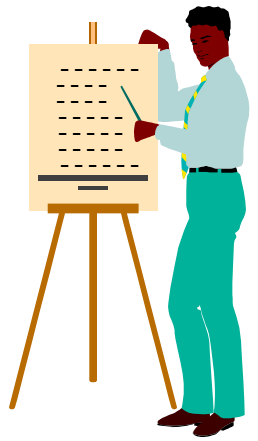
# Determining Exchange Rates

# Chapter Objectives

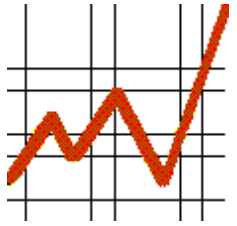
- To explain how exchange rate movements are measured;
- To explain how the equilibrium exchange rate is determined; and
- To examine the factors that affect the equilibrium exchange rate.



# Exchange Rate Movement: Measurement

- An exchange rate measures the value of one currency in units of another currency.
- When a currency declines in value, it is said to depreciate. When it increases in value, it is said to appreciate.
- On the days when some currencies appreciate while others depreciate against a particular currency, that currency is said to be “mixed in trading.”

# Exchange Rate Movement: Measurement



- The percentage change (% $\Delta$) in the value of a foreign currency is computed as

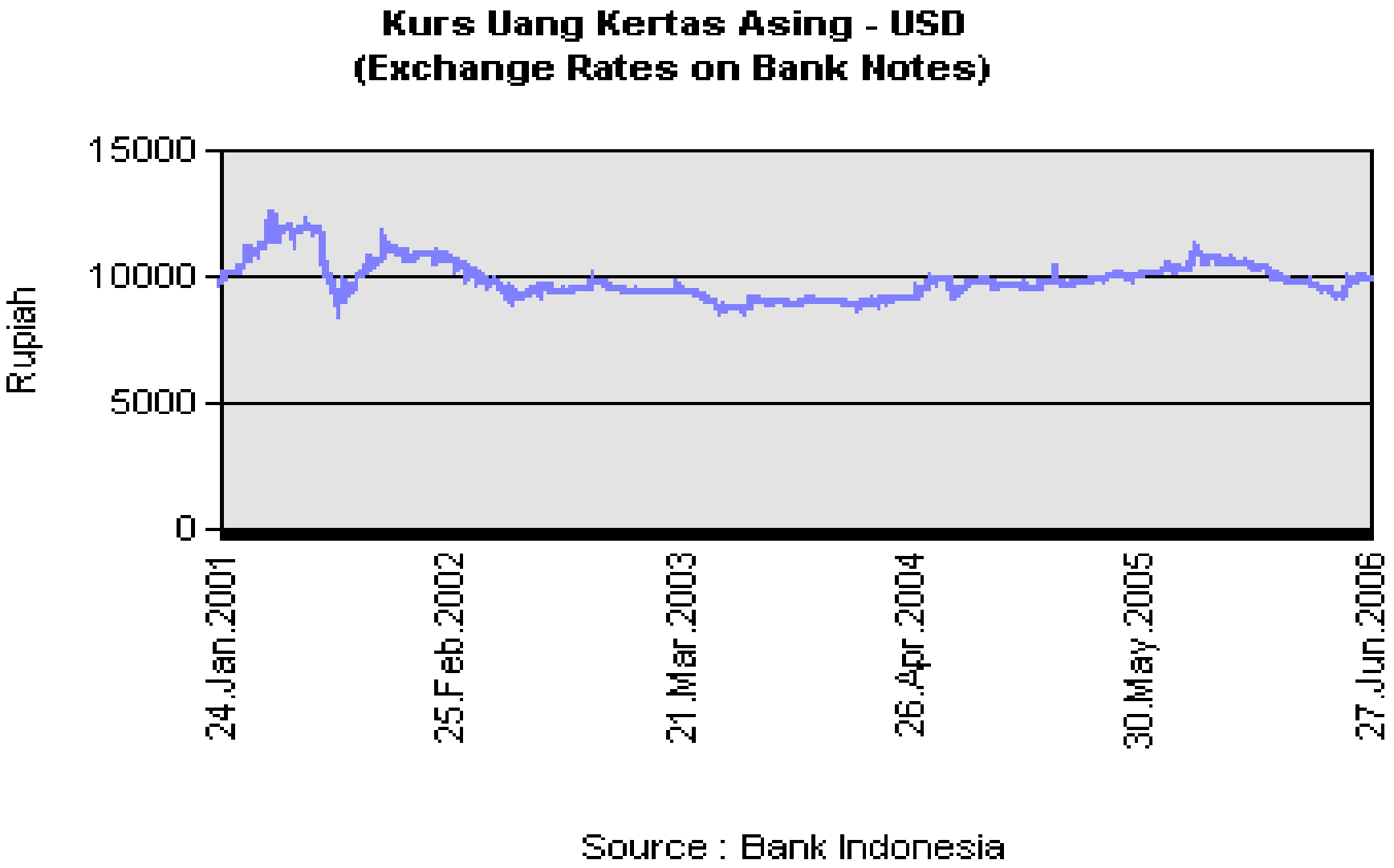
$$\frac{S_t - S_{t-1}}{S_{t-1}}$$

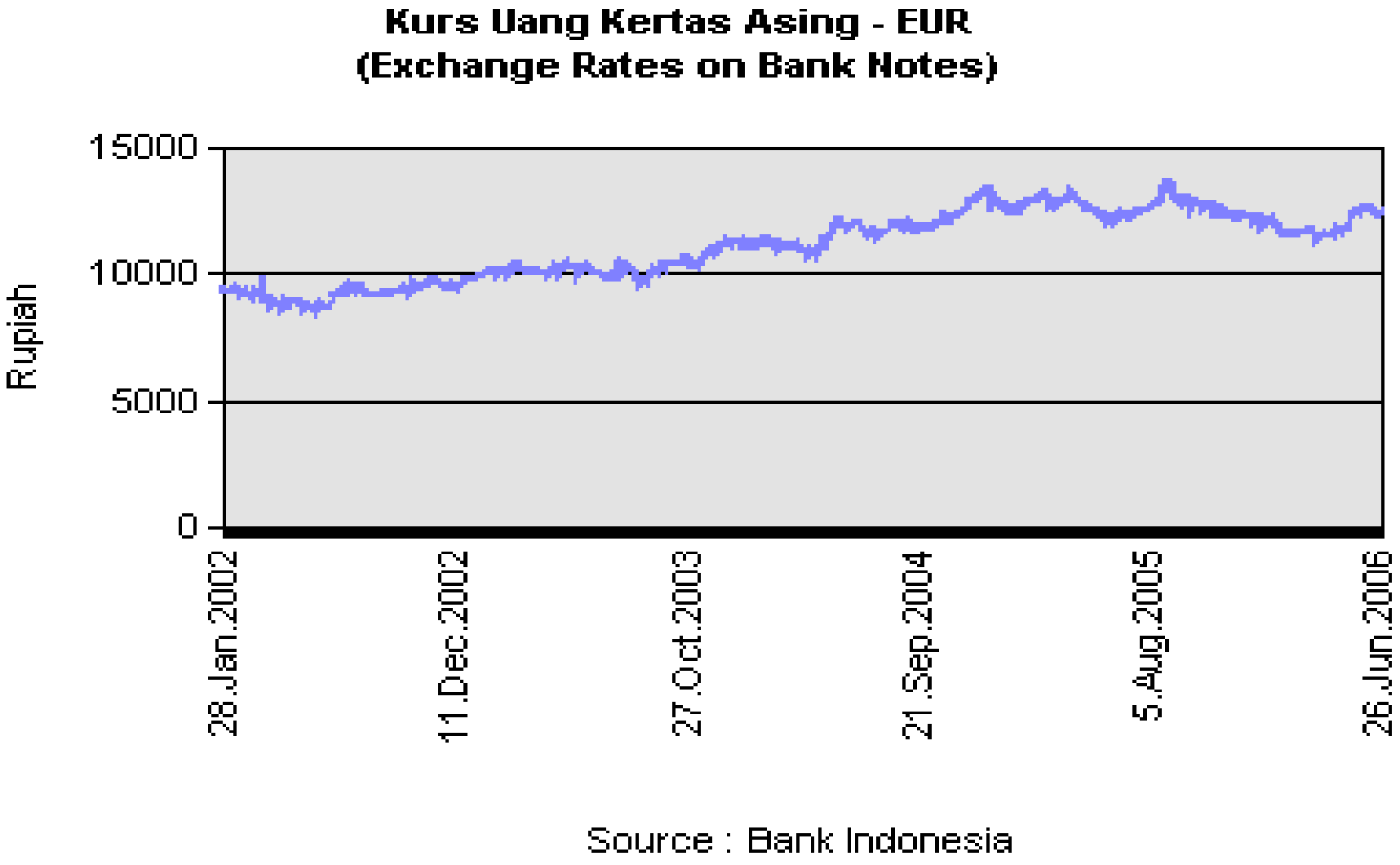
where $S_t$ denotes the spot rate at time *t*.

