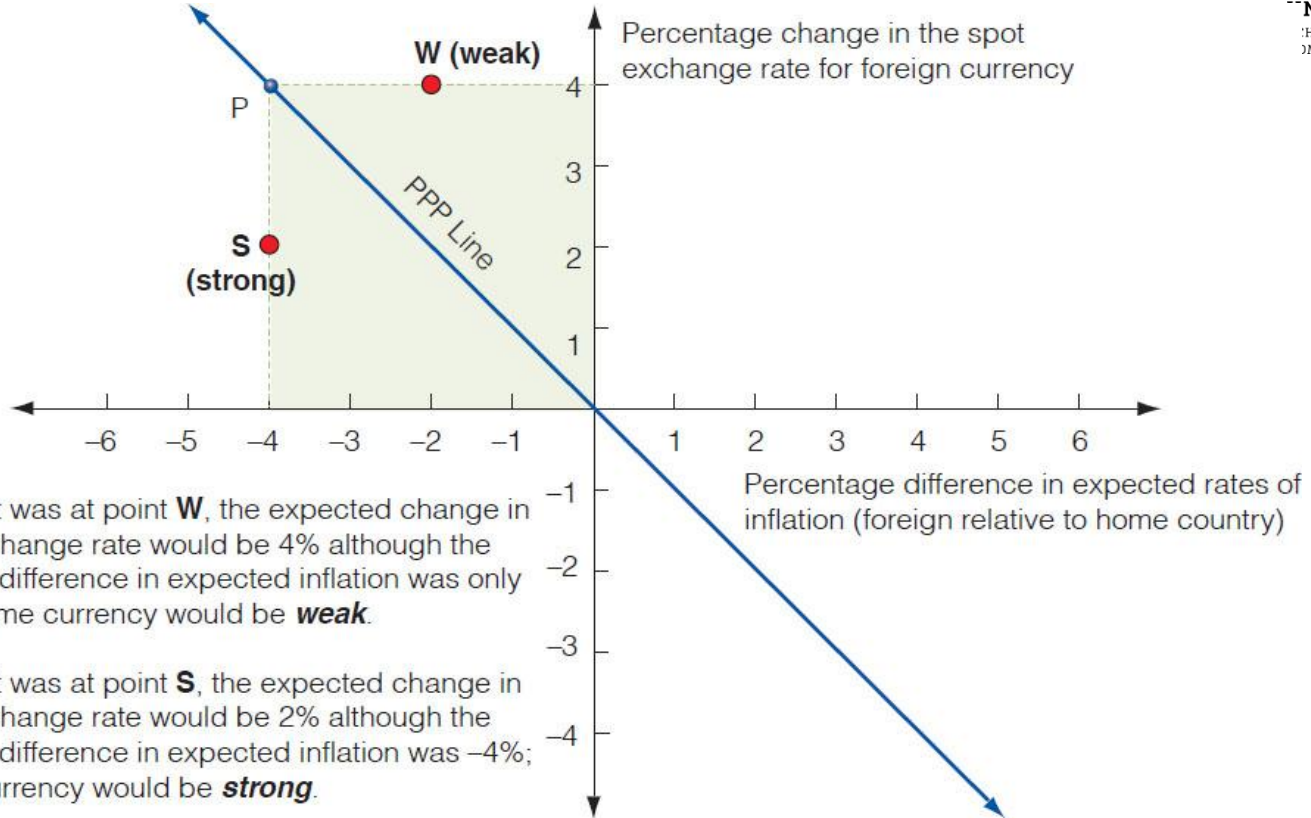
If the market was at point **W**, the expected change in the spot exchange rate would be 4% although the percentage difference in expected inflation was only −2%; the home currency would be **weak**.

If the market was at point **S**, the expected change in the spot exchange rate would be 2% although the percentage difference in expected inflation was −4%; the home currency would be **strong**.

Exchange rate pass-through

- A measure of the response of imported and exported product prices to changes in exchange rates
  - Complete pass-through: 100% of the impact of a change in exchange rates is passed on to the consumer in prices of imported goods
  - Partial pass-through: Less than 100% of the impact of a change in exchange rates is passed on to the consumer in prices of imported goods

- Although PPP implies that all exchange rate changes are passed through by equivalent changes in prices to trading partners, empirical researches in the 1980s questioned this long-held assumption

- For example, a car manufacturer may or may not adjust pricing of its cars sold in a foreign country if exchange rates alter the manufacturer's cost structure in comparison to the foreign market

The Fisher effect

- Nominal interest rates in each country are equal to the required real rate of return plus compensation for expected inflation
- Because investors concern about the real returns (i.e., the growth of their purchasing power), we would expect that as inflation increases, investors will demand higher nominal rates of returns on their investment
  - $i = r + \pi + (r \times \pi)$
  - $i = r + \pi$ (Approximate form)
    - i = nominal interest rate
    - r = real interest rate
    - π = expected inflation
  - Empirical tests (using ex-post) national inflation rates have shown the Fisher effect usually exists for short-maturity government securities