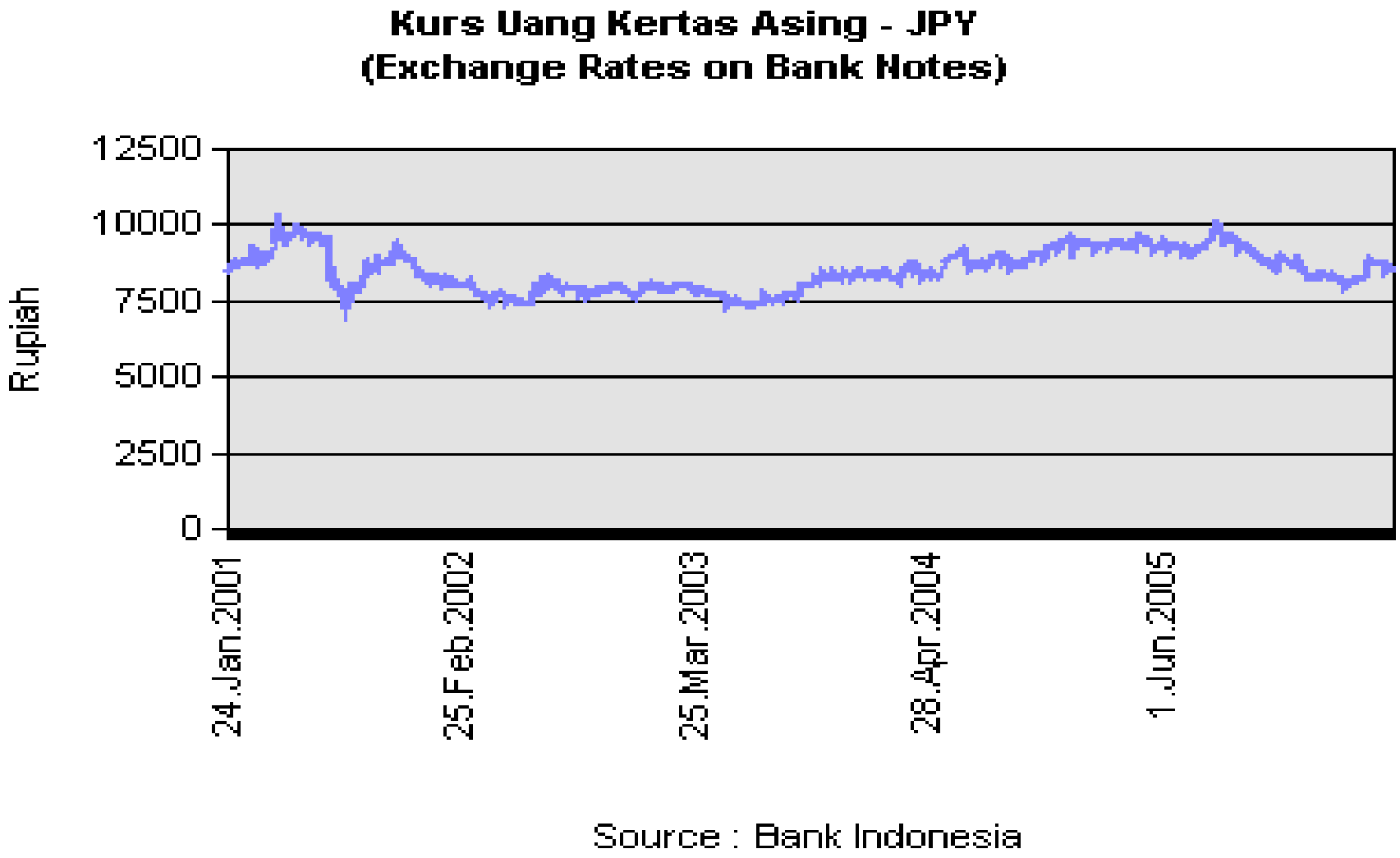
  - A positive % $\Delta$ represents appreciation of the foreign currency, while a negative % $\Delta$ represents depreciation.

# Annual Changes in the Value of the Euro

| Date | Exchange Rate | Annual % Δ |
|---|---|---|
| 1/1/2000 | $1.001/€ | – |
| 1/1/2001 | $.94/€ | – 6.1% |
| 1/1/2002 | $.89/€ | – 5.3% |
| 1/1/2003 | $1.05/€ | +18.0% |
| 1/1/2004 | $1.26/€ | +20.0% |


Kurs Uang Kertas Asing - USD
(Exchange Rates on Bank Notes)
Rupiah
15000
10000
5000
0
24.Jan.2001
25.Feb.2002
21.Mar.2003
26.Apr.2004
30.May.2005
27.Jun.2006
Source : Bank Indonesia

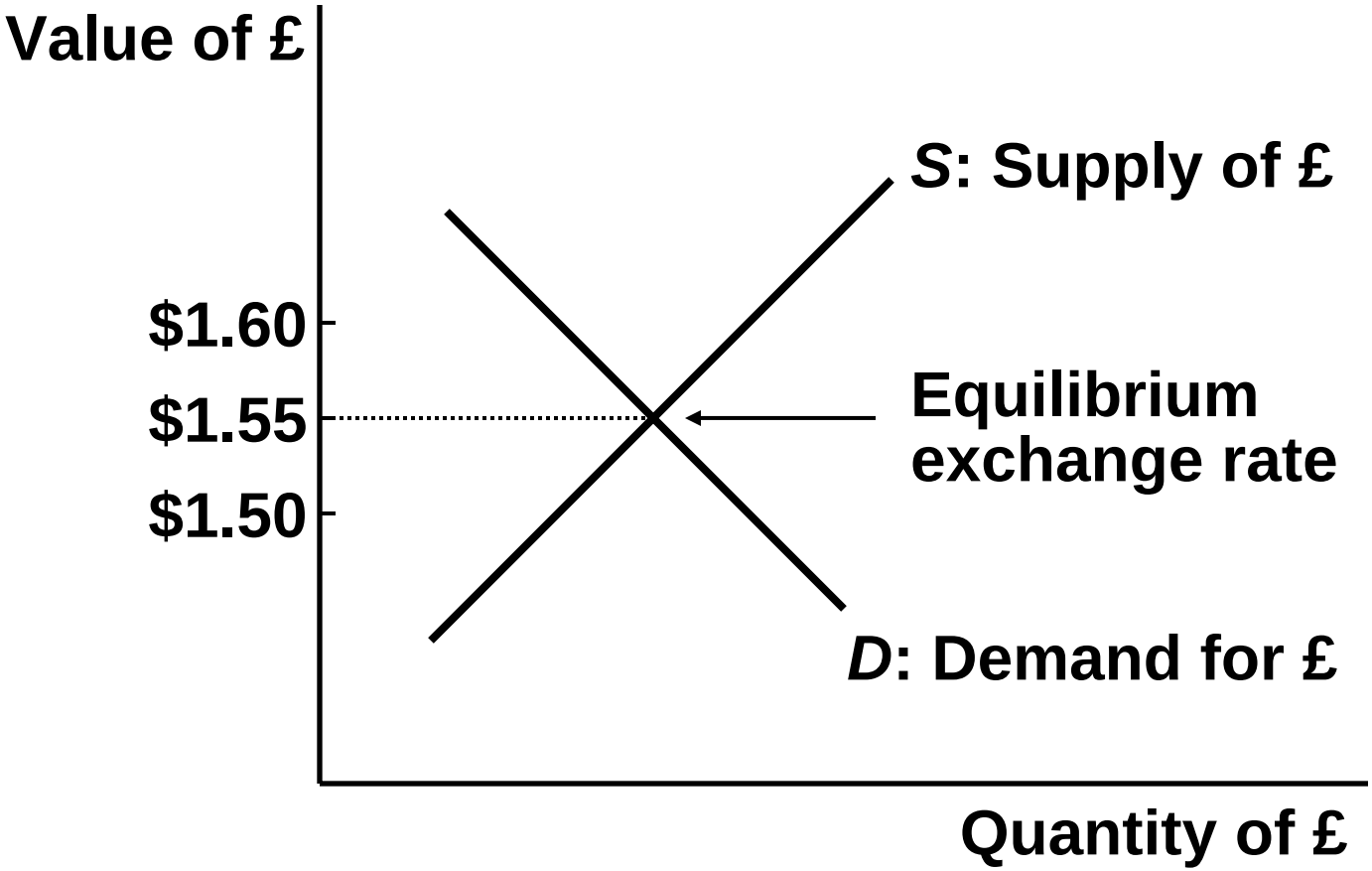

Kurs Uang Kertas Asing - EUR
(Exchange Rates on Bank Notes)
Rupiah
15000
10000
5000
0
28.Jan.2002
11.Dec.2002
27.Oct.2003
21.Sep.2004
5.Aug.2005
26.Jun.2006
Source : Bank Indonesia


Kurs Uang Kertas Asing - JPY
(Exchange Rates on Bank Notes)
Rupiah
12500
10000
7500
5000
2500
0
24.Jan.2001
25.Feb.2002
25.Mar.2003
28.Apr.2004
1.Jun.2005
Source : Bank Indonesia

# Exchange Rate Equilibrium

- An exchange rate represents the price of a currency, which is determined by the demand for that currency relative to the supply for that currency.

# Exchange Rate Equilibrium



# Exchange Rate Equilibrium

- The liquidity of a currency affects the sensitivity of the exchange rate to specific transactions.
- With many willing buyers and sellers, even large transactions can be easily accommodated.
- Conversely, illiquid currencies tend to exhibit more volatile exchange rate movements.

# Factors that Influence Exchange Rates

$$e = f\left(\Delta INF, \Delta INT, \Delta INC, \Delta GC, \Delta EXP\right)$$

$e$ = percentage change in the spot rate

$\Delta INF$ = change in the relative inflation rate

$\Delta INT$ = change in the relative interest rate

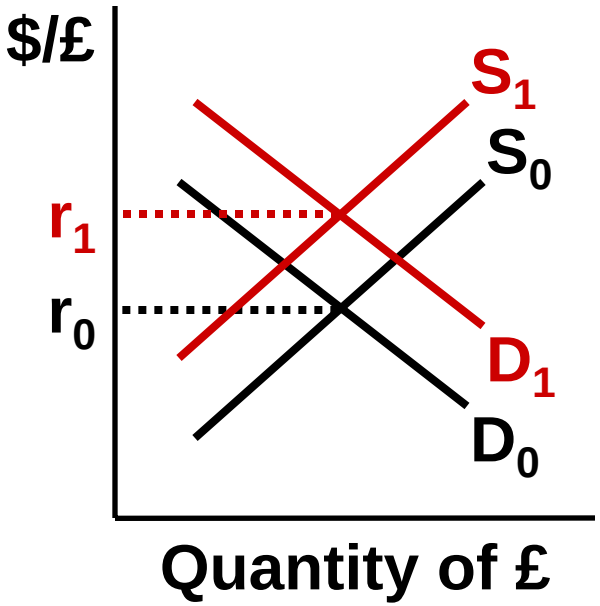
$\Delta INC$ = change in the relative income level

$\Delta GC$ = change in government controls

$\Delta EXP$ = change in expectations of future exchange rates

# Factors that Influence Exchange Rates

## Relative Inflation Rates



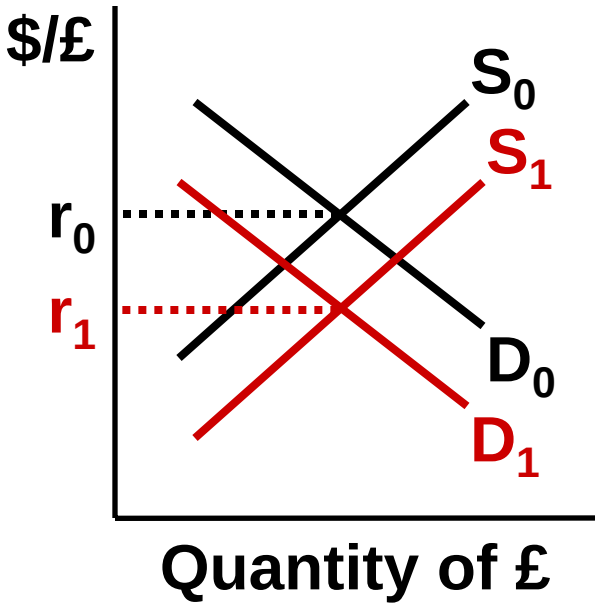

**U.S. inflation ↑**

⇒ ↑ U.S. demand for British goods, and hence £.

⇒ ↓ British desire for U.S. goods, and hence the supply of £.

# Factors that Influence Exchange Rates

## Relative Interest Rates




**U.S. interest rates ↑**

⇒ ↓ U.S. demand for British bank deposits, and hence £.

⇒ ↑ British desire for U.S. bank deposits, and hence the supply of £.

# Factors that Influence Exchange Rates

## Relative Interest Rates

- A relatively high interest rate may actually reflect expectations of relatively high inflation, which may discourage foreign investment.
- It is thus useful to consider the real interest rate, which adjusts the nominal interest rate for inflation.