The international Fisher effect

- Relationship between the percentage change in the spot exchange rate over time and the differential between comparable interest rates in different national capital markets

- Fisher found that the spot exchange rate should change in an equal amount but in the opposite direction to the difference in interest rates between two countries
  - The opposite direction means for a country with lower (higher) interest rates, its currency will appreciate (depreciate)
    - S_t = Indirect spot exchange rate at the beginning of the period
    - S_{t+1} = Indirect spot exchange rate at the end of the period
    - $i^\$$ = Interest rate in the U.S.
    - $i^\yen$ = Interest rate in Japan

$$\frac{S_t - S_{t+1}}{S_{t+1}} = \frac{(1+i^\$)-(1+i^\yen)}{1+i^\yen} = \frac{i^\$ - i^\yen}{1+i^\yen} \approx i^\$ - i^\yen$$

Forward rate

- Exchange rate quoted today for settlement at some future date
- Forward exchange agreement between currencies states the exchange rate at which a foreign currency will be bought forward or sold forward on a specific date in the future
- Forward rate for a 90-day forward agreement
  - $F^{FC/\$}$ = Forward rate for a foreign currency (FC) and the $
  - $S^{FC/\$}$ = Current spot rate for a foreign currency (FC) and the $
  - i^{FC} = Foreign interest rate
  - $i^{\$}$ = U.S. interest rate

$$F_{90}^{FC/\$} = S^{FC/\$} \times \frac{\left[1 + \left(i^{FC} \times \dfrac{90}{360}\right)\right]}{\left[1 + \left(i^{\$} \times \dfrac{90}{360}\right)\right]}$$

Interest rate parity

- Provides the link between the foreign exchange markets and the international money markets

- The theory states that the difference in the national interest rates should be equal to, but opposite in sign to, the forward rate premium or discount for the foreign currency, except for transaction costs

- The forward premium or discount is the percentage difference between the spot and forward exchange rate, stated in annual percentage terms

- Investors must be rewarded or penalized to offset the expected change in exchange rates

Interest rate parity

Covered interest arbitrage

- The spot and forward exchange markets are not constantly in the state of equilibrium described by interest rate parity

- When the market is not in equilibrium, the potential for arbitrage profit exists

- The arbitrager who recognizes such an imbalance will move to take advantage of the disequilibrium by investing in whichever currency offers the higher return on a covered basis

- The key to determining whether to start in dollars or the foreign currency is to compare the differences in interest rates to the forward premium on the foreign currency (the cost of cover)
  - If the difference in interest rates is greater than the forward premium (or expected change in the spot rate), invest in the higher interest yielding currency
  - If the difference in interest rates is less than the forward premium (or expected change in the spot rate), invest in the lower interest yielding currency

Covered interest arbitrage
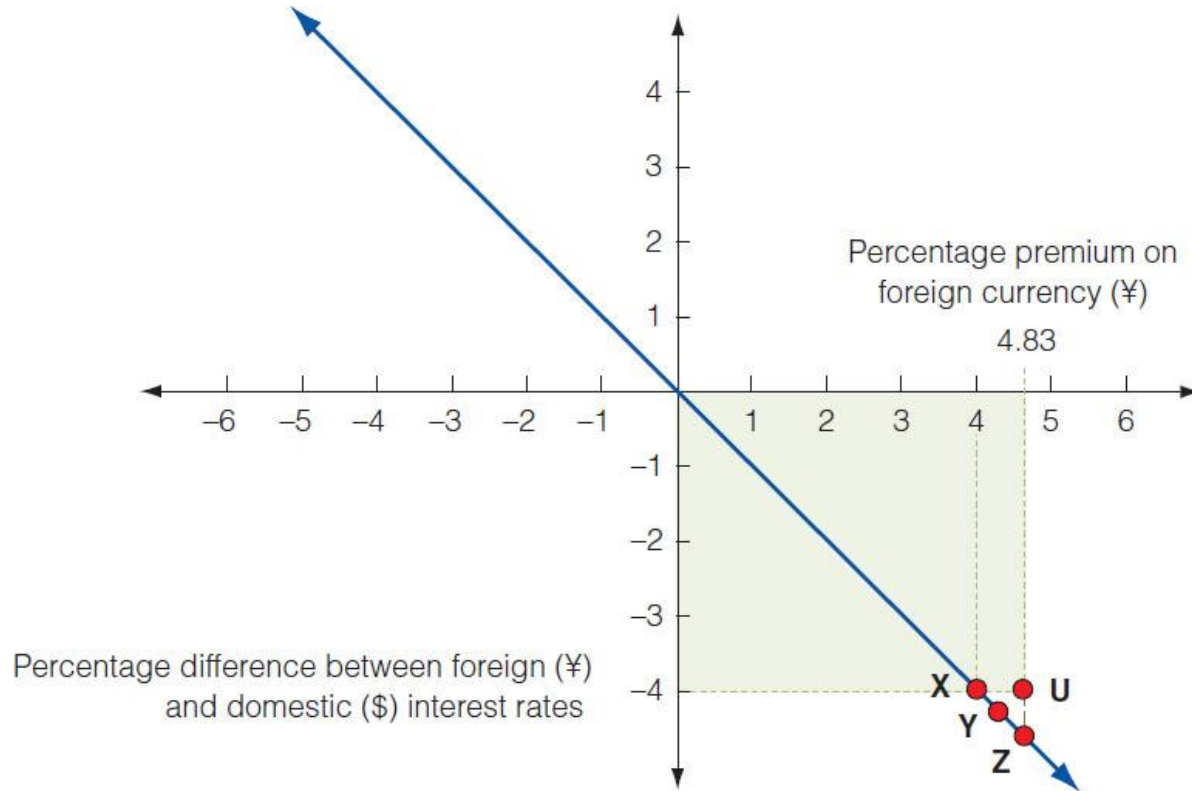
Uncovered interest arbitrage