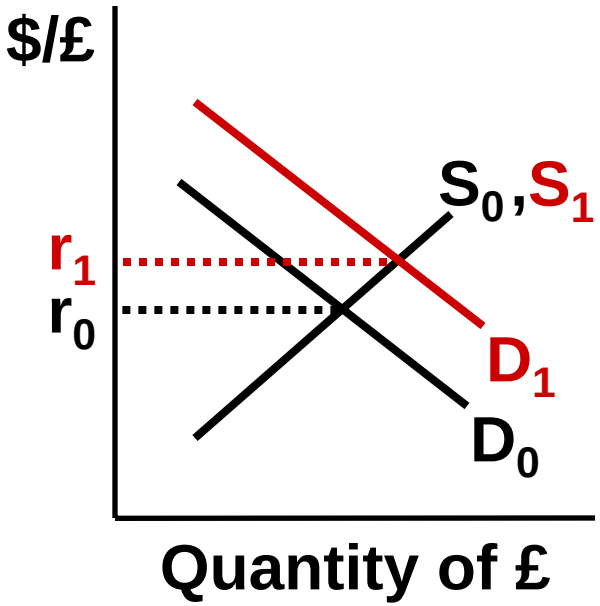
# Factors that Influence Exchange Rates

## Relative Interest Rates

- **real interest rate ≅ nominal interest rate – inflation rate**
- This relationship is sometimes called the Fisher effect.

# Factors that Influence Exchange Rates

## Relative Income Levels




**U.S. income level ↑**

⇒ ↑ U.S. demand for British goods, and hence £.

⇒ No expected change for the supply of £.

# Factors that Influence Exchange Rates

## Government Controls

- Governments may influence the equilibrium exchange rate by:
  - imposing foreign exchange barriers,
  - imposing foreign trade barriers,
  - intervening in the foreign exchange market, and
  - affecting macro variables such as inflation, interest rates, and income levels.

# Factors that Influence Exchange Rates

## Expectations

- Foreign exchange markets react to any news that may have a future effect.
  - News of a potential surge in U.S. inflation may cause currency traders to sell dollars.
- Many institutional investors take currency positions based on anticipated interest rate movements in various countries.

# Factors that Influence Exchange Rates

## Expectations

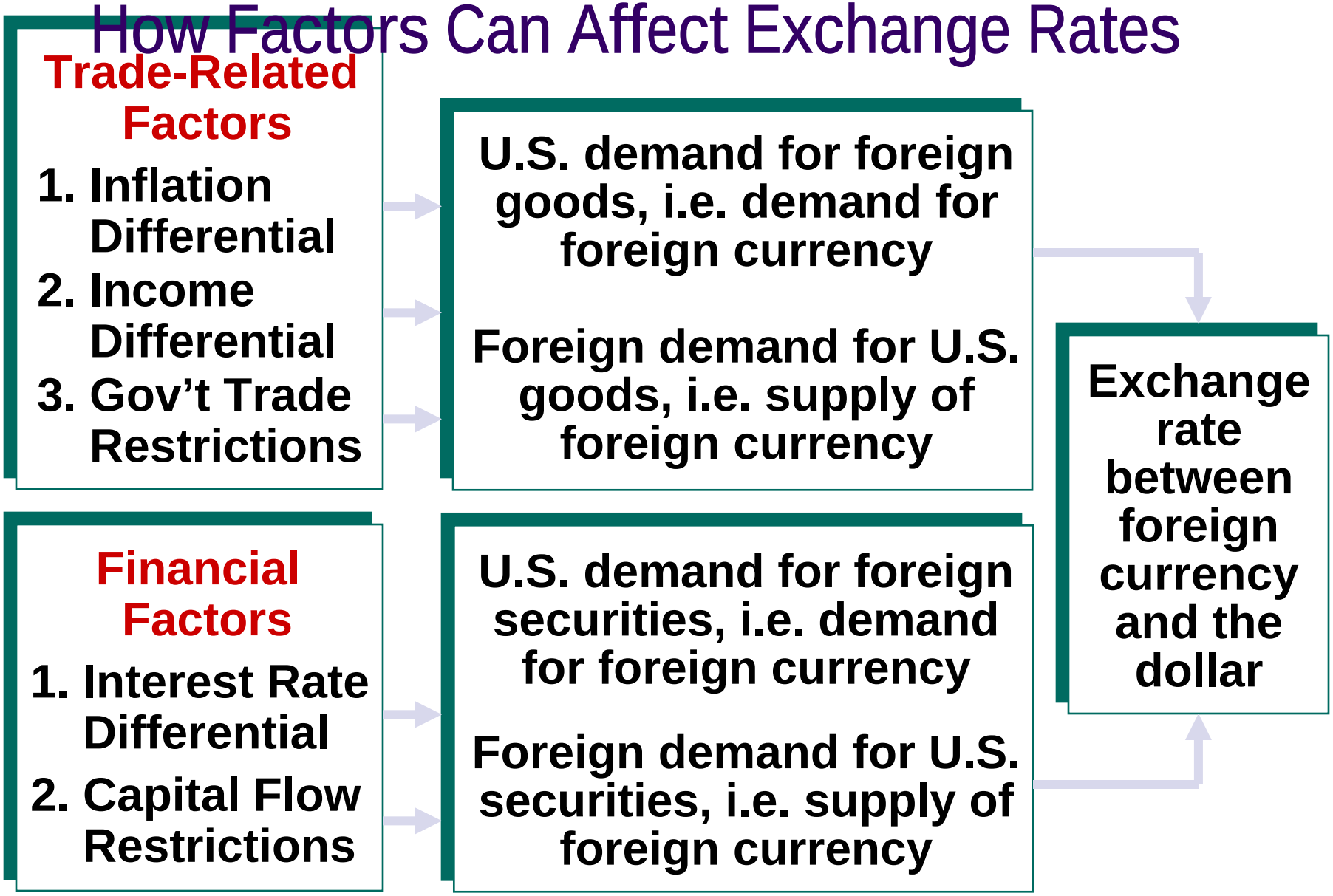
- Economic signals that affect exchange rates can change quickly, such that speculators may overreact initially and then find that they have to make a correction.
- Speculation on the currencies of emerging markets can have a substantial impact on their exchange rates.

# Factors that Influence Exchange Rates

## Factor Interaction

- The various factors sometimes interact and simultaneously affect exchange rate movements.
- For example, an increase in income levels sometimes causes expectations of higher interest rates, thus placing opposing pressures on foreign currency values.

# How Factors Can Affect Exchange Rates



# Factors that Influence Exchange Rates

## Factor Interaction

- The sensitivity of an exchange rate to the factors is dependent on the volume of international transactions between the two countries.

  **Large volume of international trade** $\Rightarrow$ relative inflation rates may be more influential

  **Large volume of capital flows** $\Rightarrow$ **interest rate** fluctuations may be more influential

# Factors that Influence Exchange Rates

## Factor Interaction

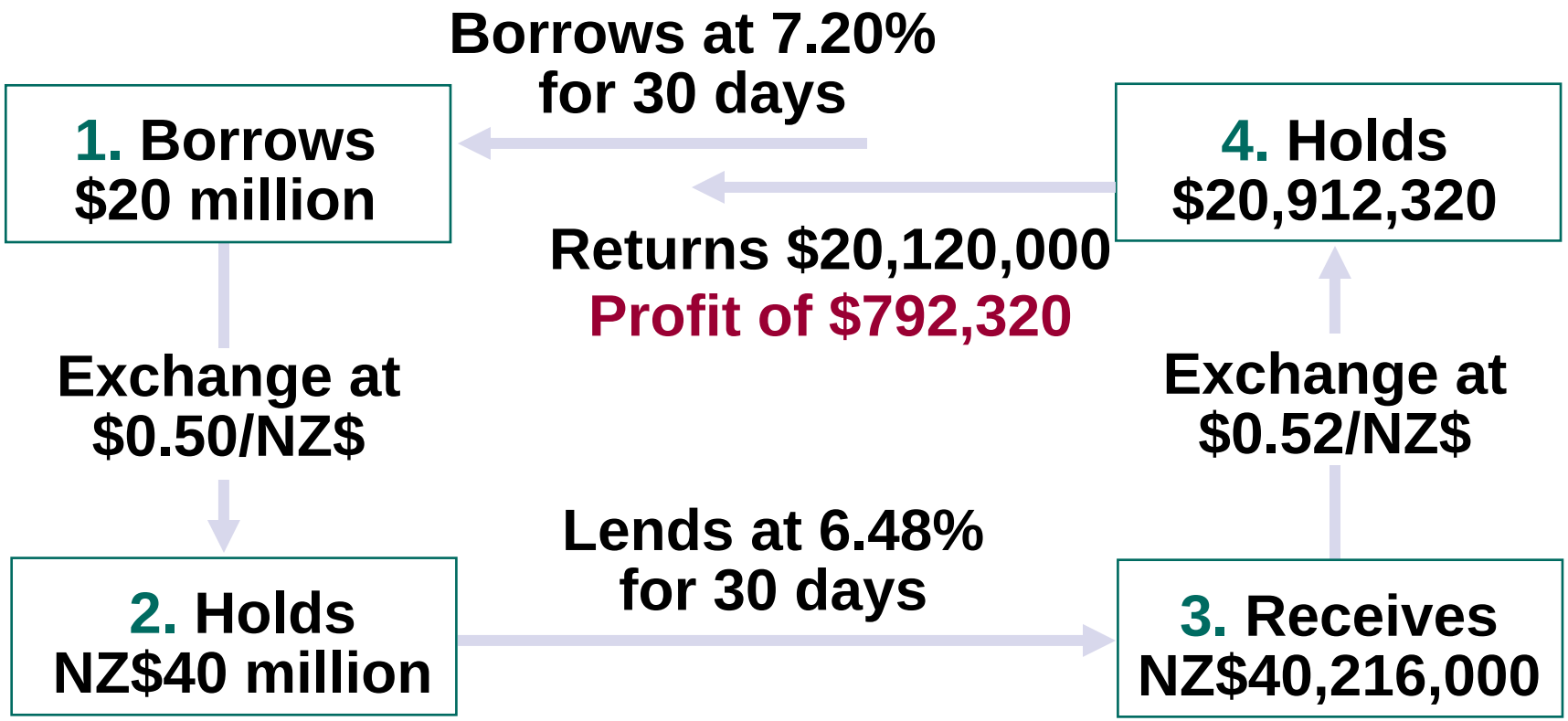
- An understanding of exchange rate equilibrium does not guarantee accurate forecasts of future exchange rates because that will depend in part on how the factors that affect exchange rates will change in the future.

# Anticipated Exchange Rates Speculation

- Many commercial banks attempt to capitalize on their forecasts of anticipated exchange rate movements in the foreign exchange market.
- The potential returns from foreign currency speculation are high for banks that have large borrowing capacity.

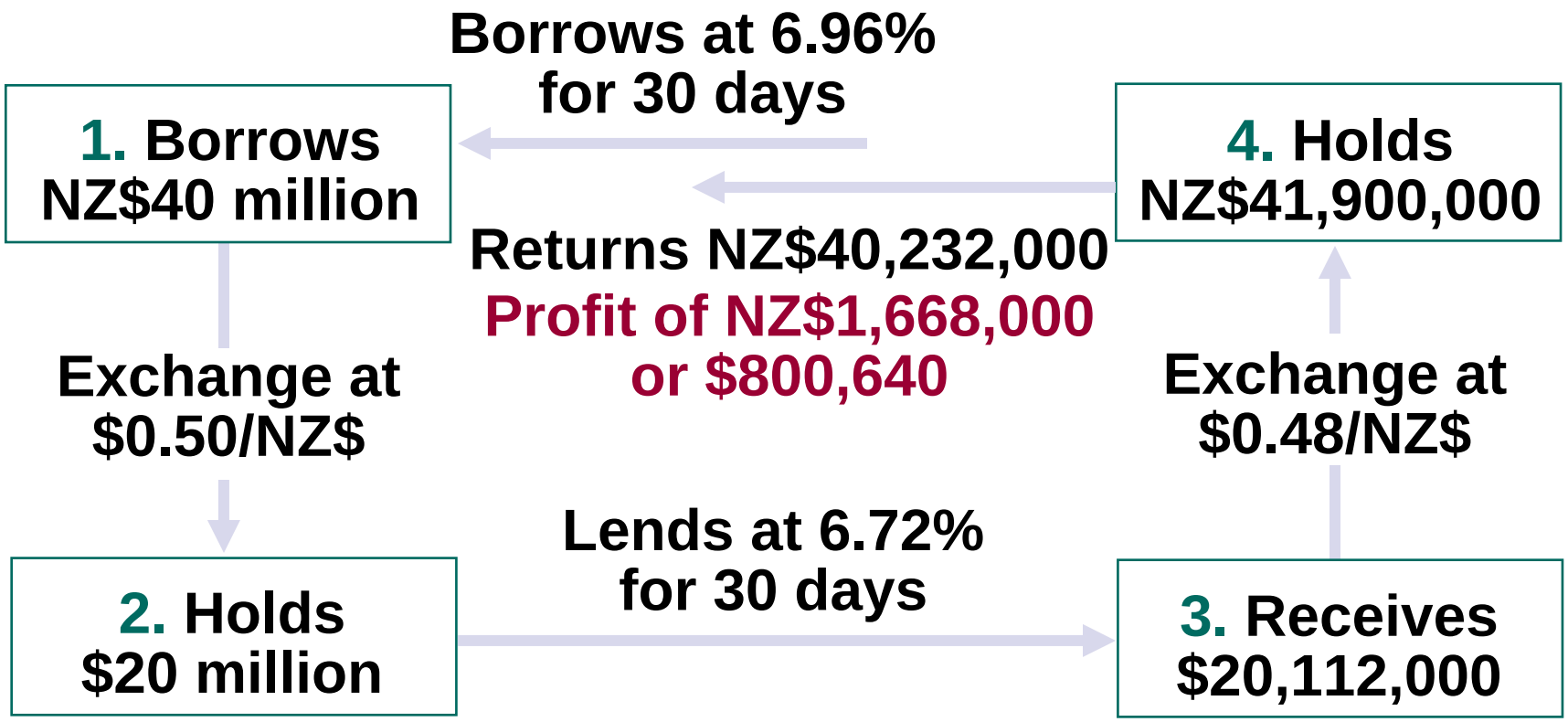
# Anticipated Exchange Rates Speculation

**Chicago Bank expects the exchange rate of the New Zealand dollar to appreciate from its present level of $0.50 to $0.52 in 30 days.**



# Anticipated Exchange Rates Speculation

**Chicago Bank expects the exchange rate of the New Zealand dollar to depreciate from its present level of $0.50 to $0.48 in 30 days.**



# Anticipated Exchange Rates Speculation

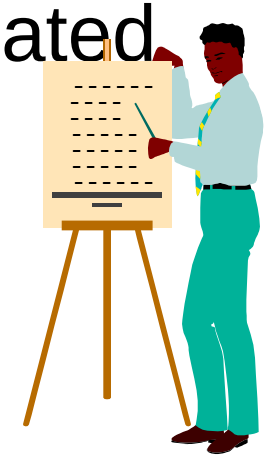
- Exchange rates are very volatile, and a poor forecast can result in a large loss.