- Investors borrow in countries and currencies exhibiting relatively low interest rates and convert the proceeds into currencies that offer much higher interest rates

- The transaction is "uncovered," because the investor does not sell the higher yielding currency proceeds forward, choosing to remain uncovered and accept the currency risk of exchanging the higher yield currency into the lower yielding currency at the end of the period

Uncovered interest arbitrage (The Yen carry trade)

Start

¥10,000,000

Investor borrows yen for 360 days at 0.40% per annum
× 1.004

Japanese Yen Money Market

360-day period

U.S. Dollar Money Market

Investor converts yen to dollars at spot rate
Spot: ¥120.00 = $1.00

$83,333.33

× 1.05

Investor deposits dollars in U.S. dollar money market at 5.00% per annum

End

¥10,040,000 Repaid
¥10,500,000 Earn
¥460,000 Profit

Expected Spot: ¥120.00 = $1.00
Investor converts dollars back to yen at expected spot rate

$87,500.00

Interest rate parity and equilibrium

Forward rate as an unbiased predictor of the future spot rate
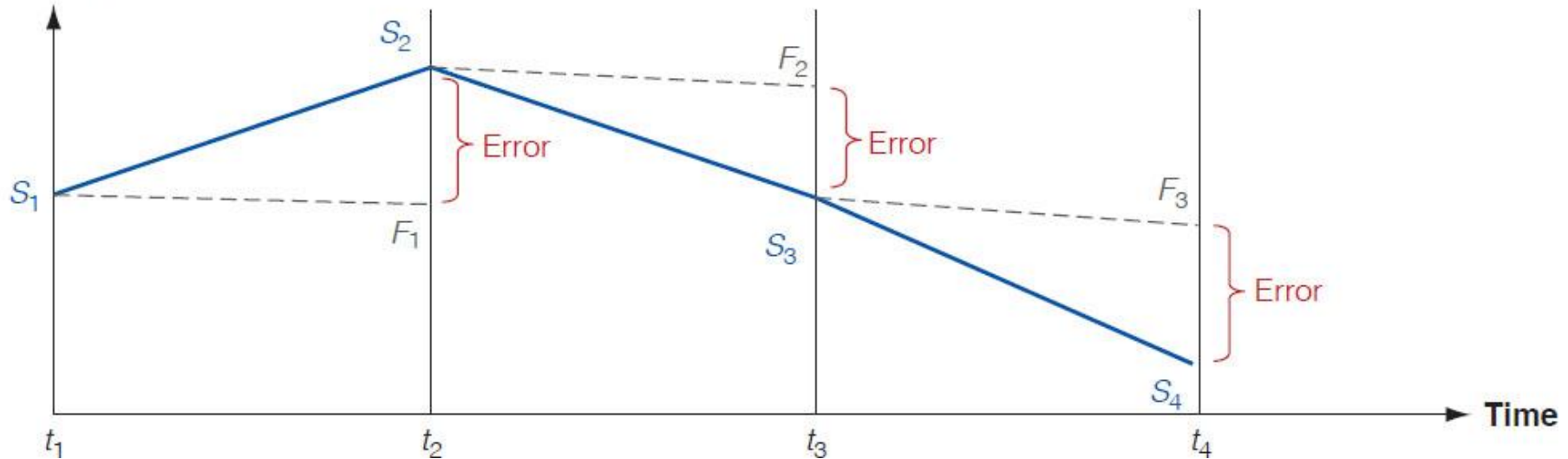
- Some forecasters believe that forward exchange rates are unbiased predictors of future spot exchange rates

- Unbiased prediction simply means that the forward rate will, on average, overestimate and underestimate the actual future spot rate in equal frequency and degree

Forward rate as an unbiased predictor of the future spot rate

THANK YOU FOR YOUR ATTENTION

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