  One well-known bank failure, Franklin National Bank in 1974, was primarily attributed to massive speculative losses from foreign currency positions.

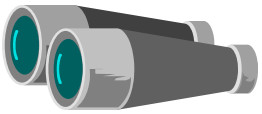
# Exchange Rate Derivatives

# Chapter Objectives

- To explain how forward contracts are used for hedging based on anticipated exchange rate movements; and
- To explain how currency futures contracts and currency options contracts are used for hedging or speculation based on anticipated exchange rate movements.

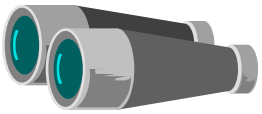


# Forward Market



- A forward contract is an agreement between a firm and a commercial bank to exchange a specified amount of a currency at a specified exchange rate (called the forward rate) on a specified date in the future.
- Forward contracts are often valued at $1 million or more, and are not normally used by consumers or small firms.

# Forward Market

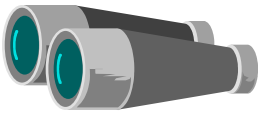


- When MNCs anticipate a future need for or future receipt of a foreign currency, they can set up forward contracts to lock in the exchange rate.
- The % by which the forward rate ($F$) exceeds the spot rate ($S$) at a given point in time is called the forward premium ($p$).

$$F = S(1 + p)$$

- $F$ exhibits a discount when $p < 0$.

# Forward Market



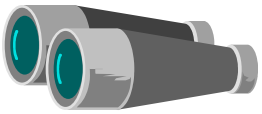
Example $S$ = \$1.681/£, 90-day $F$ = \$1.677/£

$$\textbf{annualized } p = \frac{F - S}{S} \times \frac{360}{n}$$

$$= \frac{1.677 - 1.681}{1.681} \times \frac{360}{90} = -.95\%$$

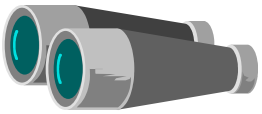
- The forward premium (discount) usually reflects the difference between the home and foreign interest rates, thus preventing arbitrage.

# Forward Market



- A swap transaction involves a spot transaction along with a corresponding forward contract that will reverse the spot transaction.
- A non-deliverable forward contract (NDF) does not result in an actual exchange of currencies. Instead, one party makes a net payment to the other based on a market exchange rate on the day of settlement.

# Forward Market



- An NDF can effectively hedge future foreign currency payments or receipts:

**April 1** — **July 1**

**Expect need for 100M Chilean pesos. Negotiate an NDF to buy 100M Chilean pesos on Jul 1. Reference index (closing rate quoted by Chile's central bank) = $.0020/peso.**

**Buy 100M Chilean pesos from market.**

**Index = $.0023/peso ⇒ receive $30,000 from bank due to NDF.**

**Index = $.0018/peso ⇒ pay $20,000 to bank.**

# Currency Futures Market

- Currency futures contracts specify a standard volume of a particular currency to be exchanged on a specific settlement date.
- They are used by MNCs to hedge their currency positions, and by speculators who hope to capitalize on their expectations of exchange rate movements.

# Currency Futures Market

- The contracts can be traded by firms or individuals through brokers on the trading floor of an exchange (e.g. Chicago Mercantile Exchange), automated trading systems (e.g. GLOBEX), or the over-the-counter market.
- Brokers who fulfill orders to buy or sell futures contracts typically charge a commission.

# Comparison of the Forward & Futures Markets

| | Forward Markets | Futures Markets |
|---|---|---|
| Contract size | Customized | Standardized |
| Delivery date | Customized | Standardized |
| Participants | Banks, brokers, **MNCs. Public speculation not encouraged.** | Banks, brokers, **MNCs. Qualified public speculation encouraged.** |
| Security **deposit** | Compensating **bank balances or credit lines needed.** | Small security **deposit required.** |
| Clearing **operation** | Handled by **individual banks & brokers.** | Handled by **exchange clearinghouse. Daily settlements to market prices.** |

# Comparison of the Forward & Futures Markets

| | Forward Markets | Futures Markets |
|---|---|---|
| Marketplace | Worldwide **telephone network** | Central exchange **floor with worldwide communications.** |
| Regulation | Self-regulating | Commodity **Futures Trading Commission, National Futures Association.** |
| Liquidation | Mostly settled by **actual delivery.** | Mostly settled by **offset.** |
| Transaction **Costs** | Bank's bid/ask **spread.** | Negotiated **brokerage fees.** |

# Currency Futures Market

- Enforced by potential arbitrage activities, the prices of currency futures are closely related to their corresponding forward rates and spot rates.
- Currency futures contracts are guaranteed by the exchange clearinghouse, which in turn minimizes its own credit risk by imposing margin requirements on those market participants who take a position.

# Currency Futures Market

- Speculators often sell currency futures when they expect the underlying currency to depreciate, and vice versa.

**April 4** → **June 17**

1. **Contract to sell 500,000 pesos @ $.09/peso ($45,000) on June 17.**

2. **Buy 500,000 pesos @ $.08/peso ($40,000) from the spot market.**

3. **Sell the pesos to fulfill contract. Gain $5,000.**

# Currency Futures Market

- MNCs may purchase currency futures to hedge their foreign currency payables, or sell currency futures to hedge their receivables.

**April 4**

**1. Expect to receive 500,000 pesos. Contract to sell 500,000 pesos @ $.09/peso on June 17.**

**June 17**

**2. Receive 500,000 pesos as expected.**

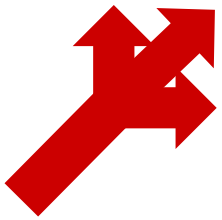
**3. Sell the pesos at the locked-in rate.**

# Currency Futures Market

- Holders of futures contracts can close out their positions by selling similar futures contracts. Sellers may also close out their positions by purchasing similar contracts.

| January 10 | February 15 | March 19 |
|---|---|---|
| **1. Contract to buy A$100,000 @ $.53/A$ ($53,000) on March 19.** | **2. Contract to sell A$100,000 @ $.50/A$ ($50,000) on March 19.** | **3. Incurs $3000 loss from offsetting positions in futures contracts.** |

# Currency Options Market



- Currency options provide the right to purchase or sell currencies at specified prices. They are classified as calls or puts.
- Standardized options are traded on exchanges through brokers.
- Customized options offered by brokerage firms and commercial banks are traded in the over-the-counter market.

# Currency Call Options

- A currency call option grants the holder the right to buy a specific currency at a specific price (called the exercise or strike price) within a specific period of time.
- A call option is
  - **in the money** **if exchange rate > strike price,**
  - **at the money** **if exchange rate = strike price,**
  - **out of the money**

    **if exchange rate < strike price.**

# Currency Call Options

- Option owners can sell or exercise their options, or let their options expire.
- Call option premiums will be higher when:
  - (spot price – strike price) is larger;
  - the time to expiration date is longer; and
  - the variability of the currency is greater.
- Firms may purchase currency call options to hedge payables, project bidding, or target bidding.

# Currency Call Options

- Speculators may purchase call options on a currency that they expect to appreciate.
  - Profit = selling (spot) price – option premium – buying (strike) price
  - At breakeven, profit = 0.
- They may also sell (write) call options on a currency that they expect to depreciate.
  - Profit = option premium – buying (spot) price + selling (strike) price

# Currency Put Options

- A currency put option grants the holder the right to sell a specific currency at a specific price (the strike price) within a specific period of time.
- A put option is
  - **in the money** **if exchange rate < strike price,**
  - **at the money** **if exchange rate = strike price,**
  - **out of the money** **if exchange rate > strike price.**

# Currency Put Options

- Put option premiums will be higher when:
  - (strike price – spot rate) is larger;
  - the time to expiration date is longer; and
  - the variability of the currency is greater.
- Firms may purchase currency put options to hedge future receivables.

# Currency Put Options

- Speculators may purchase put options on a currency that they expect to depreciate.
  - Profit = selling (strike) price – buying price – option premium
- They may also sell (write) put options on a currency that they expect to appreciate.
  - Profit = option premium + selling price – buying (strike) price

# Currency Put Options

- One possible speculative strategy for volatile currencies is to purchase both a put option and a call option at the same exercise price. This is called a straddle.
- By purchasing both options, the speculator may gain if the currency moves substantially in either direction, or if it moves in one direction followed by the other.

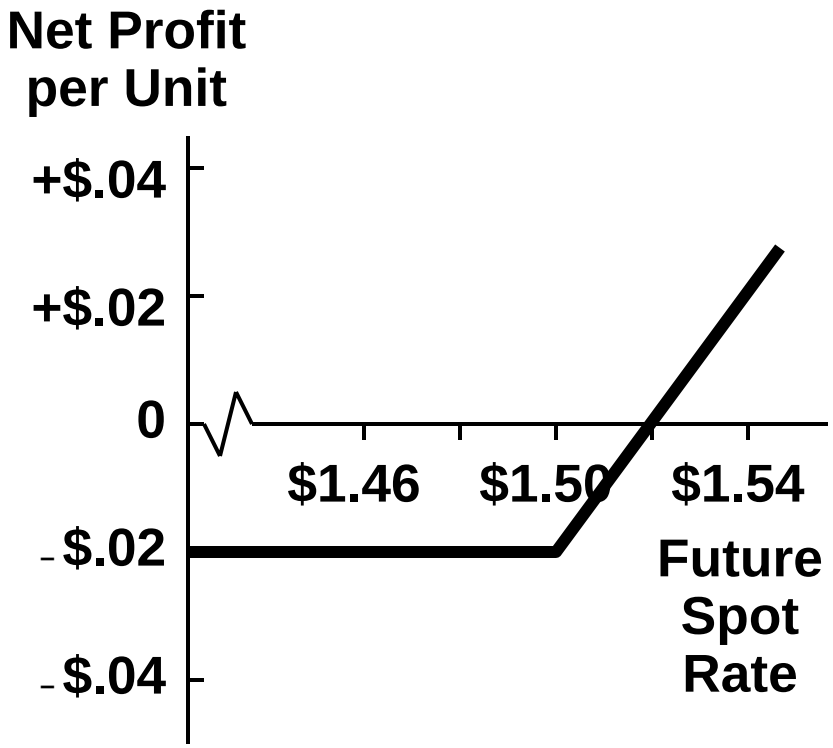
# Efficiency of Currency Futures and Options

- If foreign exchange markets are efficient, speculation in the currency futures and options markets should not consistently generate abnormally large profits.

# Currency Options Contingency Graphs

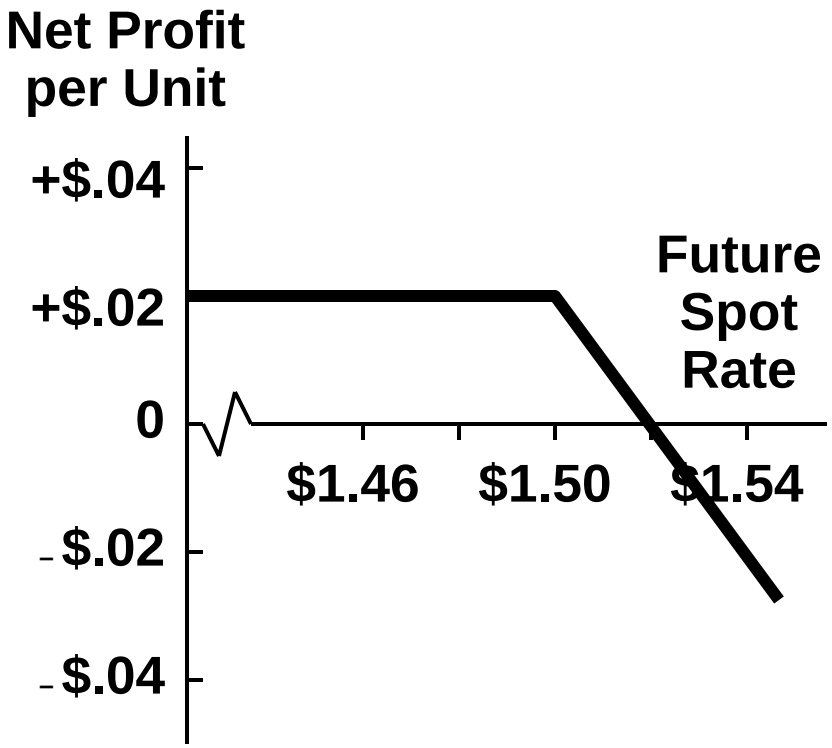
## For Buyer of £ Call Option

**Strike price = $1.50**
**Premium = $ .02**




## For Seller of £ Call Option

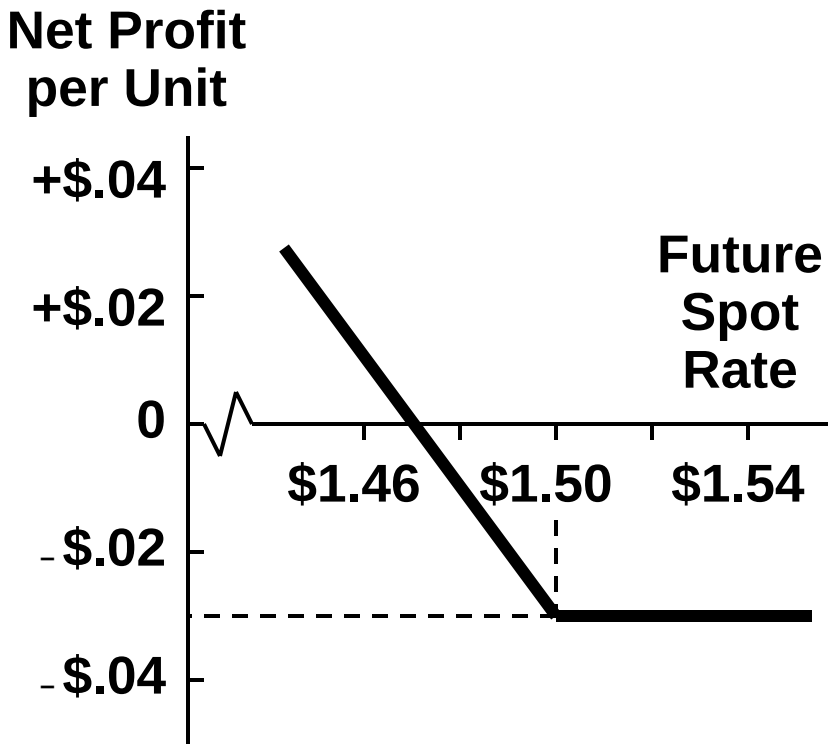
**Strike price = $1.50**
**Premium = $ .02**



# Currency Options Contingency Graphs

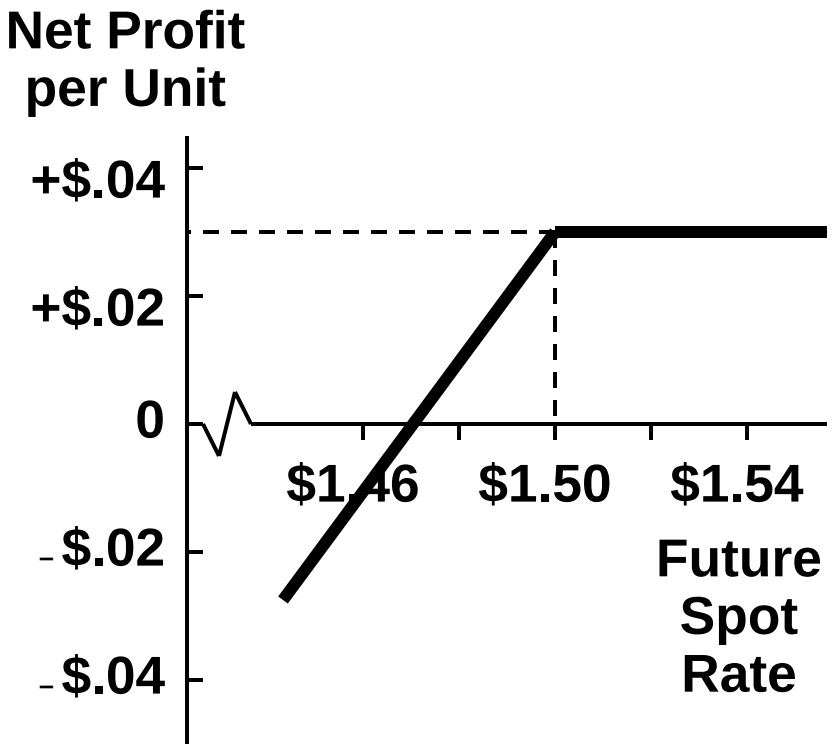
## For Buyer of £ Put Option

**Strike price = $1.50**
**Premium = $ .03**




## For Seller of £ Put Option

**Strike price = $1.50**
**Premium = $ .03**

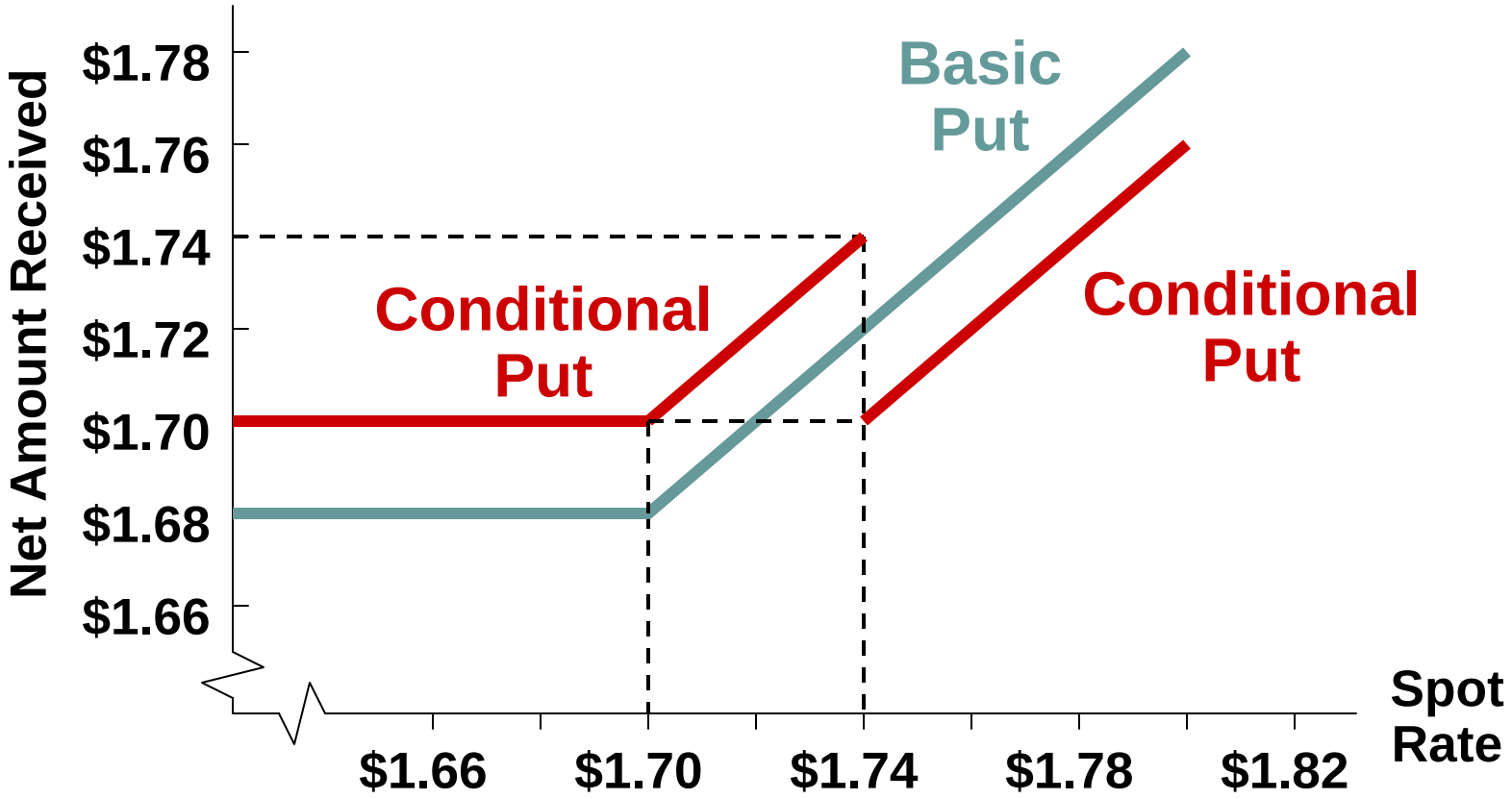


# Conditional Currency Options

- A currency option may be structured such that the premium is conditioned on the actual currency movement over the period of concern.
- Suppose a conditional put option on £ has an exercise price of $1.70, and a trigger of $1.74. The premium will have to be paid only if the £'s value exceeds the trigger value.

# Conditional Currency Options

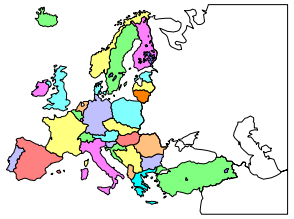
| Option Type | Exercise Price | Trigger | Premium |
|---|---|---|---|
| basic put | $1.70 | - | $0.02 |
| conditional put | $1.70 | $1.74 | $0.04 |



# Conditional Currency Options

- Similarly, a conditional call option on £ may specify an exercise price of $1.70, and a trigger of $1.67. The premium will have to be paid only if the £'s value falls below the trigger value.
- In both cases, the payment of the premium is avoided conditionally at the cost of a higher premium.

# European Currency Options



- European-style currency options are similar to American-style options except that they can only be exercised on the expiration date.
- For firms that purchase options to hedge future cash flows, this loss in flexibility is probably not an issue. Hence, if their premiums are lower, European-style currency options may be preferred.